Better Power for Health

Healthy Public Policy and Sustainable Energy in the Thai Power Sector

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Better Power for Health:
Healthy Public Policy and Sustainable Energy in the Thai Power Sector

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From the beginning to the end, this study has always been inspired by the endless struggles of the local people, affected by public policy in the Thai power sector. The impacts of their struggling are not only to protect their communities from polluted technologies and centralized power, but at the same time, to lead the ways for more sustainable energy development and healthy public policy in Thai society. This study is obviously a very small attempt, compared to their energy in fighting for better power for health over the last two decades. Therefore, I would like to dedicate this study to the Thai people who are fighting for sustainable energy, especially to Mr. Charoen Wat-aksorn, who dedicates his own life to our healthier and more sustainable future.

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List of Abbreviations

APEC	The Asia-Pacific Economic Co-operation
ASEAN	The Association of South-East Asian Nations
ATA	Appropriate Technology Association, Thailand
BOP	Balance of Payment
CBA	Cost-Benefit Analysis
CCO	The Confederation of Consumer Organizations, Thailand
CHP	Combined Heat and Power
CO	Carbon monoxide
CO_2	Carbon dioxide
CPT	The Communist Party of Thailand
DALYs	Disability-adjusted Life Years
DEDE	Department of Alternative Energy Development and Efficiency, Thailand
DPSEEA model	Driving force-Pressure-State-Exposure-Effect-Action Model
DSM	Demand Side Management
EFHIA	Equity-focused Health Impact Assessment
E for E	Energy for Environment Foundation, Thailand
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
EGAT	Electricity Generating Authority of Thailand
EGCO	Electricity Generation Public Company Limited, Thailand
En-Con Fund	The Energy Conservation Fund, Thailand
EPPO	Energy Policy and Planning Office, Thailand
ESCO	Energy Efficiency Service Companies and Organizations
ESB Model	Enhanced Single Buyer Model
ETA	Electricity Transmission Authority, Thailand (proposed)
EU	The European Union
FFC	Foundation for Consumers, Thailand
FGD	Fuel Gas Desulfurization
Ft	Fuel Adjustment Mechanism
FTI	The Federation of Thai Industries
GDP	Gross Domestic Product
HIA	Health Impact Assessment
Hg	Mercury
HSRI	Health Systems Research Institute, Thailand
HSRO	National Health System Reform Office, Thailand
IEE	Initial Environmental Effects
IMF	The International Monetary Fund
IPPs	Independent Power Producers
IRP	Integrated Resource Planning
ITSO	Independent Technical Standard Organization
LCUP	Least Cost Utilities Planning
MEA	Metropolitan Electricity Authority, Thailand
MoEn	Ministry of Energy, Thailand
NESAC	National Economic and Social Advisory Council, Thailand
NEPO	National Energy Policy Office, Thailand
NGCC	Natural Gas Combined Cycle Power Plant
NGOs	Non-governmental Organizations

NHRC	National Human Rights Commission, Thailand
NICs	Newly Industrialized Countries
NMVOC	Non-methane Volatile Organic Compound
NO_x	Nitrogen Oxide
O&M	Operation and Maintenance
PDP	Power Development Plan
PEA	Provincial Electricity Authority, Thailand
PM	Prime Minister
PTT	PTT Public Company Limited, Thailand (Previously Petroleum Authority of Thailand)
PV	Photovoltaic Cell
RATCH	Ratchaburi Power Public Company Limited, Thailand
RE	Renewable Energy
REC	Renewable Energy and Conservation
REFIT	Renewable Energy Feed-in Tariff
RID	Royal Irrigation Department, Thailand
RPS	Renewable Portfolio Standard
SEA	Strategic Environmental Assessment
SENT	Sustainable Energy Network of Thailand
SET	The Stock Exchange of Thailand
SO_2	Sulfur dioxide
SPPs	Small Power Producers
TCS	Tradable Certificate System
THB	Thai Baht
TOU	Time of Use rate
TSP	Total Suspended Particles
UK	United Kingdom
USD	US Dollar
VSPPs	Very Small Power Producers
WHO	The World Health Organization
YLD	Year Live Disability
YLL	Year of Life Lost

Chapter 1

Introduction

1.1 Research Motivation

Forty years ago, the Thai government had a big development campaign on "*Nam Lai, Fai Sawang, Tang Dee*" (Water flow, Electric lighting, Good Road). Therefore, electricity and all power plants were always the symbol of national progress. However, thirty years later, local protests against the new power plants spread all over Thailand. Power plants are no longer welcomed any more by local communities, while electricity demand continues to increase. Today, power plants are no longer perceived as a national pride. This is, in fact, a dilemma in Thai society at this moment.

Concerns about human health impacts constitute the basis for local protests against power plant projects. Since the 1990s, there is more and more evidence to show the negative impacts of power plants on human health, especially from lignite-fired and large hydropower power plants. In case of the Mae Moh lignite-fired power plant, estimates suggest that 300 villagers have lost their lives as a direct result of pollution from the power plants, thousands suffer from respiratory problems and more than 30,000 people have been displaced as a direct result of the pollution from the power plant (Figure 1.1)[1]. In the case of Pak Mun Dam, thousands families have lost their fishery resources, local jobs, and food security, after the dam obstruct the natural fish migration and change river ecosystem (Figure 1.2)[2].

Figure 1.1 Life at Mae Moh
Mr. Sributr Wongchana, the villager of Ban Hua Fai, Mae Moh district, is hooked up to an oxygen tank and breathes purified air to soothe the asthmatic irritation, as an essential part of everyday life, after long-term exposure to air pollution from the Mae Moh lignite power plant and its mining activities.
Source: Yvan Cohen, 2006.

Figure 1.2 Pray for Lives
In 2002, local people in Ban Hua Heav prayed for the government decision to continue opening the dam gate, which allows fish to migrate naturally and allows people to fish again. Finally, the Thai government decided to open Pak Mun's dam gate for four months a year to mitigate the impacts on local communities
Source: SEARIN

As mentioned by the World Energy Assessment, although energy is an essential part of human well-being, the existing ways of energy production, transformation and consumption, which are based on large-scale fossil fuel technologies, can cause several severe impacts on human health and society [3].

***"What should be the better power for health*?" is the main inspiration for this research.**

The concept of healthy public policy, introduced by the World Health Organization in 1986, aims to address the problem of health impacts relating to development policies and projects in non-health sectors, including the question above. This is because, based on the fact that to promote the "health for all", the creation of supportive environments for healthy living is crucial and cannot be achieved without moving beyond the borders of the health sector. The key ideas of healthy public policy are to put health on the agenda of all policy-making at all levels, to develop and promote choices that are conducive to health, and to make sure that a healthier choice is an easier choice to make in the policy-making process[4].

The concept of healthy public policy was introduced in Thailand in 2000 through the national health system reform[5]. Like other countries, Thailand has faced several negative health impacts of development processes and activities. Certainly, the health impacts of power generation are one of the most evident cases presented in the reform process. This leads to stronger need to implement a healthy public policy concept in the Thai power sector, i.e. to develop the better power for health (detail in Chapter 2).

In fact, apart from human health impacts, Thai society still has several good reasons to be concerned about the future of the energy sector in general and its power plant investment projects in particular. Annual greenhouse gas emission from power generation has been increased rapidly [6]. The energy import burden has also increased. At the same time, the energy intensity in Thailand has increased showing the lower energy efficiency in the overall energy management[7]. Obviously, these general concerns raise questions about the future of power plants, i.e., "*should we invest in the project that will increase greenhouse gas emission, import burden, possibly lead to the lower energy efficiency of the country and also cause the negative impacts on health?"*

Evidently, *sustainable energy development*, e.g. renewable energy and energy efficiency improvement, are the most prominent solutions to reduce negative health impacts. The life cycle assessment of different power generation technology has proved that, in general, renewable energy has much lower negative impacts on the environment compared to fossil-based and other large-scale technologies[8]. At the same time, the studies of the Extern-E project have shown that renewable energy also has much lower negative impacts on human health[9]. Moreover, both renewable energy and energy efficiency can increase jobs and reduce the import burden of the economy[10]. Therefore, sustainable energy development is more likely to be one of the healthier solutions in the power sector.

Thailand is a rich country in terms of renewable resources. The modest estimation from the Ministry of Energy (MoEn) indicates that the country has a renewable power potential of more than 15,000 MW of renewable power potentials in this country[11]. However, only around 1,000 MW, or less than 10% of its potential (or only around 2% of the total energy generation), has been utilized in the Thai power sector (detail in Chapter 3). MoEn has referred to this situation as a situation of “high potential but low development” [12].

The situation of high potential but low development urges us to discover *what makes this healthier choice a difficult choice in Thai energy policy*. Hvelplund and Lund suggest that, due to unequal power structures both financially and politically, it is less likely that the new radical and sustainable technological changes will take place by the old regimes of technologies[13]. Especially when renewable energy will reduce the value-added share of the fossil fuel suppliers and power plants, it is certainly not economically attractive for them to invest in renewable energy. Therefore, sustainable or healthier options cannot develop without supportive institutional frameworks[14].

These analyses are quite relevant to the situation in Thailand, where power utilities, like Electricity Generation of Thailand (EGAT) and natural gas supplier, like Petroleum Authority of Thailand (PTT) have monopolized power on the electricity and natural gas market and have a strong influence on policy processes[15]. It is quite clear that renewable energy never has chance to be recognized as an alternative in the EGAT’s long-term investment planning or the power development plan (PDP)[16]. In this sense, healthier choice is not considered a choice at all, if it cannot be put in the agenda of the decision-making process.

Certainly, the utilities and gas suppliers have some explanations for doing so. These explanations normally come from the set of ideas, beliefs, and information, or the so-called policy discourse, which states that the reliable power system must be centralized, both power generation and transmission sub-systems. More importantly, electricity must be cheap and the utilities believe that the larger the power plants are, the cheaper electricity will be[17]. Therefore, several policy instruments, like power pricing, have been set on the criteria of reliability and centralized power plants, which is certainly less preferable for distributed power, like renewable energy alternatives[18].

Perhaps, the most obvious and recent example of how renewable energy has been wiped out from the formal policy and planning process is the Ministry of Energy’s Newspaper Advertisement on July 31st 2006, see Box 1.1.

It is quite obvious that in the Ministry’s advertisement as presented in Box 1.1, Cheap electricity is the aim for considering choices in power planning. The way in which information is presented is really biased against renewable energy. While, in the table, fossil fuel based technology includes only fuel costs, the costs of renewable energy include both capital and operation and maintenance costs. Moreover, the information on biomass and biogas energy, which are highly competitive choices in terms of costs is hidden to the public. With these biased planning criteria and information, it is not surprising that coal and lignite will be concluded as the cheapest and, consequently, the most appropriate choice in the Ministry’s perspective. Certainly, in this perspective, the suffered lives of Mr. Sributr Wongchana (in Figure 1.1) and people in Ban Hua Heav (in Figure 1.2) are out of the calculation and planning scope.

Box 1.1 Ministry of Energy Newspaper Advertisement on
"**Appropriate Energy Options for Thailand..**?"
Source: Matichon Daily Newspaper, July 31st 2006

Conclusion: renewable energy is very expensive

Main aimis to allow Thai people to buy cheap electricity

Table The Fuel Costs of Power Generation from Different Fuels (Estimated in July 2006)

Fuel Type	Fuel Costs (THB/Kwh)
Solar Cell	20.20
Wind energy	6.90
Diesel	6.75
Fuel oil	4.00
Natural Gas	1.50
Imported Coal	1.00
Lignite	0.53

Source: Energy Policy and Planning Office

Including capital and O&M cost

Not providing the information on generation cost of biomass and biogas energy, which are highly competitive in Thailand

Not including capital cost, O&M and environmental costs

In this unfavorable institutional framework and policy discourse, the situation of renewable energy and the heath aspect are quite marginalized in the planning process. The question is, according to the concept of healthy public policy, how we can make this healthier choice become an easier choice to make in the Thai power sector's policy process.

Therefore, if healthy public policy should be a meaningful concept to Thai society, it should aim to analyze and, more importantly, promote healthier options in the Thai power sector. In doing so, several questions must be raised, for example:

- Is a healthier policy option possible for the Thai power sector?
- How have different policy options been analyzed in the existing policy and planning process?
- Who controls and influences policy and planning process? And how can they do that?
- What kinds of assumptions, options, and targets are used in the policy and planning process? What kinds of policy discourse are used for rationalizing or legitimizing their assumptions, options, and decisions made?
- What kinds of other ideas and movement challenges this mainstream policy discourse? How they challenge the dominant one? What kind of alternative policy discourses can support the healthier policy changes?
- How can different policy options lead to different impacts in terms of environmental, health, social, and economic aspects
- What should be an appropriate and healthier policy option for Thai society?
- How will the healthier options be implemented in the existing institutional structure? What should be a supportive institutional framework and an important policy discourse for the development of a healthier option in the Thai power sector?
- Last but not least, how can we make this happen in the real political world?

This research aims to address all these questions. In other words, it tries to test and reflect on how the concept of healthy public policy can be operationalized in the Thai power sector and how it can contribute to the actual policy changes in this sector. With the experiences and reflections of this study in mind, hopefully, it is possible to shed the light to sustainable energy policy changes in the Thai power sector and, at the same time, pave the way for introducing a healthy public policy in other sectors of Thai society.

1.2 Research Questions

To fulfil the objectives of this research, this project has four main sets of research questions in this project, as explained below:

1. **Policy Analysis:** How have policy directions and structures been evolved in the Thai power sector? How are policy discourses and discourse coalitions developed? What are the main differences among policy discourses? How do they interact with each other? What are the main implications of these different discourses on the strategic impact assessment and policymaking in the Thai power sector?

2. **Strategic Impact Assessment:** What will be the different impacts of different policy options? Which policy options can lead to better impacts in environmental, social, economic, and health perspectives? Which policy options will provide society with the capacity and flexibility need when dealing with a possible uncertain future?

3. **Institutional Framework:** What is the supportive institutional framework, including public regulations required to promote more sustainable and healthier policy option and why? What are the main similarities and differences among policy discourses in terms of institutional framework? What kinds of actions or strategic areas should be developed in order to facilitate policy directions toward healthier solutions?

4. **Policy as a Social Learning Process:** How do the policy analysis, impact assessment, and institutional analysis contribute to actual policy changes during the three years of research study? How can the Thai public gain a broad and deep access to policy processes and assess the options of different policy discourses? What are the main consequences of a deliberative policy analysis on the policy process in Thai power sector? How can we learn from this experience?

1.3 Conceptual Framework

As earlier mentioned, health impacts of power generation give rise to concerns of Thai society. As presented on the first page, power generation does is not only affecting human health through the exposure of polluted environments (like the case of Mae Moh lignite-fired power plant), but also through the changes of living conditions (as seen in the Pak Mun hydro power plant). The result of these well-known affected cases creates oppositions in the local communities, surrounding the new power plants projects.

One of the most relevant explanations for the dilemma in the Thai power sector is the concept of risk society. According to the risk society, our society is now facing new kinds of risks that are *manufactured* within human society. These manufactured risks have paradoxically emerged from the conventional ways of protecting human being from traditional risks[19]. The energy sector is one of the good examples of manufactured risks which generate from the local to the global scales. These manufactured risks are normally characterized by a high degree of uncertainty and inequality[20]. Obviously, the conventional ways of public decision-making and planning with an economic expansion target and technocratic domination have great difficulties in dealing with these complex problems of uncertainty and inequality[21].

Concurrently, it is also obvious that political space and policy arenas are now more open. The active citizens have participated meaningfully in the policy-making process. Consequently, the policy process becomes more complicated with different interpretations, problem definitions, visions, rationalities and policy options, so-called different *policy discourses* [22], as also seen in the Thai power sector (discussed later in Chapter 4). This requires the development of a new public policy process, which can allow the differences to play constructive roles in the process. Otherwise policy-making will certainly turn into social conflicts. In other words, the active and constructive participation within *deliberative discussion* and *interactive policy process* is certainly required to deal with these emerging complexities[23]

Healthy Public Policy is one of the attempts to improve the policy-making process with the special focus on the human health impacts from development policies and projects outside the health sector. The core ideas are to put health on the agenda in all policymaking and promote healthier choice in decision-making and planning process. In pursuing these core ideas, the *systematic assessment of future health impacts* of different policy options is highly recommended. However, since health highly depends on different aspects of life, this systematic assessment of health impacts cannot be done without analyzing the policy impacts on environment and society.

Strategic Environmental Assessment (SEA) is one of the approaches of environmental management that tries to facilitate policy discussions by providing better insights on future impacts, derived from the implementation of different policy options. With the aim to support sustainable development, several aspects of future impacts, including environmental, social, and human health, must be consider within the SEA process[24]. Therefore, SEA is one of the possible ways of integrating health and other important dimensions into the sustainable planning process.

In the energy sector, Hvelplund and Lund have developed the new approach of *feasibility studies for innovation and public regulation* with the clear insight that with unequal power structures, the new radical sustainable technologies are hardly developed in the old regimes of assessments, institutions and public regulations[25]. First and foremost, the new ways of policy assessment and feasibility studies need to consider various aspects of national development goals, rather than targeting only narrow economic indicators, such as utilities' cost minimization. Moreover, they have to be fully aware of long-term environmental and economic impacts, the distributional effects within and between nations and the unbalanced economic and political power structures. The *institutional rearrangements* are also very crucial for the success of technological development for sustainability[26].

All these important concepts can significantly help to explain the energy problems and conflicts in the Thai power sector. Evidently, the expansion of Thai power involves a number of manufactured risks, especially human health impacts[27]. The policymaking and planning process in the Thai power sector is still centralized and has very limited opportunities for public participation, though some policy discourse coalitions have been gradually formed and play their roles[28] [29]. The information provided to the Thai public has easily been distorted and disguised, as already shown in Box 1.1.

Furthermore, the objective of energy planning is always closely related to utilities' cost minimization, though several national development goals may better be achieved through sustainable energy development, including environmental improvement and reduction of income inequality[30]. Recently, the Thai government has announced the new policy and target for renewable energy development[31]. However, the great difficulty in achieving this target is highly expected due to unfavorable institutional structures within the Thai power sector[32].

This leads to the hypothetical idea that the policy and planning process in the Thai power sector is perhaps the most important "*cause of the cause*" for serious negative health impacts derived from Thai power generation. Therefore, if this hypothetical idea has been confirmed, the policy and planning process must be improved by facilitating *democratic discussion* and a continuous *social learning process* towards healthy public policy and sustainable energy development. The new policy process has to consider carefully a) future risks and uncertainties, b) human health consequences and c) the different policy discourses and options.

Based on these concepts, this research project is an attempt to analyze the existing policy and planning process and pave the way for sustainable policy and planning practices. To reach this aim, this research will be divided into four main connected parts.

First, the historical policy changes will be analyzed in order to achieve a better understanding on policy processes, different policy discourses, and the relationship between power and rationality behind different policy discourses. The main methodology for this part is the *historical and policy discourse analysis* (discussed in Chapter 2). The outcomes of the first part will frame policy options and impact indicators for strategic impact assessment in the second part as well as the insights into the foundation of institutional frameworks in the third part.

In the second part, the impacts from different policy options will be analyzed. The main methodology for this part will be the *strategic environmental assessment* (SEA), with the focus on human health impacts. Therefore, on one hand, this research provides an additional insight into human health impacts compared to other sustainable energy planning. On the other hand, this research also adds the environmental, social, resource, economic, and environmental impacts on the healthy policy considerations. This is due to the fact that, according to the concept of healthy public policy, the inextricable links between health and other supportive aspects must be highlighted in pursuing healthier policy changes. Moreover, to facilitate a deliberative policy discussion, the results of SEA must be reviewed and discussed in several policy workshops, organized by this research.

Then, an existing institutional framework and a supportive institutional framework for healthy policy option will be analyzed in the third part. The analysis will be conducted in the connection with cognitive and normative dimensions of different policy discourses, which always lead to different suggestions in terms of public regulations. The main methodology will be *the institutional analysis*, as explained in Scott and Hvelplund (discussed in Chapter 2 and 3). Certainly, this part aims to show the practical ways of moving from policy discourses and impact assessment into social reality.

Last, the research aims to form critical reflections on how the attempts in this research study can be translated into actual social learning processes and healthier policy changes. Therefore, apart from the analysis of policy discourses, strategic impact assessment and institutional framework, this study also involves *several means of policy communication*, especially *public forums at regional and national levels*.

The aims of the public forums are a) to facilitate the discussions among different policy discourses, b) to get public feedback on this impact analysis and its policy recommendations, c) to achieve a better understanding of the potentials and practical issues of sustainable energy development in Thailand, and d) to stimulate public discussion about the strategic directions of the Thai power sector and their consequences.

During the three years of study period (September 2003 –August 2006), the public forums have been organized in several forms, as chronologically shown in Table 1.1.

First, together with *sustainable energy trips* within the region, *three regional public forums* have been organized to discuss the potentials, experiences, and strategic directions and impacts of power generations and sustainable energy development in Thailand and in each region. In the northern region, *the sustainable energy fair* was also incorporated into the public forums in order to provide a better public understanding for participating in this policy discussion (see Figure 1.3).

Second, in July 2005, *three policy workshops* have been set up in Bangkok for more a detailed analysis of policy discussions at the national level. In order to gain better insight into several aspects of policy issues, each policy workshop has its own special focus, including Thailand's power planning system, supportive policy framework for renewable energy development, and good governance in renewable energy development.

Third, the public forums were also taking place at other occasional events, which are related to the policy discussions in the Thai power sector and healthy public policy formulation, including No Coal Forum in Lampang, Sustainable Energy Festival in Nakorn Ratchasima, National Health Assembly in Bangkok, etc.

Most of these public forums and policy workshops have been publicly reported by several mass media and journalists in Thailand as part of the policy communication, in order to facilitate policy discussion at a wider level and more influential impacts. The examples of media coverage are presented in Figure 1.4.

Table 1.1 Public Forums in Discussing Policy Directions and Strategic Impact Analyses

Policy Workshop	Date and Place	No. of Persons	Key Points of Discussion
1. Evaluation of Government Energy Policy (Occasional event)	8 December 04 Bangkok	60	Strengths and weaknesses in existing energy policy
2. Future of Thai Electricity (Preliminary policy workshop)	11 January 05 Bangkok	30	Present energy problems, an impact analysis of 3 policy options
3. No Coal Forum (Occasional event)	23 January 05 Lampang	500	Health impacts from coal, Energy future without coal
4. Alternative energy for the North-eastern Thailand (Regional Forum)	22 Feb. 05 Surin	80	Energy problems, potential of renewable energy of the region.
5. The Risk of Privatization: Case of the Thai power system (Occasional event)	30 March 05 Bangkok	30	EGAT Privatization and the impacts on sustainable energy development
6. Lessons Learnt from Local Energy Planning (Occasional event)	2 April 05 Ratchasima	150	Potential and future of local energy planning
7. Out of the Crisis Through the Renewable Way (Regional Forum)	4 June 05 Chiang Mai	129	The crisis of the energy system and the alternative energy solution scenarios, the exchange of experiences among energy producers
8. Good Governance and Tri-party Mechanism in Energy Project Management. (Occasional event)	7 June 05 Bangkok	35	Good governance and its implication on the energy system, especially for renewable energy
9. The Future of Thai Energy as a Healthy Public Policy in National Health Assembly (Occasional event)	8 July 05 Bangkok	200	Present energy problems, an impact analysis of 3 policy options
10. The Energy Strategies for the Southern Thailand (Regional Forum)	9 July 05 Songkhla	40	The analysis of energy strategies in the regions and RE potentials
11. RE Policy Workshop I : The Energy Crisis and Energy Planning in Thailand (National Policy Workshop)	12 July 05 Bangkok	29	Flaw institutional structure and assumptions in energy planning and suggestions for better planning
12. Electricity Governance in Thailand: The Launching Workshop (Occasional Events)	13-14 July 05 Bangkok	25	Evolution on privatization policy and the assessment of good governance in the power policy processes
13. RE Policy Workshop II: RE from Strategy to Reality (National Policy Workshop)	19 July 05 Bangkok	22	Concluding session and policy recommendations for RE development
14. RE Policy Workshop III: Good Governance in RE Development (National Policy Workshop)	26 July 05 Bangkok	21	Policy recommendations for good governance for the RE development
15. Reforming the Power Sector Through Democratic Process, (Public Lecture at Midnight University)	30 July 06 Chiang Mai.	20	The need and possibility of reforming the power sector by democratic movement.
16. Reforming Energy Policy, Regional Forum for National Economic and Social Development Advisory Council	31 July 06 Songkhla.	120	The reason for reforming energy policy due to monopoly power and conflict of interests.
17. Reporting "*An Assessment of Electricity Governance in Thailand*" to the Electricity Regulator	3 August 06 Bangkok.	15	The results of governance assessment, the areas of improvement in the coming years.
18. Press conference on "The Hidden Agendas of Thai Energy Businesses in Power Planning Process	27 August 06 Bangkok	40	The political economy analysis of electricity planning process and policy suggestions.

Figure 1.3
Various Policy Communication Activities

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OPINION/FEATURE

Powerful alternative

Detrat Sukkamnerd's tireless promotion of unconventional sources of energy is aimed at correcting flawed government policy

SUNDAY BRUNCH

Kamol Sukin

At 37, Detrat Sukkamnerd may be considered too "old" for many activities, but he may also be considered too "young" to stand up and criticise Thailand's energy policy, insisting that it is wrong.

"Monopoly is a non-sustainable direction and will make consumers pay more and more for the same amount of electricity consumption", said Detrat Sukkamnerd. About the current popular energy-saving campaign of Prime Minister Thaksin Shinawatra's government Detrat has only this to say: "Cactuslike, it will exist but cannot grow."

Detrat is one of the leading alternative-energy experts in Thailand, who has (incredibly) spent the past 13 years examining charges on electricity bills for fairness. His sharp comments could make the Electricity Generating Authority of Thailand (Egat) and the Energy Policy and Planning Office (EPPO) feel insecure.

Detrat is an economics graduate, with a master's degree in agricultural and rural development. Next month, accompanied by his wife, five-year-old daughter and 11-month-old son, Detrat will fly to Denmark for a year, to finish his doctoral thesis on "Thailand's Energy-Planning System" at Aaborg University.

Detrat is a city boy, a bookworm, living in Nonthaburi, just outside of Bangkok. From his comments, you would think he hated Egat. But that is not so, as Detrat himself pointed out, given that his own father was an engineer there.

"While helping me with my physics homework, my dad always explained it in the context of his work. So I did learn a lot about the Thai energy sector when I was young," said Detrat.

He had an activist's mindset even in high school. While at Suan Kularb School, he participated in the first, and one of the biggest, environmental protests against the Nam Choen Dam proposed by Egat. This incident kick-started his environmental crusade.

He was the first one to adopt an economic approach while opposing the building of the historic Pak Mool Dam, insisting that if it were built, there should be an effort to compensate the unfortunate villagers for lost opportunities in fish-farming. This was later accepted by the government and the project's financier, the World Bank.

Detrat is now in Thailand's Alternative Energy Network, the only non-governmental agency to have compelled attention. "Thai energy policy is monopolised by Egat, the EPPO and PTT. That limits our options to a few fuel sources: coal, oil and natural gas," explained Detrat. "It also concentrates on supply-side management," he said, adding, "We should think more of alternative energy options."

And he thinks decision-making in the energy sector should not be left entirely to experts, causing a lack of transparency. "If the public is told why we have to go in for more gas or more coal projects, no one can doubt the statistics provided. I found some interesting information in those statistics," he said.

But won't alternative energy options like wind power and solar energy prove expensive in the future? Not really, says Detrat.

"There are three types of alternative energy sources in Thailand. One is cheap; another, quite competitive; and the third, rather expensive," he explained. The cheap source is demand-side management (DSM) and energy-saving. The competitive one includes biomass, biogas and micro-hydro options. The expensive options are solar energy and wind power.

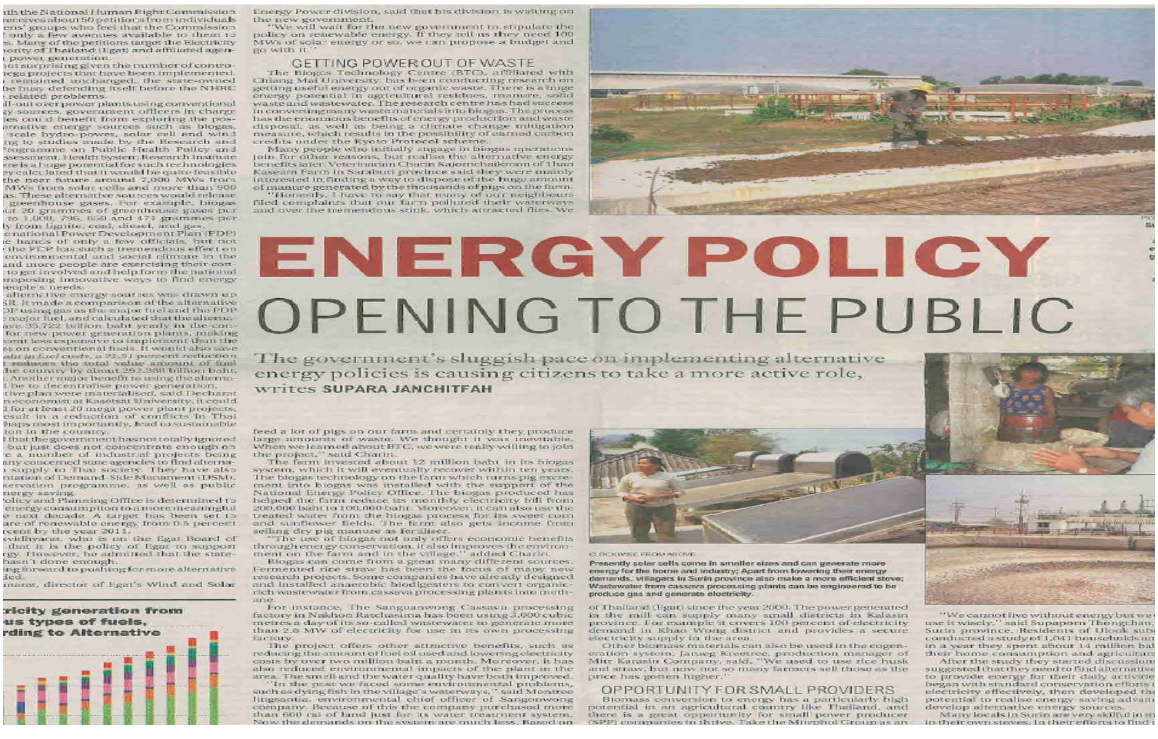
"I'm not saying we should discard the conventional options, but we need to balance them with the other ones, he said.

But why does he describe the current policy as "cactuslike"? Detrat said because it looked good from a distance. The government is said to be willing to make Thailand use 6-per-cent alternative energy by 2011, and it also wants domestic gasohol production. A series of problems lay with each alternative option, and most obstacles were being placed at the policy-making level. DSM and energy-saving projects are in the hands of Egat, which said it could generate only 500MW, while the real potential could be pegged at 3,000MW, said Detrat.

"Legally, Egat also controls the expansion of biomass and biogas power projects. But there is no core authority to oversee development of micro-power projects. Egat also controls the growth of co-generation power projects legally. And there is no proper policy for boosting research in and aiding the development of wind and solar energy in order to make it cheaper," he added.

"Legally, Egat also controls the expansion of biomass and biogas power projects. But there is no core authority to oversee development of micro-power projects. Egat also controls the growth of co-generation power projects legally. And there is no proper policy for boosting research in and aiding the development of wind and solar energy in order to make it cheaper."

Detrat Sukkamnerd
Energy activist



ENERGY POLICY
OPENING TO THE PUBLIC

The government's sluggish pace on implementing alternative energy policies is causing citizens to take a more active role, writes SUPARA JANCHITFAH

Energy Power division, said that his division is waiting on the new government.

"We will wait for the new government to stipulate the policy on renewable energy. If they tell us they need 100 MWs of solar energy or so, we can propose a budget and go with it."

GETTING POWER OUT OF WASTE

The Biogas Technology Centre (BTC), affiliated with Chiang Mai University, has been conducting research on getting useful energy out of organic waste. There is a huge energy potential in agricultural residues, manure, solid waste and wastewater. The research centre has had success in converting many waste materials into biogas. The process has the enormous benefits of energy production and waste disposal, as well as being a climate change mitigation measure, which results in the possibility of earned carbon credits under the Kyoto Protocol scheme.

Many people who initially engage in biogas operations join for other reasons, but realise the alternative energy benefits later. Veterinarian Charin Kajornchaikroon of Than Kasearn Farm in Saraburi province said they were mainly interested in finding a way to dispose of the huge amount of manure generated by the thousands of pigs on the farm.

"Honestly, I have to say that many of our neighbours filed complaints that our farm polluted their waterways and over the tremendous stink, which attracted flies. We feed a lot of pigs on our farm and certainly they produce large amounts of waste. We thought it was inevitable. When we learned about BTC, we were really willing to join the project," said Charin.

The farm invested about 12 million baht in its biogas system, which it will eventually recover within ten years. The biogas technology on the farm which turns pig excrement into biogas was installed with the support of the National Energy Policy Office. The biogas produced has helped the farm reduce its monthly electricity bill from 200,000 baht to 100,000 baht. Moreover, it can also use the treated water from the biogas process for its sweet corn and sunflower fields. The farm also gets income from selling dry pig manure as fertiliser.

"The use of biogas not only offers economic benefits through energy conservation, it also improves the environment on the farm and in the village," added Charin.

Biogas can come from a great many different sources. Fermented rice straw has been the focus of many new research projects. Some companies have already designed and installed anaerobic biodigesters to convert organic-rich wastewater from cassava processing plants into methane.

For instance, The Sanguanwong Cassava processing factory in Nakhon Ratchasima has been using 3,000 cubic metres a day of its so-called wastewater to generate more than 2.8 MW of electricity for use in its own processing factory.

The project offers other attractive benefits, such as reducing the amount of fuel oil used and lowering electricity costs by over two million baht a month. Moreover, it has also reduced environmental impacts of the plant in the area. The smell and the water quality have both improved.

"In the past we faced some environmental problems, such as dying fish in the village's waterways," said Montree Jitgsantia, environmental chief officer of Sangonwong company. Because of this the company purchased more than 600 rai of land just for its water treatment system. Now the demands on the system are much less. Based on

Figure 1.4 Examples of media coverage and journalist reports on policy workshops and sustainable energy trips.

1.4 Structure of the Research

To answer these four sets of research questions, the research will be divided into nine chapters. Each chapter is connected to each other as presented in Figure 1.5

After this introduction chapter, the concept of healthy public policy analysis will be reviewed in Chapter 2. In this chapter, the core ideas of healthy public policy and the introduction to Thai society under the health system reform will be elaborated. This will show that the needs for healthy public policy in Thailand in general and in the Thai power sector in particular are closely inked to the concept of new modernity, which includes the emergence of the risk society, network society and the demand for deliberative democracy. With these new emerging conditions, the conventional or linear policy analysis, which assumes a complete rationality in policy-making, is less likely to be effective. The new way of policy analysis is needed in order to understand the interplay between different stakeholders, between different policy discourses, and between power and rationality. This chapter will introduce the concept of deliberative policy analysis, which will be used for answering the research question 1 in Chapter 4.

In Chapter 3, the main focus is sustainable energy as a possible and healthier alternative. This chapter will begin by providing the background concepts and information about energy and health linkages. From these linkages, it is clear that renewable energy is a healthier technological choice. However, as already mentioned, this health benefit and also other societal benefits are not sufficiently recognized in the old regimes of technology. The new concepts, institutions, and practices for sustainable energy planning must be introduced. In this chapter, the concepts of institutional analysis, feasibility study and strategic environmental assessment will be reviewed. The concept of strategic environmental assessment will be further elaborated, as a main analytical framework of this research in Chapter 5, while the concepts of institutional analysis will be applied in Chapter 7. Last but not least, sustainable energy potentials in Thailand and their present conditions will be reviewed in order to ensure that Thai society really has a possible option for better power for health.

From the conceptual framework in Chapter 2, Chapter 4 provides a deliberative policy analysis, i.e. answers to research question No. 1, based on a long-term historical analysis and policy discourse analysis. In the historical analysis, different driving forces, influences, and historical events will be reviewed, in order to show how different policy discourses have interacted and why some policy discourses become dominant in a specific period of time in the nearly half-century history of the Thai power sector. With these insights, four influential policy discourses; namely state monopoly discourse, power pool discourse, private monopoly discourse, and decentralization discourse, will be identified and elaborated. The comparison of these policy discourses will show the similarities and differences between them, which have determined policy options or directions for future investment in the power sector, as in the Thai context, referred to the power development plan (PDP). These three policy options, or three PDP options, will be used as alternatives in the impact assessment analysis in Chapter 5 with the aim to find the healthier solution for the Thai power sector in Chapter 6.

As earlier mentioned, Chapter 5 is an analytical framework for strategic impact assessment. In other words, this chapter is a blueprint for answering the second set of research questions. To provide the framework of analysis, this chapter will begin with the operational strategy to apply strategic environmental assessment (SEA) to this research. In short, the strategic environmental assessment will focus on the three PDP options, as long-term investment options in the Thai power sector. These three PDP options provide different investment strategies in terms of demand prediction, as well as fuels and generation technologies used. These three PDP options include PDP-Gas (of which 81% of power generation will rely on natural gas), PDP-Coal (of which half of the new power plants will be switched to coal), and PDP-Renewables (of which 10% of power generation in 2011 will be converted into renewable energy and replaced by a more realistic demand prediction).

According to national development objectives, SEA in this research will mainly focus on the environmental, health, social, resources, and economic impacts of these three PDP options. Like other SEA studies, the impact analyses are mainly based on a number of assumptions about the linkages between technologies and their consequences. In this Chapter, the review of different information and viewpoints on these linkages will be reviewed and discussed in all aspects of the impact assessment above mentioned. Finally, the set of assumptions for impact analysis has been made. Because these assumptions are highly contestable and, in many cases, uncertain, the sensitivity analysis is necessary to provide the insights into how these three PDP options will respond or lead to different impacts on different assumptions and situations.

The outcome of the analysis framed in Chapter 5 will be presented in Chapter 6. In Chapter 6, the second set of research questions will be answered. The chapter will begin by describing the environmental impacts of the three PDP options. Then, health impacts of three PDP options will be presented. Later, the different impacts on social, resources, and economic aspects will be provided. It is clear from the results that PDP-Renewables is a cleaner and healthier option and, at the same time, an attractive option for economy and society, too. In economic terms, PDP-Renewables will not lead to an increase in total generation costs. On the contrary, it can reduce the import burden and provide more GDP contribution to the economy. The results of the sensitivity analyses also confirm that the advantage of PDP-Renewables can be maintained in different situations and assumptions, which indicate the higher flexibility for society to readjust with uncertain future situations. In sum, this chapter provides a clear answer that a healthier choice is feasible for the Thai power sector.

With the healthier option, the analysis in Chapter 7 will move to an institutional analysis in order to understand how this healthier option can be developed in the present institutional framework. The analysis of the institutional framework will begin with market and governance structures, succeed by to pricing structure and interconnection issues. Unfortunately, the analysis shows that the existing institutional framework is not favorable to the development of PDP-Renewables in various aspects. This is mostly, because the existing institutional framework has been set by different normative and cognitive pillars of institution. Therefore, the changes towards a more supportive institutional framework, as suggested in this chapter, highly depend on the outcomes of the normative and cognitive battlefields. However, the concrete analysis of different public regulations, the good reference cases, and the expanded social learning process will significantly help in contesting in these decisive battlefields.

Chapter 8 consideres all the suggestions developed in Chapter 6 and 7 in relation to the actual policy changes in the three-year study period (September 2003-August 2006), with the aim to provide reflections on the concepts of healthy public policy and deliberative policy analysis in Chapter 2. The chapter will begin by highlighting the interactions between the research works and policy process through different ways of public communication. Obviously, some desirable policy changes have taken place within the three years of study. However, these desirable changes do not occur mainly because of the study findings, but rather because the government cannot avoid an inevitable fact (such as lower demand growth), strong public and academic demand for changes, and the legal decision by other independent organization in Thai society (like the Supreme Administrative Court on canceling the EGAT privatization process). This means that, apart from analyzing policy processes and impacts, the stimulations and supports to the social learning process is essential to the healthier policy changes. Therefore, the future of healthy public policy and sustainable energy in the Thai power sector is more likely to depend on the continuous works to support the social learning process as suggested in this chapter rather than academic finding in itself.

Overall, analytical conclusions, reflections, and perspectives developed in this research study will be summarized in Chapter 9. To end the study and to initiate the new story of the Thai power sector, “the better power for health” must be developed in three dimensions of power; namely sustainable power in physical term, balanced people’s power in political terms, and societal wisdom power in philosophical terms.

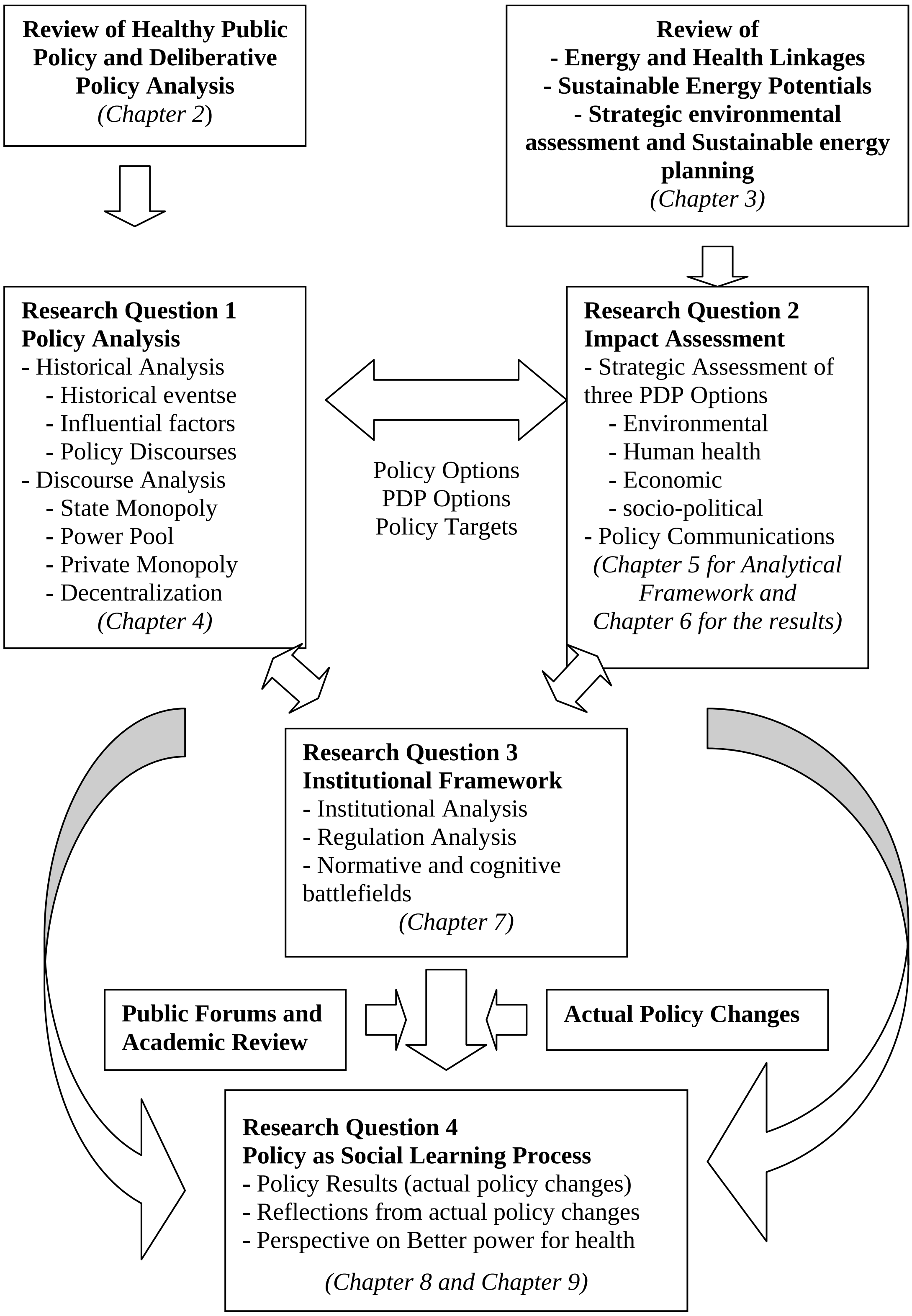


Figure 1.5 Structure and Outline of the Research

1.5 Scope of the Research

This research will focus mainly on the policy process of Thai power sector, not energy policy in general. Furthermore, in order to make it relevant to actual policy debates, the analysis in this research, especially the part about strategic impact assessment or the second part, will emphasize the process of the power development plan 2004 (or PDP) which determine the choices of power generation and investment for the next 12 years (2004-2015). Although EGAT considers PDP as its long-term development plan, these 12 years may be not an adequate time perspective for more radical changes in power technologies, as earlier suggested by Hvelplund and Lund. Therefore, the healthier policy changes that can be suggested from this study are still more likely to be initial or transitional changes within this coming decade, rather than an absolute long-term solution.

It is very important to mention that, in the strategic environmental assessment, the impacts of three PDP-options will be analyzed. This means that a healthier solution is developed through the comparison of these three policy choices. Moreover, since these three policy options are developed on the basis of their policy discourses and not by any optimization techniques, the healthier solution resulting from this research is more likely to be one of the better solution, rather than the best or healthiest option that can be found in the Thai power sector. This is why the research title is called "better" power for health rather than "the best" power or the healthiest.

As earlier mentioned, this research would like to see the actual policy change and provide the reflections from actual policy changes within the three years of the study. However, as generally known, policy changes may incrementally or radically take place over a longer period of time. The study cannot include all policy changes that take place after the closing of the research; that is August 2006.

Apart from these above-mentioned limitations, there are still number of technical limitations can still be found in the analysis, especially in terms of strategic impact assessment. In this matter, all technical limitations and assumption used in strategic impact assessment will be discussed in detail in Chapter 5.

1.6 Ethical Considerations in this Research

There are two critical points for ethical consideration in this research. The first consideration is linked to the health impact analysis and the second one to the close interaction between research and policy process.

Firstly, the study of human health impact is an ethical issue in itself. Since human health impacts are complicated phenomena, assessing future health impacts from power generation and investment usually face several limitations and uncertainties in its methodology. For example, the impacts of greenhouse gas emission on the climate change and, consequently, the impacts of climate change on human health are still under debate and need more detailed studies, especially for the application to Thailand. Moreover, the health impacts of multi-pollutant interactions (from power plant emissions) are not yet fully understood and measured. Since recent and on-going epidemiological studies continuously provide new information about the health impacts of power generation and, at the same time, new cleaner technologies are continuously introduced on the energy market, this also implies that assessing tomorrow's impacts by today's knowledge certainly involves limitations and uncertainties.

However, avoiding of assessing the future impacts is also facing a serious ethical question. Once the policy decision is made either now or the near future, the health impacts, including the negative ones, are more likely to occur and to affect the Thai people. Therefore, in my view, conducting this research is necessary and, to face ethical challenge, careful ethical consideration is needed in all research process.

This also links to the second ethical consideration in this research. Conventionally, to be objective, the research (and researcher) is expected to separate from the policy or decision-making process. Moreover, in some related disciplines, like economics, they also require to be a “value-free” analysis.

However, the main aim of the healthy public policy, introduced by the World Health Organization, is to promote health and healthier policy options in non-health sectors. Therefore, with the clear aim to raise value of health higher in the agenda on policy-making, healthy public policy research cannot be value-free research. Furthermore, with the idea to make a healthier choice an easier choice, healthy public policy, in my view, is an action-oriented research rather than just pure academic analysis.

Specifically, this research aims to test the social validity of the healthy public policy concept by participating in actual policy changes and reflecting on this attempt. Hence, research and policy are not totally separable; they have several intentional interactions as have been explained and will be explained in detail in Chapter 8.

The main question is how to cope with these ethical considerations in this research. A good analysis without the attempts to “contribute” to desirable changes may also lead to questions about the social responsibility of the academic society. Moreover, if the goal of science is to discover the reality, how could we blind our eyes from the policy or decision-making processes, which, in several cases, determine the future realities. Is it also an important social responsibility for the science community to discover about how the realities have been made and discuss with the society about what can be alternative future realities? Therefore, in this view, the social responsibility is the central point of ethical consideration in this research.

However, to fulfil the social responsibility principle, honesty, carefulness, and openness within the research process are highly required. Moreover, to pursue the idea of healthy public policy, public education in the policy process is also an essential part of ethical consideration in this research. In order to follow and achieve these ethical principles in science, several processes form part of this research have been made in these following ways;

- **Literature review** on health impacts of power generation, which try to ensure the carefulness and honesty about potential impacts of different policy options by looking for different results from several previous studies and showing them clearly in the analytical framework of Chapter 5.
- **Clear presentation of methodology and data used** both in order to ensure the openness for all sources used in my assessment and analysis. This will allow and facilitate other researchers or people to examine and challenge the assumptions and consequently the results of this research.
- **Declaration of all limitations and uncertainties**, which is very essential to gain honesty, carefulness, and openness. Concurrently, it is also very important for the social responsibility and the public education within the decision-making process.

- **Sensitivity Analysis** is one of the best ways to analyze the reliability and flexibility of research finding in uncertain future conditions, which hopefully can contribute to a higher degree of openness, carefulness, and, thus, social responsibility in this research study.
- **Review processes** are also useful for pursuing the openness and carefulness within the research process, which, in this case, it has been done in two main ways, including;
    - **Academic review process** which refers to the formal university process of a PhD study at Aalborg University and the peer review in the Journal and conference,
    - **Public review process** in Thailand, to ensure that this research is properly incorporating all relevant societal concerns in Thai society and also include the responses of the different stakeholders in the analysis.
- **Deliberative policy recommendation** is necessary at the end of the research process. Although the clear policy positions is needed in the political decision, but the limitations, uncertainties, and the results from sensitivity analysis should also be explicit and meaningfully addressed.

However, all the above-mentioned attempts have some certain limits. For example, the reviewers may provide the comments within their scope of expertise and policy positions. At the same time, the sensitivity analysis is still based on today's knowledge of tomorrow's uncertainties (which in several cases go further beyond today understandings). Therefore, it is not possible to claim that all ethical questions are totally solved in this research.

At the last stage of this research process, this research project still needsto be "humble" and "honest" about its results its recommendations, and its policy contributions. Although the research aims to present its findings in a meaningful way for policy decision, it must not aim to provide the "final answer" to society. Oppositely, it should encourage and facilitate Thai society to discuss about "questions", other "possibilities", and perhaps "the answer" in more deliberative and constructive ways.

Perhaps, the best possible solution for Thai society is to consider policy as a continuous social learning process, which always requires further questions and possibilities, rather than focusing on specific one-shot political decision-making. By this way, it may encourage society, politicians, and scientists, to learn more closely from each other in protecting and promoting human health. Certainly, this may seem like a dream today, but, at least, it is a good ethical dream for our healthier future.

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Chapter 2
Healthy Public Policy and Policy Analysis

As earlier mentioned in Chapter 1, healthy public policy is a core concept, which initiated the research questions of this research. Therefore, it is essential to take the concept of healthy public policy as a point of departure, including the development of health impact assessment (HIA) as one of the main tools for promoting a healthy public policy. After that, it will be explained how the concepts of healthy public policy and HIA appear in the dynamics of Thailand's health system reform taking place in 2000. This part will provide an important notion on how "health" has been interpreted in Thai society and how it links to the policy directions outside the health sector.

From this point of departure, it is clear that the emergence of Thai movements in the healthy system reform in general and healthy public policy in particular is quite related to the concepts of risk society, network society, and deliberative democracy. Therefore, these concepts of new modernity will be reviewed and provide insights to be used in the policy analysis, which is based on the first set of research question. Three theoretical frameworks of policy analysis will be discussed in this Chapter, beginning with a conventional policy analysis and succeeded by a policy negotiation analysis and a deliberative analysis. From these theoretical backgrounds, the conceptual framework for analyzing public policy in the Thai power sector will be identified. Last, the cases of healthy public policy movement in the power sector, both internationally and domestically, will be presented in order to build up a common understanding and the link the analysis to the areas of sustainable energy and health in the next chapter.

2.1 Healthy Public Policy

Since the 1st International Conference for Health Promotion in 1986, the World Health Community has asserted the importance of inter-sectoral commitment and action to improve the health determinants of the population, or the "all for health" principle, to fulfill the ultimate goal of "health for all".

The commitment refers to the notion of healthy public policy, introduced in the Ottawa Charter as the outcome of the 1st International Conference for Health Promotion. Since political, economic, social, cultural, environmental, behavioral, and biological factors can all favor health or be harmful to it, the healthy public policy aims to create a supportive socio-environment to enable people to lead healthy lives.

The main idea of the healthy public policy is to put health on the agenda of policy-makers in all sectors and at all levels, to direct their attention to the health consequences of their decisions and to make them accept their responsibilities for health. Healthy public policy "combines diverse but complementary approaches including legislation, fiscal measures, taxation and organization changes". It is also very important to identify obstacles to the adoption of healthy public policies in non-health sectors, and the ways to remove them. Therefore, healthy public policy efforts should also aim "*to make the healthier the easier choices for policy-makers as well*"[1].

In the pursuit of a healthy public policy, the government must be responsible for taking into account health as an essential factor when formulating policy in non-health sectors. These sectors, especially agriculture, trade, education, energy, transportation, etc., should be accountable for the health consequences of their policy decisions[2]. Therefore, as suggested by the Ottawa charter, "*the systematic assessment of the impact of rapidly changing environment- particularly in areas of technology, work, energy production and urbanization- is essential and must be followed by action to ensure positive benefits to the health of the public*"[3].

Besides the government responsibilities, the Ottawa charter also stresses that, "health promotion is the process of enabling people to control and to improve their health". According to the Charter, "people cannot achieve their fullest health potential unless they are able to take control of those things which determine their health".[4] This means that the empowerment of communities – their ownership and control of their own endeavors and destinies – should be at the heart of the healthy public policy strategy. In doing so, the healthy public policy must also increase the options available to people to exercise more control over their own health and over their environments, and to make choices conducive to health[5].

Since "our societies are complex and interrelated, health cannot separate from other goals" [6]. As elaborated more in the Adelaide Recommendations on the Healthy Public Policy in 1988, "a basic principle of social justice is to ensure that people have access to the essentials for a healthy and satisfying life. At the same time, this raises overall societal productivity in both social and economic terms"[7]. Therefore, healthy public policy must combine economic, social, ecological, and health issues in integrated development strategies and actions[8].

Moreover, since "inequalities in health are rooted in inequality in society", healthy public policy should give high priority to underprivileged and vulnerable groups and "recognize the unique culture of indigenous peoples, ethnic minorities, and immigrants"[9].

According to its concept, the introduction of healthy public policy has led to major shifts in health paradigms and policy initiatives, including;

- The realization of the importance of health impacts (both positive and negative) of non-health sectors, which leads to a need for more proactive inter-sectoral policy initiatives and actions to tackle health risks and promote health at more upstream levels.

- The integration of health into the general concepts of sustainable development, human rights, and social justice. Under these concepts, health becomes both means and ends of a desirable future and has inextricable links with other development goals.

- The introduction of more holistic views of health, which later influences the development of several useful analytical frameworks, including the ecosystem health approach and the social determinants of health, as presented in Figures 2.1 and 2.2.

- The strong recognition of community and civic roles in health promotions, not only through the participation in development processes, but also through the control over those things which affect their health and lives.

Therefore, the introduction of the healthy public policy in the Ottawa Charter has given rise to new languages and new practices in health promotion as well as in the policy processes of other sectors. In the 1990s and 2000s, several international commitments and practices, including the Amsterdam Treaty, the EU directive on environmental assessment of plans and programs[10], healthy cities, and etc., have been adopted and developed with the clear statement that human health should be seriously considered in all relating policy formulation, as suggested in the Ottawa Charter. Concurrently, healthy public policy has later been adopted and further developed in various countries and in various policy areas, as later shown in this chapter.

2.2 The Development of Health Impact Assessment

A commitment to healthy public policy means that governments, at national and local levels, must measure the health impacts of their policies, and communicate these findings to communities and societies. In doing so, the systematic assessment of the health impact of a rapidly changing environment is also essential and must be followed by action to ensure a positive benefit to the health of the public[11].

Following this idea, Health Impact Assessment (HIA) was sooner developed as a main tool to make health consequences a part of the consideration of all policy-makings. HIA has been defined by WHO as "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of population, and the distribution of those effects within the population"[12]. In UK, *HIA gateway* has described HIA as "a developing process that uses a range of methods and approaches to help identify and consider the potential – or actual – health and equity impacts of a proposal on a given population"[13].

Although HIA can be defined in a number of ways, it is clear that its primary output is "a set of evidence-based recommendations geared to informing decision-making process"[14]. More importantly, the fundamental goal of HIA goes beyond just providing information; "the aim of HIA is to achieve changes in policies and proposals so that they support better health and reduce health inequalities[15]. In other words, HIA tries not only to project the impacts of policies, programs, and projects, but also to influence the political decision-making process on the basis of its findings and processes[16].

Figure 2.1 The Ecosystem Health Approach
Source: Jean Lebel, 2003,7.

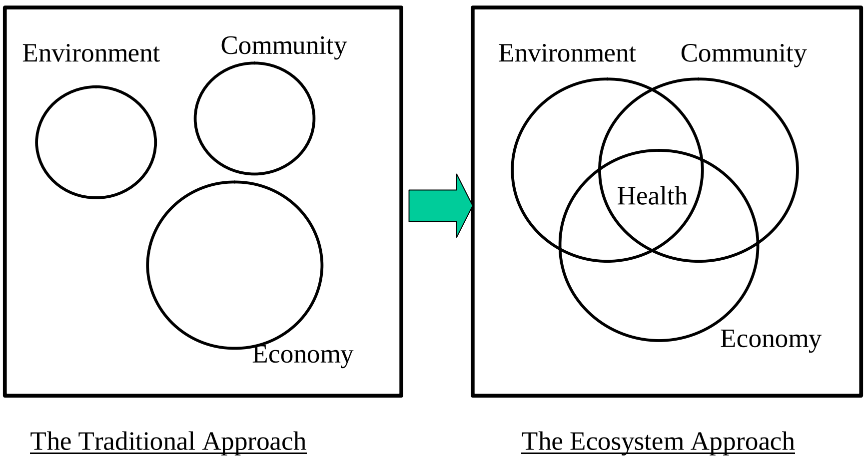
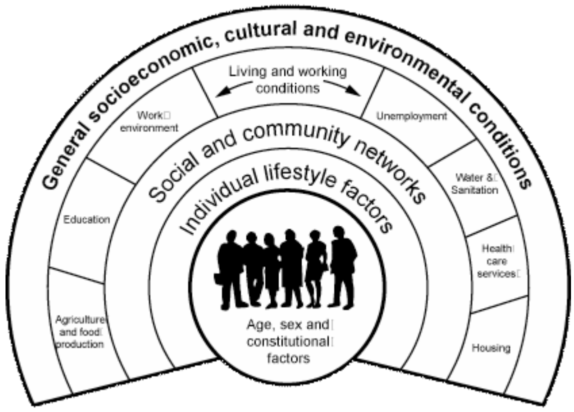


Figure 2.2 Framework for Social Determinants of Health



Source: Dahlgren G, Whitehead M. *Policies and Strategies to Promote Social Equity in Health*. Stockholm: Institute of Futures Studies, 1991;

HIA, therefore, has its own specific role, compared to other tools in health promotion. HIA aims to provide a mechanism to achieve the engagement of other sectors in health promotion through the assessment of inter-sectoral actions and recommendations for the future development of those. In pursuing this goal, HIA needs to address changes in health determinants “upstream” in the planning process, in order to identify health opportunities in the development processes.

Since HIA is directed at non-health sectors, HIA cannot only serve as a technical tool for public health specialists. It has to be a tool which is accessible and reliable to different stakeholders within societies. In this sense, HIA should be recognized as the bridge which integrates health dimensions and development processes, and at the same time, as the window which allows the health sector to participate more proactively and meaningfully in other parts of the wider public sphere.

2.2.1 HIA Development in the Recent Years

The development of HIA in these recent years can be seen in two different streams or approaches. The first stream is the natural development of environmental impact assessment (EIA)[17]. This approach, usually called environmental health impact assessment (EHIA), was initially promoted by the WHO in the 1980s to address neglected health considerations in conventional EIA[18]. In practice, EIA seldom address health considerations, despite the fact that legal frameworks for EIA in many countries already include health impacts as a compulsory element[19].

EHIA is basically based on the bio-medical model of health, and assesses the changes of mortality, morbidity, and injuries[20]. Thus, EHIA mainly applies epidemiology and toxicology to its studies. Due to its focus on a specific cause-effect relationship, this approach is sometimes called the “tight perspective”[21].

This approach was first applied to large infrastructure projects in developing countries. At present, EHIA is practiced in developed countries such as Australia, New Zealand, and Canada[22]. Several regional offices of the WHO have funded a number of projects involving workshops and guidelines on EHIA in some countries[23]. Additionally, some international donor agencies and financial institutes have also paid interest in integrating health into their project appraisal processes[24].

The second stream of HIA has evolved from the concept of “healthy public policy”. Although the idea of a policy impact assessment of the population’s health is not new, the emphasis on the relation between impact assessment and decision-making is of recent date[25]. In 2000, at the 5th Global Conference on Health Promotion, HIA was proposed as to be “a device for forcing the relevant bodies to take action in favor of healthy public policy” and “a potential catalyst for inter-sectoral action for health”[26].

This approach is based on the socio-environmental model of health, which considers wider determinants of health including individual, social, economic, and institutional factors[27]. Some researchers refer to this approach as the “broad perspective”[28].

This approach is now popular in developed countries, such as Canada, the UK, Sweden, and the Netherlands[29]. Concurrently, some developing countries, like Thailand, have also played an active role in developing HIA in their health system reform[30], which will be discussed later. Recently, this HIA approach was also applied to raise the awareness of health inequalities, called equity-focused health impact assessment (EFHIA)[31]. Within recent years, HIA in this approach has been applied to various inter-sectoral policy developments, like housing, transportation, agriculture, energy, urban planning, etc., from the local and national levels to the international level[32].

HIA applies a wide variety of tools and methods; for example, literature reviews, epidemiological modeling of risk, key informant interviews and focus groups to elicit community views and perceptions. Because HIA is a relatively new and developing approach, it is very difficult to determine its most appropriate methodological approach.

Although the main goal of HIA is to provide evidence-based recommendation, in reality, appraising evidence can also be complex because of the interrelationship between different health determinants and their causal pathways. Moreover, it is also difficult to isolate the influences of particular policy interventions on complex and dynamic social systems. Therefore, when predicting health impacts in complex situations, it needs to be understood as "the prediction of tendencies and types of impacts" rather than absolute measures[33]. In the Netherlands, for several policy assessments, the focus of HIA is more on the effects of policy on health determinants than on "health" itself[34].

2.2.2 HIA and Policy-making

Although HIA has a clear aim to influence policy-making[35], the early version of HIA assumed a linear process with a direct link between impact assessment and decision-making processes. For example in Australia[36], the links between policy development and the usefulness of HIA were not explicitly defined in many HIA studies. In other words, in these studies, HIA has developed "without real consideration of the political and administrative frameworks within which it has to operate[37]. Therefore, many HIAs have failed to communicate their message to the decision-makers or to be policy-relevant, or they arrived too late to influence decision-making[38].

Fortunately, the later versions of HIA have tended to put more emphasis on decision-making structures and political processes[39]. This requires an HIA process which is compatible with decision-making rules and procedures, including time frame[40 41]. Some studies and guidelines also suggest that HIA studies are most likely to influence decision-making, if the decision-maker owns the assessment and is closely involved in all stages of the HIA. However, on the other hand, it is also difficult to reconcile to the principle of openness and transparency[42]. Moreover, entrusting HIA to a policy-maker could also be dangerous, especially in developing countries[43].

The review from UK experiences shows that several HIA studies can successfully influence policy-making, for instance in the formulation of mayoral strategies for London[44] or in urban development projects[45]. The key of success can be seen in the strong political commitment, the participatory processes of different stakeholders, and the effective ways in which a non-statutory assessment is adapted to the statutory planning framework. The importance of enabling institutional infrastructure can also be seen in other HIA reviews[46], including cases in developing countries[47 48].

Since policy-making, in reality, is subjected to a very wide range of influences, it can certainly be difficult to establish a cause & effect relationship between HIA processes and subsequent policy decisions[49]. As mentioned by Bartlett, “impact assessment does not influence through some magic inherent in its techniques or procedures. More than methodology and substantive focus, what determines the success of impact assessment is the appropriateness and effectiveness in particular circumstances of its implicit policy strategy”. Therefore, the success of HIA should not necessarily be evaluated in terms of a one-off event, but more as “a continual effect that brings change in organizational thinking about health and subsequent decision-making”[50]. This viewpoint asserts the importance of long-term involvement in the development of a healthy public policy[51].

2.3 Thailand’s Health System Reform

The concepts of healthy public policy and HIA were first introduced to the Thai public during the process of the National health system reform, beginning in 2000. This reform provides important spaces and processes for several changes in Thai society, including the expansion and deep-rooting of a healthy public policy concept. Therefore, it is important to understand the evolution of this concept in Thai society through the health system reform process.

2.3.1 Driving Forces of the National Health Systems Reform

Although, the general health status in Thailand has improved satisfactorily in the last two decades, some evidence of failure in the health system’s performance has gradually unfolded[52]. With the success in economic modernization, Thailand is now facing new forms of health risks, including HIV/AIDS, traffic injuries, mental stress, and environmental hazards. Thailand’s mortality rate (per 1,000 population), which had declined from 20 in 1975 to 4.1 in 1986, climbed up to 5.0 in 1997 and 5.1 in 1998[53].

The average health expenditure rose nearly nine-fold from 12.1 to 103.6 USD during the period of 1980 to 1998. The increasing rate was 9.1% per annum in real terms, which was higher than the 7.0% annual growth rate of GDP per capita during the same period. Moreover, national statistics show that, in 1992, in comparison, the poor part of the population spent a higher percentage of their household income (8.17% of their income) on health care than the rich (1.27%). The difference is approximately 6.4 times higher for the poor. The infant mortality rate in non-municipal areas is 1.85 higher than that in municipal areas, with the trend of a widening gap[54].

Combined with drastic changes in social and political conditions during the 1980s and 1990s, the national health system was increasingly forced to reform. The climax was reached in 1997, when the new constitution was adopted and implemented, with the massive supports from civic movement. Under the new constitution, health becomes a matter of human rights, not just public welfare. Consequently, government is required to provide public health services of the same standards to all parts of the population. All development programs and projects that have adverse impacts on health are now required to conduct environmental impact assessment with a public scrutiny process. The civic roles in policy formulations and public decision-makings, as well as in the implementation of the decisions made, have been asserted in this constitution. Last, the new constitution requires a decentralization of government services, including health services[55].

With all these facing crises and new societal directions, the Thai government announced the process of National Health Systems Reform in 2000. Under the regulation of this announcement, the national health system reform is defined as "a process that leads a transitional management of the national health system to a capable system aimed at physical, mental, social, and spiritual well-being of the people, as well as people's accessibility to health services that are of good quality, efficient and equitable"[56].

2.3.2 Strategic Process of the National Health Systems Reform

The tangible outcome of the reform is to develop the "National Health Act" as a constitutional framework of the national health system. However, unlike other legislations in Thailand, the reform aimed to use a drafting process as the opportunity for mutual learning in Thai society. Based on the concept of "the triangle moves the mountain", the creation of relevant knowledge, political involvement and social movement must join hand and strengthen one another in carrying out the transitional management towards a better health system. Therefore, the active discourses and public hearing formed an integral part of the reform process, bringing knowledge and innovative ideas with a visionary perspective to the desirable health system[57].

The process was initiated with a national and six regional seminars on "The Desirable Health System in Thailand" in 2000. The results of these seminars were put into the background paper prepared for the development of the framework of the health system reform. In January 2001, the principle framework for the national health system reform was developed and followed by the public hearing and feedback process. During the period of April-August 2001, 35,000 people from more than 1,800 organizations joined the public hearings held in every province of the country and more than 100,000 approaches of public feedback were sent to the Health System Reform Office (HSRO). Both the framework, feedback, and other ideas were discussed and summed up in the first National Health Assembly in September 2001, attended by 1,500 representatives from all provincial forums of previous public hearing[58].

Based on the results of the first National Health Assembly, the first draft of the National Health Act was developed and again succeeded by an extensive public review process with a) general public hearings in 500 districts in Thailand joined by more than 400,000 people, b) 20 public hearings on specific issues (e.g., disability, traditional medical wisdoms, health impacts of development projects, etc.) and c) the provincial health assemblies in 76 provinces attended by more than 40,000 participants. The results of all three processes were summarized and developed into the final draft of the National Health Act in July 2002. This final draft was submitted for endorsement to the National Health Assembly in August 2002 (with 4,000 participants). After the endorsement, the draft was submitted to the Prime Minister at the closing ceremony of the assembly, demonstrating the political commitment to pursue this reform and the formal legislative process[59].

The formal legislative process of the National Health Act has lasted for a longer period than anyone in the reform movement could expect (up to now, it is still in the parliamentary process) due to detailed technical discussions and debates in the governmental legislative process and the uncertainty of previous political commitments. However, instead of just waiting for the law enforcement, several suggestions and mechanisms made during the drafting process have been continuously developed both within governmental and civil sectors. This includes the continuation of the annual National Health Assembly and provincial health assemblies, which has now become the main public forum for deliberating the important issues of the national health system. Also several research programs were set up by the Health Systems Research Institute to prepare the detailed designs of the expected health systems together with the related government organizations and civic groups, including a research program on healthy public policy and health impact assessment.

2.3.3 Health in New Dimensions

Through this reform process, several new ideas for the health system were introduced, demonstrated, deliberatively discussed, and developed on an on-going basis, which led/have led to significant changes in the dimensions of health within Thai society.

The new dimensions begin with the definition of health. In the draft, health is defined as *"the complete status holistically interrelated in the physical, mental, social, and intellectual (or spiritual) balances*"[60] (see Figure 2.3). Therefore, health is no longer an issue of illness. It becomes an issue of complete well-being, both for individuals and society as a whole, and both in physical and more social and spiritual senses.

Following the new definition of health, health systems are now referred to as "all of the interconnected management that enhances healthiness and factors relevant to health aspects, such as individual factors; economic, social, political, educational, legal, religious, cultural and traditional factors; scientific and technology factors; as well as the factors on public health and public health service"[61]. In other words, now the health system is moving beyond the previously termed "health sector" (see Figure 2.4).

Moreover, it is stressed clearly in the draft that "healthiness is the human dignity"[62] and "healthiness is the ultimate goal of the community and society"[63]. In this view, healthiness is becoming "the national ideology and the coverage insurance of security". The draft also asserts the right of a person "to participate with the state and the community in generating the environmental conditions which are appropriate, balanced, safe, of high quality, and meet the standard of continuous normal living in good health with good quality of life"[64]. Hence, health is no longer the responsibility of health professionals alone. It is now becoming the challenge and responsibility of each individual and society as a whole.

Therefore, the new health systems "should aim at creating health for all and all sectoral participation should be enhanced for therein health promotion with the continual potential building process of persons, families, communities, and socio-environmental conditions for reciprocal benefits of living together"[65].

In pursuit to this goal, apart from several specific mechanisms, national and provincial health assemblies were established. The assemblies are defined by the draft as "the sitting process in which all sectors could intellectually and harmoniously participate and exchange their knowledge and experiences, through a systematic and participatory management, to reach a state of well-being”[66].

Within five years’ time (from 2001-2005), all these new dimensions and forums provide a great opportunity for several health issues and practices to be broadly demonstrated and deliberatively discussed in Thai society. This includes the issues of traditional health practices, health manpower management by locality, holistic health care, health-oriented agricultural policy, healthy public policy and health impact assessment (see Figure 2.5). Some of these issues, for example health-oriented agricultural policy, have led to the governmental policy changes of the target of 50% pesticide reduction in the Thai farming sector[67].

As concluded by Wiput Phoolcharoen, “just as a drop of water on a tropical plant induces the sudden spread of seeds, the health reform process is pushing the evolving health system forward at a rate never seen before”[68].

2.3.4 Healthy Public Policy and HIA in Thailand

The issues of healthy public policy and HIA were first raised at the national seminar on “The Desirable Health System in Thailand” in 2000 and echoed during the public hearings at the provincial level in 2001. This issue has become more important to Thai society, mainly because of the increasing occurrence of health problems caused by environmental hazards; such as air pollution, pesticide contaminations, improper waste treatments etc., as well as the evidence and concerns of health impacts of development projects; such as large dams, coal-fired power plants, trans-national gas pipelines, highways, etc.

After the issue was raised in the reform process, the Health Systems Research Institute (HSRI) has set up the academic review process in 2001, which, consequently, reinforced the concept of “healthy public policy”, introduced 10 years earlier in the Ottawa Charter. The notion of healthy public policy received good public response in combating the problems faced by Thai society and was put into the framework of the national health system reform[69].

Later, in 2001, the issue of healthy public policy became the first topic of discussion in the first National Health Assembly, showing its relevance and importance in the context of the Thai health reform. In the assembly discussion, two HIA studies on industrial development and agricultural policy were presented, showing clear negative health impacts of well-known governmental policies and projects. As a result of the first assembly, the concepts of healthy public policy and HIA were included in the first draft of the National Health Act, paving the way for HSRI to develop a research program on healthy public policy, and health impact assessment began in 2002 to support further development in healthy public policy and HIA in Thailand[70].

In the draft, healthy public policy refers to “the progressive guideline that intends to establish a socio-physical environment facilitating health and enabling people to approach choices which are conducive to health”[71]. The draft stresses that the expected health systems shall have “guidelines and measures to establish the healthy public policy and the process of HIA from the public policy, aimed at joint learning of all sectors in the society, through the sufficient academic utilization, with the transparent and accountable mechanism”[72]. The draft also asserts the right of the Thai people to "participate in accessing the information, suggesting, performing, using the assessment outputs and making decision on the approval and permission of the policy implementation and crucial projects that may have an impact on health"[73].

After the long process of public hearing, including special hearings for those who had been affected by development projects, the special session on healthy public policy and health hazards was organized in the second National Health Assembly in 2002 to scrutinize and later endorse the draft of the National Health Act in August 2002, as earlier mentioned.

The evolution of a healthy public policy in Thailand has been closely linked to the development of health impact assessment (HIA). This phenomenon was influenced by the intense conflicts related to public decision-making on several development projects and the ineffectiveness of the EIA system in the country.

From 2002, the HIA guidelines and capacity-strengthening activities were carried out for both the academic community and active citizens in general. Under the HSRI research program, more than 50 HIA case studies were conducted of several policy issues, both at the national and local levels. Although, all the cases aimed at implementing desirable policy changes, only some of them will be able to reach the expected policy outcomes, highlighting the importance of policy contexts in healthy public policy developments. To foster desirable policy changes, five policy networks, including one for energy and industrial policies, were set up with the role to seek opportunities and formulate strategies for healthier policy changes[74]. Later, the recent lessons from these policy networks were summed up and further developed into an operational framework for healthy public policy formulation in Thailand, as discussed later in this chapter.

After the five years of introduction, the concepts of healthy public policy and HIA were further elaborated and developed by several actors and in several sectors in Thai society. In the civil sector, several HIA were conducted by the grassroots organizations and were taking crucial part in their policy arguments. At the same time, the healthy public policy becomes part of their policy languages, especially in agricultural policy. In 2005, the policy recommendations from the National Health Assembly on health-oriented agricultural policy were acknowledged by the Thai cabinet. Moreover, several local administrative organizations and civil groups apply this concept to change their own policy direction towards a safer food system and a healthier agricultural production, which confirms that the healthy public policy is not only a matter of governmental authority, but also a question of social responsibility[75].

In the government sector, the Ministry of Public Health established the HIA division in 2002 to support regional and provincial health offices in HIA works. The Ministry of Natural Resource and Environment also incorporated HIA as a main component of the on-going EIA reform. Later, in 2005, the National Economic and Social Advisory Council (NESAC) also recommended the Thai government to implement and support the development of healthy public policy and HIA, in the country. This recommendation was also acknowledged by the Cabinet later in the same year[76].

Apart from what has been written in the draft of the National Health Act, all of these further attempts have paved the way for broadening the concept of healthy public policy in Thai society, deepening this concept into the culture of public decision-making, and uplifting the concept into the process of public policy-making in the country.

2.3.5 Health System Reform and New Policy Phenomena

The process of health system reform and the development of healthy public policy in Thailand as described earlier have presented the significant shifts in the characteristics of Thai politics and the public policy process. At least, three significant phenomena can be identified and will be further discussed in this study as follows;

a) The Increasing Awareness of the Risk Society

During the process of reform, the increase in new environmental and social health risks becomes one of the most concerning issues in the Thai health system, along with the issue of universal coverage and quality in health care, traditional medical wisdoms, and health governance. The evidence of negative health impacts of development projects and wrong policy directions is pervasive in the country, as presented in the public hearing and health assemblies.

Overall, the statistics on health status have shown that while Thailand can control and reduce the so-called traditional health risks, like malnutrition, infectious diseases, and infant mortality, we are now facing an increased number of illnesses related to new health risks, including traffic accidents, mental disorder, cancer, cardiovascular diseases, and allergies. Moreover, within recent years, due to poor environmental quality in some areas and poor social conditions for some population groups, some infectious diseases like dengue, malaria, tuberculosis, which were previously somehow under control, have also re-emerged and now threaten the Thai health system[77].

This may refer to the concept of transitional risk, as introduced by the WHO[78]. According to this concept, the general development process in each country can bring down the occurrence of traditional health risks. However, at the same time, this development process also causes the expansion of so-called modern health risks, such as air pollutions, obesity, accidents, and chemical contaminations. Thus, at one point of time within the long process, society needs to change its development direction or mechanism to tackle these increasingly threatening risks. Otherwise, these risks will be out of control. Moreover, if the social inequality is rooted in society, it is highly expected that the traditional risk will re-emerge, as some groups of the society cannot sufficiently enjoy or gain access to the benefits of this development process.

It is also very important to note that the characteristics of the illnesses caused by modern health risks are quite different from the previous ones. First, it is hard to precisely determine specific causes of the illness, since most of them to a large extent are multi-causes and at the same time multi-effects. Second, most of these health risks are highly intertwined in the everyday life of modern society from dietary patterns to transportation choices, from working conditions to community relationships. Third, these everyday practices leading to health risks are not controlled by each individual, since they are always linked to availability and quality of goods and services, rooted into cultural practices and social conditions, guided by existing institutions, or determined and controlled by government authorities. Thus, most of them cannot be controlled through previous health protection methods, like vaccination, or even conventional sanitation systems. Lastly, in many cases, those who take the risks are often not those who make the decisions that create the risks. Hence, the issue of social justice is always a part of the discussions on managing these health risks.

This is why, when the forums were opened, the concerns were echoed. Instead of being forced to take risks, the Thai people are now struggling to take part of the decision process, which may influence their health in a negative way. They have also learnt that, due to uncertainties in analyzing risks and impact pathways, the decision-making process can easily turn out to be non-transparent, dominated by some values and authorities, and unaccountable for them, as seen in several EIA cases. This is also why the participatory and accountable approach of HIA was stressed in the draft of the National Health Act.

Since, Thailand, as a modern society and fast growing economy, is now rooting into the nature of risk society, where the manufactured risks become more important, the traditional ways of managing risks are now ineffective; mistrust and conflicts are spread over society, and social justice concerning risk management is now in question.

b) The Expansion of Network Society

Another political phenomenon, which can also be seen in the development of a healthy public policy, is the development of civic movement. During the reform process, thousands of grassroots and professional organizations have joined hands in presenting their demands and ideas for the country's new health system. The civic movement comprises several patient associations, NGOs, academics, spiritual leaders, and health professionals. Some civic movements, like in healthy public policy issues, have emerged as a protest against government projects which cause severe environmental and health impacts. Other movements, like traditional medical wisdom, fight for the recognition of their practices and identities. But they join hands in their search for a healthier society and the wish to improve the health system with this reform.

For the healthy public policy issue, affected local communities and academics have taken the lead in establishing the new concept, which places the health item higher on the development agenda. Presently, besides opposing government policy and projects, the movement also fights for a more participatory, transparent, and accountable decision-making process within several policy issues, together with the introduction of alternative policy initiatives in Thai society. Moreover, they do not only try to push the government to do so, they themselves also invest and take the lead in developing these policy directions and mechanisms and put them into practice. Several forums and sessions were arranged within the reform process for exchanges of ideas and experiences in the practical implementation of their policy initiatives.

In other words, Thai civic movements do no longer consider themselves as customers of the health system or public policy. They now become active policy-makers in several political arenas. In pursuing these policy changes, they do not only focus on what government should do or should not do; but they are also looking for what they can do themselves. They do not only fight for the expected policy outcomes, but also for policy spaces and recognitions. In this view, public policy is not only the pressuring for government decisions, but also the self-determination of their own destinies. Last, they do not fight individually; they join hands around the bigger notion of healthy society and create or further develop their initiatives around more specific areas, including healthy public policy.

c) The Stronger Demand for Deliberative Democracy

It is quite clear from the draft of the National Health Act that the demand for deliberative democracy was echoed within the health system reform. As seen from the healthy public policy and HIA issue, the draft stresses the importance of “joint learning of all sectors in the society, through the sufficient academic utilization, with the transparent and accountable mechanism” in the decision-making process. It also asserts the rights of Thai people to participate in policy issues that may have an impact on health.

To operationalize this right, national and provincial health assemblies have been established to provide forums for the Thai people to exchange their knowledge and experiences. The draft also provides an opportunity for people to propose or organize the health assemblies around the specific health issues, including the formulation of a healthy public policy.

After 5 years of implementation, the evaluation of health assemblies shows that the Thai people have actively utilized the health assemblies for identifying or reformulating their problems, watching and warning of policy changes and implementations, consulting and exchanging of best practices, deliberating the discussions on several policy directions, mechanisms and implementations, and for policy networking[79].

In short, under the health system reform, policy and public decision-making are no longer processes of choosing, but rather processes of understanding. Policy is not only a matter of negotiation but also an opportunity for recognition and learning how to see and do the things differently. Certainly, within a diverse and dynamic society like Thailand, mutual respect and understanding cannot always be pre-assumed, but must essentially build upon appropriate policy processes and cultures in order to cope with the unequal distribution of risks and conflicts in the decision-making process within the country.

2.4 The Concept of New Modernity

The concept of new modernity has been presented in different versions with the main idea that the traditional concepts of modernity are no longer sufficient when explaining today’s social phenomenon. There are three concepts of the new modernity, which are relevant to the recent development in Thai health system, namely the concept of risk society, the concept of network society and the concept of deliberative democracy. This section will elaborate on the theoretical explanations and insights of these three concepts.

2.4.1 The Risk Society

It is quite clear that development does not only bring new opportunities to Thai society, it also creates various risks for society. The unequal distribution of risks has stimulated social conflicts and mistrust towards development projects and planning within this society. In various cases, including several power plant projects, the result has often been a degree of political deadlock.

The situation in Thailand can be described by use of the concepts of "risk society". As Gidden has pointed out, "risk society is where we switch the focus of our anxieties from what the nature can do to us to what we have done to nature"[80]. Beck has explained that "a central paradox of risk society is that these internal risks are generated by the processes of modernization, which try to control them"[81]. Furthermore, another paradox of the risk society is that "the more we try to colonize the future, the more likely it is to spring surprises on us". In other words, these future uncertainties are the "consequences of scientific and political efforts to control or to minimize them" or so-called 'manufactured uncertainties'[82].

In the risk society, "risk has become an inescapable part of our lives and everybody is facing unknown and barely calculable risks"[83]. More importantly, in reality, "there is the big difference between those who take risks and those who are victimized by risks other take"[84]. These manufactured uncertainties and risks "are being produced by industry, externalized by economics, individualized by the legal system, legitimized by the sciences, and made to appear harmless by politics"[85]. Therefore, once the risk conflicts occur, the traditional scientific knowledge, technical practices and political institutions are certainly in a crisis as they try to cope with the upcoming risks and uncertainties and provide ultimate solutions for society.

It is quite obvious that, due to the incompleteness of scientific knowledge and profound uncertainty, today's situation forces us to "make *hard* decision with the only *soft* evidence"[86]. In practice, "the gap between knowledge and impact can be exploited" and "counter-arguments can be mobilized", in order to maintain traditional modernized ways of development[87].

Therefore, the growing public mistrust, cynicism, and the perception of declining legitimacy regarding professional and scientific expertise are inevitable outcomes, especially in countries "where the lack of trust in government institutions is associated with the growing link between state and scientific expertise in policy making"[88]. This creates a situation in which "politics has to be made under conditions of 'radical uncertainty' while social protest cannot be controlled with a traditional politics of expertise"[89].

While "those orthodox theories and politics remain tied to the belief that the risks we face can still be captured by nineteenth-century scientific models of hazard assessment, industrial notions of hazard and safety"[90], the theory of risk has called for reconstruction of "epistemological and cultural status of science and the constitution of politics"[91]. As stressed by Wollacott, "risks are not just moments of danger as we forge forward: they are the process itself". To engage with this process, we need a new public policy, which emphasizes[92]

(a) Direct and continuous dialogue between the public, experts and politicians about the decisions which lead to risks being taken,

(b) An effective use of the precautionary principle, so that we can all engage creatively with risk,

(c) A positive understanding of the changing nature of personal and institutional relationships and a direct connection between policy initiatives and the reality of people's lives, and

(d) Policy initiatives, which give space to a new politics, are taken into consideration in the context of democratic debate.

Therefore, the politics of risk society is more demanding compared to the traditional ones. It "demands active participation through all layers of social, political and economic activity"[93]. As concluded by Beck "corporate economic decisions, scientific research agendas, plan for the development and deployment of new technologies must all be opened up to a generalized process of discussion, and a legal and institutional framework for their democratic legitimation must be developed"[94].

2.4.2 The Network Society

In coping with manufactured risks and uncertainties, Thai people have organized their policy network. They gradually expand their actions from questioning and opposing the traditional way of acting to developing and advocating for more sustainable ways. The interactions between them and other actors in Thai society have certainly expanded in order to shape and strengthen policy argument and network.

This phenomenon should refer to the concept of "network society". In the network society, "people are no longer viewed as mere users and choosers of policies and technologies; they become active 'makers and shapers' of the realities that affect their lives"[95].Therefore, policymaking meets the new dynamics of political activity. Elaborating on Gidden's 'life politics' or Beck's notion of 'subpolitics', this become "a new style of political involvement in which people combine individual lifestyle choices" with "the capacity for very sharp and focused but at the same time discontinuous political activity"[96].

Previous studies show that, in the network society, the confrontation with a particular public program is likely first to provide the shared basis for discussion and then bring together the range of individuals in a particular area or region[97], as also seen in Thailand. While previously policies were viewed as the outcome of political battles among political parties, "we nowadays see how citizens themselves get worked up about various policy initiatives (or the lack thereof) and become politically active for the very first time"[98].

In the network society, "politics is a process in which different actors from various backgrounds form specific coalitions around specific story lines" or so-called 'policy discourse'[99]. According to Hajer, "once a new discourse is formulated, it will produce story lines on the specific problems, employing the conceptual machinery of the new discourse (e.g. sustainable development). A discourse coalition is thus the ensemble of a set of story lines, the actors that utter these story lines, and the practices that conform to these story lines, all organized around the discourses"[100].

In his viewpoint, "policy discourse then is constitutive of political community"[101], since there is no pre-given community to resist the plans (or policies); rather it is the policy program that aptly stimulates political community, which shares an ensemble of ideas, concepts, and categories, and can be described as a "community of fate"[102]. In other words, "policymaking creates a community of fate composed of people that might never have perceived themselves to be part of the same community before". Since communities do not pre-date politics but rather politics leads to the creation of communities, "this, of course, turns the theories of politics upside down"[103].

The more profound idea of the network society is that "we can discern shifts in networks: new networks eroding the power of previously powerful ones". In this sense, "society should be conceived of as made up of open or unstable structures that expand, readjust, shift and evaporate; that create new chances but new risk too, of practices that mobilize some problems, leaving another aside"[104].

Principally, "politics in the network society is characterized by a search for multi-level governance, regimes or transnational policy discourses"[105]. The emergence of networks is certainly not the end of state authority "but the redefinition of it, characterized by a much more open mind allowing for much more diversity and experimentation"[106].

Therefore, the quality of public policy practices as a public domain, as a stage for joint reflection and deliberation, should receive an explicit and serious attention. Both in the risk society and the network society, politics and policymaking should not simply be viewed as a process of finding solutions; "it is as much about finding formats that generate trust among mutually interdependent actors"[107]. As concluded by Hajer and Wagenaar[108], "the significance of this new understanding of political process as potential generator of trust sheds new lights on the range of 'interactive', 'consensus building', and 'roundtable' practices that have emerged in the context of the network society".

Practically, as cautioned by Beck[109], "the failure to recognize the significance of these processes of policy-induced deliberation will erode the legitimacy of politics, whereas the active attempt to seek to incorporate these processes might precisely enhance the legitimacy of politics".

Therefore, analytically, it is important to understand the tensions and conflicts generated by the impact of the newer 'networked' forms of policymaking and political mobilization, and also to examine the potential of these new practices to search for more democratic governance and change the rule and character of the political game in the context of the risk society and the network society[110].

2.4.3 Deliberative Democracy

> *"Democracy works poorly when individuals hold preferences and judgment in isolation from one another, as they often do in today's liberal democracies. When individuals lack the opportunities, incentives, and necessities to test, articulate, defend, and ultimately act on their judgments, they will also be lacking in empathy for others, poor information, and unlikely to have the critical skill necessary to articulate, defend, and revise their views."*
>
> *Warren, 1996*[111]

As Warren warned us, in the context of risk society and network society, the representative democracy is now ineffective to provide ultimate solutions for societal serious facing problems. Society must develop and establish ‘deliberative democracy’, based on, at least, three indispensable characteristics of democracy; namely expansive democracy, inclusionary democracy and deliberative democracy.

First, ‘expansive democracy’ is “characterized by increased participation, either by means of small-scale direct democracy or through strong linkage between citizens and broad-scale institutions, by pushing democracy beyond traditional politics spheres and by relating decision-making to the persons who are affected”[112].

Second, the inclusion refers to ‘the action of involving others’. Therefore, an inclusionary democratic decision-making process is ‘based on the active involvement of multiple social actors and usually emphasizes the participation of previously excluded citizens’[113].

Last, deliberation is defined as “careful consideration” or “the discussion of reasons for and against”.[114] According to Pimbert and Wakefort, “a deliberative process assumes that, at least initially, there are different positions held by the participants and that these views should be respected”. Principally, deliberative process should be designed to “enable participants to evaluate and reevaluate their positions in the light of different perspectives and new evidence”. Therefore, “while the goal is usually to reach decisions or at least positions upon which decisions can subsequently be taken, an unhurried, reflective and reasonably open-end discussion is required”[115].

According to Warren[116], “democracy has intrinsic value for those who engage in deliberative processes, value that is tied to an immanent potential for transformation and the development of capacities for citizenship that enable individuals and groups to respond directly and effectively to uncertainty and social conflict”. In other words, “deliberative participation serves two potential functions: the ‘education’ of citizens and the ‘transformation’ of views through discussion”[117]. Therefore, “deliberation is a common, if not inherent, component of all decision-making and democratic societies”[118].

In the context of network society, public decision-making transcends the formal institutions of government to more comfortably rest within the sphere of governance[119], which Healey has aptly defined as ‘the management of the common affairs of political communities’[120]. Governance is a process of participation, which depends on networks of engagement. It attempts to embrace diversity in contemporary society and promotes greater responsibility and, in doing so, seeks to reshape accountable relationships[121].

Presently, when value pluralism, social inequality and future uncertainty is inescapable, a variety of institutional mechanisms need to be in place to develop some degree of social cohesion, as well as address some fundamental problems of social polarization and inequality[122]. In the context of risk society and network society, where resources and opportunities to influence the decision-making process are not the same for everyone and, additionally, those who take the decisions may not be those who end up being negatively affected by decision-making[123], the processes and their rules of game in dealing with uncertainty and inequality in public policy are certainly crucial.

Therefore, today, politics is not simply concerned with policy outcomes, we now quarrel about the rules of the game themselves[124]. Any credible theory of democratic practice must thus devote attention to the possibility of building new policy institutions that permit the public to engage in a much wider range of discourse and democratize the mechanisms that integrate scientific expertise and political discourse[125].

As argued by Weeks[126], “if deliberative democracy aspired only to the narrow goal of informing policy makers of the judgment of citizens, participation could minimize to a small statistically representative sample. Its ambitions are, however, much grander and encompass the revitalization of civic culture, improving the nature of public discourses and generating ‘the political will to take effective action on pressing problems”.

This awareness seems to facilitate a new creativity in thinking about new modes of conflict resolution. It suggests that the essence of dealing with policy conflicts might be a more substantial process of deliberation, shared problem solving and developing regimes of joint responsibility, than merely interest-based bargaining. In short, “whereas in the past we used to think of policymaking as the consequence of political will formation, it now is often policymaking that leads to political will formation” [127].

However, it is vital for those entering any arena of negotiated policy-making to understand that real difficulties can lie ahead, linked to professional resistance towards the adjustment of long established institutional competencies, the competing and different values of participants, hostile follower, unequal relationship of power, controlled participation and suffocation by comfortable association. Therefore, the interactive public decision-making process, as deliberative democratic culture, is certainly not free of risks, which clearly highlights the importance of a reflective participatory practice[128].

2.5 Conventional Policy Analysis

Before explaining deliberative policy analysis, it is useful to understand the main ideas and limitations of the conventional policy analysis. In general, conventional policy analysis has two main characteristics; representative democratic decision-making and rational (or scientific) decision-making. Conventionally, “classical-modernist political institutions seek to involve people in politics via a choice of elected officials, who are subsequently supposed to represent the interest of their voters, initiate policy and oversee its implementation”[129].

In relation to rational decision-making, many policy-makers and scientists still assume that “there is a linear relationship between policy and knowledge, a 1:1 relationship”[130]. According to the conventional view, “the world of science is separated from the world of politics and policy”. In this view, “science is pure, interest-free and impartial and therefore takes place in a world that is separated from the circles in which results of scientific activity are applied”. In short, the relationship between science and politics is rather one-sided: “science is there to tell politicians and policy-makers the truth”[131].

This leads to the ‘theory of technocracy’, which, according to Fischer, is “a variant of elite theory, which refers to a governance process dominated by technically trained knowledge elites". The function of the technocratic elite is to "replace or control democratic deliberation and decision-making processes (based on conflicting interests) with a more technically informed discourse (based on scientific decision-making techniques)", resulting in "the transformation of political issues into technically defined ends than can be pursued through administrative means"[132].

This conventional methodology and epistemology, or so-called positivist policy analysis, tacitly assumes – and requires – "a certain hierarchical societal ordering". A 'scientistic' policy analysis has become "part of a particular institutional order in which political and economic elites effectively insulated from the citizens' voice, sought to design economically efficient and technologically efficacious solutions to what they perceived as society's problems"[133].

However, Veld [134]has argued that "it has already been known for a long time in the science of administration and the philosophy of science that this rational model of the relationship between knowledge and policy is not adequate". In the context of risk society, people in industrialized and post-industrialized societies no longer view science as "representing certain knowledge"[135]. Citizens feel themselves 'at risk' from science-based social and technological development and are skeptical about scientific solutions, especially when 'experts' have indeed contributed to creating public health, social and environmental crisis in the first place[136]. Lovan et al[137] also observed that, "there has emerged a deficit of trust in the ability of public officials to effectively deal with the wicked problems of society and in this context citizens today are more ready to challenge perceived technocratic hegemonies built on the foundations of professional and expertise".

As concluded by Hajer and Wagenaar[138], "whereas within the old regulatory regime the idea prevailed that one could still employ the 'knowledge for policy' practice ('first get the fact right') the new political reality is no longer a credible policymaking strategy".

In an alternative viewpoint, "Science is not an activity that takes place in a social vacuum, but is constructed socially just like all other social activities. And therefore, scientific activity, in particular scientific activity that serves to support social processes of decision-making, is also subject to influence of power and (self) interests"[139].

Based on Veld and Verhey[140], "sometimes high-running conflicts are created there where it is 'discovered' that research is not free of values, but can be associated with political-social values of specific interested parties in the policy. Certainly, in this situation, "the parties involved tend in particular to trust that knowledge, that fits one's own position in the debate"[141].

From the observation of policy-making and public decision-making in the Netherlands, it was found that the dominant policy players succeed in transferring their conception of a problem to the political arena. Usually, the problems are mainly approached as problems that can be solved in a technical way, which certainly manipulates the demand for knowledge. This is why the fact that these developments can or must occur in a different way is usually not a subject for official policy discussion. In other words, "the reflexive capacity of society is not an item and is therefore not included in the official definition of the problem and the solution".

Consequently, the orientation leads to the fact that some research questions are not posed, that problems are not fully placed in the social context, that choices are not made explicitly and that alternatives are sometimes excluded without any apparent reason for this being given"[142].

This leads to the conclusion that "the articulation of the demand for knowledge and the use of knowledge in the policy arena are strongly influenced by the values that play a role in policy"[143]. In other words, "knowledge and values exercise mutual influence, in which, however, the relationship is asymmetrical. Values have a stronger influence on knowledge than knowledge on values"[144].

This can also be seen as the relationship between knowledge and power. Based on the same observations, it also found that "the attention is highly concentrated on formal knowledge that is particular in the possession of policy-makers and researchers"[145]. The knowledge of other groups is not used actively. Observably, "the policy fields and research institutions, too, are closely interwoven" therefore "knowledge and policy infrastructures show many similarities"[146]. More seriously, in practice, there are many taboos that limit public discussion, especially if it links to "radical alternatives of the opponent of proposed solution"[147]. As shown by Veld and Verhej[148], "policy makers will ignore and reject knowledge that shows that the present economy forms a threat for us and our environment and cannot continue as such".

This observation turns the conventional theories upside down. This is not only a perception of knowledge being power, "but more important, power is knowledge". This is because "power determines what counts as knowledge, what kind of interpretation attains authority as the dominant interpretation". Certainly, in politics, "power procures the knowledge which supports its purposes, while it ignores or suppresses that knowledge which does not serve it"[149].

Flyvbjerg concluded, "while power produces rationality and rationality produces power, their relationship is asymmetrical", since "power has a clear tendency to dominate rationality in the dynamic and overlapping relationship between these two". In other words, "power has rationality that rationality does not know". Based on his conclusion, the first step to overcome this conventional weakness is "to understand power, and when we understand the power we see that we cannot rely solely on democracy based on rationality to solve our problems" [150].

Therefore, in recently developed views, "knowledge is seen as a social construction and the way in which knowledge is used in complex questions can better be expressed in terms of a political struggle, or at least in terms of differences in the perception of problems, the conducting of negotiations, the forming of alliances and such"[151]. In other words, both the problem itself and the knowledge to encounter the problem "are considered to be a social construction of multi-actor model"[152].

The development of this viewpoint links up with discussions of a post-normal science, Trans-science and interactive policy-making[153]. According to Habermas, "scientific rationality must not be limited to an analysis of empirical data, but the interpretation of socially constructed values and meanings and the political criticism from society must also form part of the concept of rationality"[154].

Veld and Verhej suggest that “one of the more recent approaches of science has as its motto ‘let the people decide’ (democratic approach of science): not only is it recognized that science never is free of values, but it is also deemed desirable that values are used and made explicit in the scientific activity”[155].

In this view, “science and values must be linked up together by having the actors in the policy arena discuss and also determine research questions, research methods and assumptions, so that negotiated knowledge may be arrived at, that is not free of values, but have been negotiated in an open debate about choices that influence the production of knowledge”[156].

In politics, policy process should “take as their point of departure an integral problem analysis instead of very selective and solution-oriented analysis”. “Early openness and interaction about a problem and solution formulation” by different problem owners is also essential. Within the context of risks society, “the uncertainties and dilemmas could be made more explicit so that discussions on usefulness and necessity can also deal with them”. This suggestion implies “more qualitative and interdisciplinary research, more research aimed at the social and environmental effects of policy and more use of practical and intuitive knowledge”[157].

This has also led to the formulation of the concept of ‘citizen science’, according to which “citizens are involved in the formulation of problems as well as in the formulation of solutions”. Therefore, it requires “the upgrading of lay-knowledge side to side with the traditional expert knowledge as a source for wisdom in policy”[158]. In this view, policymaking becomes the open-end social learning process, “which is not necessarily considered to lead to new consensus among actors holding different views and interests, but at least to explore the horizon of possible alternatives and the room where future consensus and disagreement may evolve”[159].

2.6 Policy Negotiation Analysis

The unrealistic assumption of the linear model forced policy analysts to search for a more practical-oriented framework. The second approach, the so-called policy negotiation model, focuses on policy as courses of action, within ongoing processes of negotiation between multiple actors over time. As famously described by Lindblom, policy process in this approach is recognized as “the science of muddling through” rather than a well-defined rationalized process[160].

The policy negotiation analysis can expand the scope of policy analysis to cover the issues of policy network, policy window, policy entrepreneurs, and policy-oriented learning. Within the negotiation analysis, two main analytical frameworks can be differently applied to the healthy public policy in Thailand; namely Multiple Stream Theory and Advocacy Coalition Framework.

a) Multiple Streams Framework:

The multiple streams framework was developed by John Kingdon (1984)[161]. It views the policy process as the composition of three streams of actors and processes: *a problem stream,* consisting of information about various problems and the proponents of various problem definitions and significance; *a policy stream* involving the proponents of solution to policy problems; and *a political stream* consisting of politicians and elected officials.

In Kingdon's view, the streams normally operate independently of one another and do not lead to any significant changes, except when a "window of opportunity" permits policy entrepreneurs to couple various streams. If the entrepreneur's attempt is successful, the result is major policy change. However, normally the policy window is opened and closed very rapidly, therefore, timing and policy entrepreneurs' strategy is certainly crucial for policy changes[162].

This framework provides very useful insights for a policy analysis. Unlike the linear model, the multiple streams framework has recognized the fact that full rationalization cannot be applied, which, in fact, is a normal situation in the political world. In this situation, the timing is crucial. Analyzing three policy streams and policy windows can help us to understand why policy changes happen in some cases and not in others.

In practice, some policy changes do not occur due to the forces of the problem stream, but mainly because of the initiatives in policy streams (answer before problem). In some case, the policy and political streams are just waiting for the problem to appear. Therefore, these three policy streams can be used as both analytical and operational frameworks. The focus on policy entrepreneurs is also very important in order to understand the roles of change agents at the policy arena. Last, based on this framework, the success in policy advocacy depends on chances as much as on skills and capacity[163].

However, the multiple streams framework seems to focus on policy process as each decision-making snapshot within the overall policy dynamics, which consequently make policy works become tactical rather than strategic. It also omits an overview insight on long-term changes including historical influences within a policy arena. Last, the independence of three streams may not be true in many cases, especially when the strong relationship of different actors operating in different streams is established [164].

b) The Advocacy Coalition Framework:

The advocacy coalition framework was developed by Sabatier and Jenkins-Smith[165]. Unlike the multiple streams, this framework views policy changes as a continuous process of changing ways of thinking in the longer term. Thus, this framework focuses on the interaction of advocacy coalitions - each consisting of actors from a variety of organizations and institutions who share a set of policy beliefs, who are actively concerned with a policy problem or issue and who regularly seek to influence public policy – within a policy subsystem[166].

In this approach, policy change is a function of competition and policy-oriented learning within the subsystem and related to events and conditions outsides the policy subsystem. This advocacy coalition framework asserts the importance of policy network as one of the main mechanisms for policy changes. In more complex policy subsystems, individual policy entrepreneurs are hardly successful. Co-operation and co-ordination among different actors as a process of sharing capacities, expertise and opportunities is necessary for policy works in the longer term. In this way, a powerful policy network can effectively push policy into their directions and block the effort and policy window of other networks[167].

According to this framework, the policy belief is very important and persistent. Therefore, "the line up of allies and opponents tends to be rather stable over periods of a decade or so"[168]. In this situation, major socio-economic changes, such as economic dislocations or the rise of social movement have played a crucial role in policy changes. This is because a severe reality shock can jolt policy-makers into examining and rethinking the basic policy belief that guides their policy action[169].

Alternatively, policy-oriented learning within and across the policy networks may also provide another way to change policy over time. However, this policy learning normally does not occur automatically, since coalition members will resist information, suggesting that their deep core or policy core beliefs may be invalid and/or unattainable. Policy learning is only likely to happen, if very solid empirical evidence is presented with accepted quantitative data and consensual theories, especially in the natural sciences rather than in the social sciences. Moreover, this framework suggests that policy learning is most likely to develop in the professional forums with professional norms[170].

Main benefits of the policy coalition framework are a) to look beyond formal policy authorities and understand the interactions of policy networks within the policy subsystem, b) to involve more participants than traditional policy-making, c) to provide longer views of policy changes as an outcome of changing attitudes and surrounding situations, rather snap-shot decision-making as usually taking place in conventional and multiple streams approach, d) to recognize real-life aspects of bound rationality and value pluralism within the policy process, and e) to highlight opportunities and potentials of policy learning within the policy process.

Although the advocacy coalition framework provides a more realistic and interesting approach to policy analysis, it is still incomplete in explaining and guiding the public policy process in the era of new modernity. Firstly, it over-emphasizes the importance of external shock, which make the policy process become passive to external situations. Consequently, this means that the role of policy strategies, as a way to provide better (or alternative) policy understandings and explanations to society, is implicitly overlooked. Therefore, it fails to explain why and how changes come about. In many cases, what lead to the expected policy changes are new persuasive policy explanations with a set of fact and normative orientations (or so-called policy storyline), rather than external factors or policy belief alone. At the same time, compared to policy belief, common and contested policy explanations may provide broader opportunities for joining policy networks and also sharing the deliberative discussions within the policy process[171]. Lastly, the technocratic mode of policy learning overlooks the rising of social concerns and increasing roles of social movements in policy processes around the world, including in Thailand's national health system reform.

2.7 Deliberative Policy Analysis

Unlike conventional theories, deliberative policy analysis needs to draw its assumptions on contemporary situations, when we have to develop democratic systems on dispersed power, diminishing trust, ambiguous institutions, profound uncertainty and inequality, powerful transnational influences and active but highly differentiated citizens. Deliberative policy analysis does not view policymaking as the outcome of formal politics, as seen in conventional approach. On the contrary, it is policymaking itself "that provides the practices in which people start to deliberate and become politically active"[172].

In the viewpoint of deliberative policy analysis, "public policy often creates and functions as a public domain, a space in which people of various origins deliberate on their future as well as their mutual interrelationships and their relationship to the government"[173]. In this view, "policymaking is a constant discursive struggle over the criteria of social classification, the boundaries of problem categories, the inter-subjective interpretation of common experiences, the conceptual framing of problems and the definition of ideas that guide the ways people create the shared meaning which motivate them to act"[174]. Therefore, "policy analysis and planning are practical processes of argumentation"[175].

The main task of deliberative policy analysis is to understand "interactive and deliberative processes of discovering ends, recognizing other parties, marshalling the evidence and giving reasons, exploring the implications of various value positions and developing joint responsibility in concrete situations"[176].

Taking all these main characteristics into account, conducting deliberative policy analysis in the new context has to be developed from the five pillars of policy analysis which are presented below.

2.7.1 Interpretative Process

This interactive public policy process assumes "the preexistence of individuals engaged with others in a diverse, fluid, and overlapping "discourse community", each with its own meaning systems and hence knowledge forms and ways of reasoning and valuing"[177]. In other words, it presupposes that we live in a social world with the possibilities of multiple interpretations[178]. Therefore, it is quite important not only to raise the question of costs and impacts of policy, but also the different meanings of policy to different actors[179].

The central question for interpretative policy analysts is "how are the policy issues being framed by various parties to the debate?"[180]. The words 'fluid' and 'overlapping', as mentioned earlier by Healey, suggest that deliberative analysis should not take individual and public preferences as 'given', as usually done in conventional economic analysis, but 'would instead have to account for where people get their images of the world and how those images shape their desires and visions"[181].

Through communication in this interactive process, the role of language is certainly crucial in policymaking. As aptly cautioned by Majone, "as politicians know only too well but social scientists too often forget, public policy is made of language. Whether in written or oral form, argument is central at all stages of policy process"[182]. In this context, "interpretative modes of policy analysis seek to identify both the specific meanings, intended and made, of specific policies and those meanings are communicated and variously interpreted"[183]. In other words, deliberative policy analysis should “be able to understand the complex ways in which meaning is hidden in policymaking discourse and thus be able to anticipate political controversies”[184].

Therefore, deliberative policy analysis must go “beyond the investigation of differences of opinion about technical facts alone”[185]. Besides seeking to explain a given reality, deliberative policy analysis “must also attempt to explain how social groups construct their own understanding of that reality”. This notion is very important for policy analysis, since one of the basic goals of politics is ‘to change an existing reality’[186]. At the same time, “policy politics is itself about establishing definitions of and assign meaning to social problem”[187].

Fischer asserted that “recognizing reality to be a social construction, the focus necessarily shifts to nature of situational context and to discursive processes which shape the construction” [188]. However, this post-positivist approach does not mean the rejection of empirical study. On the contrary, deliberative policy analysis must include empirical investigation, but needs to situate it ‘in a larger set of normative concerns that give its findings meaning’[189]. As mentioned by Majone, “the structure of a policy argument is typically a complex blend of factual statements, interpretations, opinion and evaluation”[190].

Hence, the task of deliberative analysis is to understand “a matter of establishing interconnections among the empirical data, normative assumptions (that structure our understanding of the social world), the interpretative judgments involved in the data collection process, the particular circumstances of situational context (in which the findings are generated and/or to which the conclusion apply), and specific conclusions”[191].

Concurrently, the task of deliberative analysis is “to tease out the normative conflict lurking behind often equally plausible interpretations of the same abstract goals or values”. Furthermore, it should ensure that “various modes of defining policy problems have to be recognized as competing languages in which people offer and defend conflicting interpretations”[192]. Certainly, the fundamental goal of this policy analysis is to discover ways of ‘living together differently but respectfully’[193].

2.7.2 Communicative Process

Since one of the objectives of deliberative democracy is to enable participants to learn and transform their views in the light of different perspectives and new evidence along the interactive process, the roles of communication are very important.

As mentioned by Healey, “within the argumentation of these communicative processes, all dimensions of knowing, understanding, appreciating, experiencing, and judging may be brought into play”. In deliberative democratic society, “the struggles of engaging in inter-discursive communicative action is to grasp these diverse viewpoints and find ways of reasoning among the competing claims for action, without dismissing or devaluating any one until it has been explored”[194].

While “some conceptions of democratic dialogue may be too narrowly restricted to a particularly rigid form and style of rational argumentation: ‘polite, orderly, dispassionate, gentlemanly argument’ ”, which implicitly devaluates “the perspectives of those who are less skilled in such forms of argument”, deliberative democracy must apply a richer and broader concept of democratic communication, including greeting, rhetoric, narrative stile and story telling[195].

As stressed by Smith, “this broadening of what is understood as a legitimate form of communication is important, especially if all voices are to be heard and considered”[196]. Healey also asserted that policy-making and planning processes “should be enriched by discussion of moral dilemmas and aesthetic experience using a range of presentation forms, from telling stories to aesthetic illustrations of experiences”[197].

In the context of value pluralism, the ultimate goal of the communicative process should not always be unanimity or consensus, which sometimes may force participants to accept others’ view (mainly dominant discourse); the deliberative communication should rather aim for ‘mutual understanding’. Disagreement does not undermine deliberation, “as long as participants accept the conditions under which collective decision and judgments are reached”[198]. As explained by Baynes, “an emphasis on mutual understanding highlights the requirement on participants to confront the variety of points of view on particular issues and to be open to the possibility of the transformation of preferences after reflection on, and consideration of, their own and others’ perspectives”[199].

To reach mutual understanding, intercommunicative policy-making and planning must “involve respectful discussion within and between discursive communities, ‘respect’ implying recognizing, valuing, listening to, and searching for translative possibilities between different discourse communities”[200]. The translation possibilities and capabilities are very important in the context of the interpretative process, as described before.

In doing so, policy-making and planning should involve “invention not only through programs of actions but in the construction of the arenas within which these programs are formulated and conflicts are identified and mediated”. Certainly, it needs “to be reflective of its own processes” [201].

As concluded by Healey, “communicative planning is not only innovative, it has the potential to change, to transform material conditions and established power relations through the continuous effort to “critique” and “demystify”; through increasing understanding among participants hence highlighting oppressions and “dominatory” forces; and through creating well-grounded arguments for alternative analyses and perception – through actively constructing new understanding”[202].

2.7.3 Contestation Process

Since different participants have different worldviews, values and interpretations, interactive policy-making practices are certainly contested terrain. The contestation can be seen in problem identification, agenda setting, definition of processes and rules of game, policy contents, and policy outcomes and practices. Hence, the policy-making practices "should be analyzed and indeed appreciated at sites for the articulation of conflict and difference, as a place for social and cultural contestation"[203].

One approach to the analysis of these policy practices is the concept of *discourse coalition*. According to Hajer, "a discourse coalition is basically a group of actors who share a social construct", which can be seen as "a way to give meaning to ambiguous social circumstances"[204].

Discourse is here defined by Hajer "as an ensemble of ideas, concepts, and categories through which meaning is given to phenomenon". This discourse coalition approach suggests that "once a new discourse is formulated, it will produce story lines on the specific problems, employing the conceptual machinery of the new discourse (e.g. sustainable development)". A discourse coalition is thus the "ensemble of a set of story lines, the actors that utter these story lines, and the practices that conform to these story lines, all organized around the discourses"[205].

The discourse coalition approach suggests that "politics is a process in which different actors from various backgrounds form specific coalitions around specific story lines". Since different discourses frame certain problems in different ways, they provide different solutions to society. Their story lines become "the medium through which actors try to impose their view of reality on others, suggest certain social positions and practices, and criticize alternative social arrangements"[206].

In the contestation process, new story lines can become a popular way of conceptualizing the world (such as sustainable development), but a discourse coalition can be viewed as "the dominant discourse" in a given political realm only if it fulfills two conditions[207];

1. "it dominates the discursive space; that is the central actors are persuaded by, or forced to accept, the rhetorical power of a new discourse" (so-called 'condition of discourse structuration'),

2. "this is reflected in the institutional practices of that political domain; that is, the actual policy process is conducted according to the ideas of a given discourse" (so-called 'condition of discourse institutionalization').

The implication of Hajer's idea is to emphasize the significance of policy 'practices'. Although some discourse coalition might work well at conceptual levels, at the end, what determine the social reality are still the practical ones. Therefore, deliberative policy analysis must go beyond the reference to interests, by "analyzing how interests are played in the contexts of specific discourses and organizational practices"[208].

2.7.4 Practice-oriented Process

Machiavelli warned us a long time ago, "a man who neglects what is actually done for what should be done learns the ways to self-destruction"[209]. However, the focus of conventional approach has always been on "what should be done", while Flyvbjerg recently argued for a reorientation towards "what is actually done"[210]. Hajer and Wagenaar also argue that "one of the main reasons for the often observed ineffectiveness and irrelevance of the traditional policy science is precisely this Cartesian bias; the gap between the theoretical rationality of the policy sciences and the practical rationality of the practitioner"[211].

The promise of traditional, rational policy analysis is precisely to sanitize political decision-making from irrational politics. However, as we know very well, "politics is 'messy', 'unpredictable', and an 'obstacle course' for policy and 'a hostile environment' for policy analysis[212]". There is "an uneasy relationship between social scientists and public officials, because one group provides 'disciplined research' while the other has 'undisciplined problems''"[213]. In the real world, where existing knowledge is incomplete and imprecise, society is full of inequality and uncertainty, and where policymakers have to act to cope with facing situations at hand within present organizational limits, the formal logic does not seem to work well, neither in theory nor in practice. Obviously, policy-makers must apply their practical rationality or practical judgment to determine their actions in such context.

This can refer to the Aristotelian conception of phronesis of the informal logic of practical reasons[214]. Informal logic "emphasizes an assessment of the problem in the particular context, seeking to decide which approaches are most relevant to the inquiry at hand". Fischer explains that "practical reason distinguishes contextually between the world of theory, the mastery of techniques and the experiential wisdom needed to put techniques to work in concrete cases"[215]. Hence, in their view, "practice is an attempt to develop unified account for knowing and doing. It expresses the insight that knowledge, knowledge application and knowledge creation cannot be separated from action; that acting is the high road to knowing"[216].

Practical deliberation thus seeks to bring a wider range of evidence and arguments to bear on a particular problem, situation, or position under the investigation of policy analysts[217]. Since, in everyday politics, actors articulate value in appreciating the possibilities and limitations of the situation at hand, the practical deliberation also focuses its attention on value. Along this view, the real challenge of the deliberative policy analysis is to "find ways of combining the analysis of the discursive production of reality with the analysis of the (extra-discursive) social practices from which social constructs emerge and in which the actors that make these statement engage"[218].

As stressed by Fischer and Forester[219], "to see policy analysis and planning as argumentative practices is to attend closely to the day-to-day work analysts do as they construct working accounts of problems and possibilities. Recognizing these accounts as politically constrained, organizational accomplishments in the face of little time and poor data, we can evaluate the analysts' arguments not only for their truth and falsity but also for their partiality, their selective framing of the issues at hand, their elegance and crudeness of presentation, their political timeliness, their symbolic significance, and more".

2.7.5 Learning Process

In recent years it has become common wisdom in the policy sciences to appreciate social movements and individual citizens as a valuable source of ‘local knowledge’ that enhances the knowledge produced by formalized policy-making practices[220]. Jamison also shows the importance of social movements as ‘cognitive praxis’ in the development of critical environmental knowledge[221].

Fischer and Forester also argue that “through thoughtful, passionate, and informed argumentative processes, which Benjamin Barner calls ‘democratic talk’, citizen can learn, and policy and planning analysts can promote that learning”[222]. In policy politics, “people learn about the world in public, share processes in which they test what they have learned. The way they test the relevance and validity of their knowledge in a particular situation is through public discourse”[223].

However, in order to learn from such a contested protest, a reflexive and critical capacity should be kept alive in the processes of argumentation[224]. In other words, “before the rationality of choices come the prior practical rationality of careful attention, critical listening, setting out issues, and exploring working relationships as pragmatic aspects of problem construction”[225].

Therefore, the role of policy analysts has changed radically. Rather than providing technical answers designed to bring political discussion to an end, the task of the policy analysts as facilitators is to “assist citizens in their efforts to examine their own interests and to make their own decisions”[226]. The facilitation of citizen learning can be understood as “enlarging the citizens/clients abilities to pose the problems and questioned that interest or concern them and to help connect them into the kinds of information and resources needed to help them”[227].

The assignment of the deliberative policy analysts is thus “to understand the conditions for citizen learning and to design and enable the setting within which citizens develop their own policy positions”. With this goal, “professional experts must become specialists in how clients learn, clarify, and decide”. Concurrently, it is very important to create “the institutional conditions with which citizens draw on their own abilities and resources to solve their own problems” and “institutional and intellectual conditions that help people to pose questions in their own ordinary (or everyday) language and to decide the issues important to themselves”[228].

2.8 Analyzing Public Policy in the Thai Power Sector

As the objective of the research is to analyze present public policy process in the Thai energy sector as well as to propose new policies for a healthier power system, the concept of deliberative policy analysis can be very useful. To follow the deliberative policy analysis into the research, it certainly has to base the research strategy on the analysis of the five pillars of deliberative policy analysis, as previously mentioned. In applying deliberative policy analysis to this project, the research strategy will be divided into three main connecting parts.

2.8.1 Policy Discourse Analysis

The first part of the research will concentrate on the analysis of 'the policy discourse coalition' within the Thai power policy arena. This part will mainly analyze (a) different interpretations of energy problems and policy directions of different actors (b) the formation of the policy discourse, discourse coalition, and policy practices around the power policy arena, (c) the dynamics of communicative and argumentative processes between different discourse coalitions, and (d) the recent outcomes of policy and political changes in the Thai power sector, both in terms of content, process, languages, and actual practices.

The main objective of this part is to gain a better understanding of public process in the context of Thai society, which is important for an appropriate and meaningful participation in the policy process. This understanding is also very important for the development of theoretical and analytical frameworks for policy analysis and healthy public policy development in Thai society.

The main expected outcomes of this part are;

(a) the recognition of different problem definitions, discourse framing, and future visions and directions by different coalitions and actors including their argumentation, which will certainly define the indicators for the policy assessment analysis in the next step,

(b) the understanding of communication processes and cultures within and between coalitions within the power policy arena, which is crucial for designing communication strategy in policy assessment, and

(c) the understanding of the practices of different actors and coalitions (including their knowledge) and the situation at hand that force, inhibit, or stimulate them to develop their practices.

Based on the insights from the previous discussions on conventional policy negotiation, and deliberative policy analysis, we can see that policy-making is an outcome of the interaction between three main policy layers; namely formal policy process and decisions, policy sector, and public domain. Therefore, the deliberative policy analysis of the Thai power sector in this study will be done through the analysis in three main layers.

a) Formal Policy Process and Decision

Formal policy processes and decisions refer to authorized policy-making processes and decisions in the power sector, which are normally operated and controlled by the government institutions. Since, the authorized decisions in terms of planning and regulations are always crucial for the directions of the power sector, understanding formal policy process and policy decision is certainly essential. Especially, when the government institutions still dominate the policy process and public deliberation is still not well-grounded in the policy process and culture, as is the case of the Thai power sector, analyzing formal policy process and decision is important to understand the driving forces and their reaction or interaction forces within the policy arena.

As it becomes more obvious that formal policy process is not the complete rationalized process but full of power and different societal values interplaying with expected policy directions and decisions, this study will not look at the formal policy process and decision in the rationalized model, as assumed in conventional analysis. Rather the formal policy process will be analyzed in order to see and show a) the domination of (or balance between) specific societal values, b) the pre-assumptions of formal policy process and planning, c) the main and competitive rationales in policy-making, d) the influences of internal and external forces in decision-making, e) the openness of and the interaction within this policy process, and e) the limitations of the formal policy process in terms of cognitive, normative, and regulative dimensions.

Understanding the formal policy process is also useful in terms of identifying policy strategy and action, since it allows us to understand a) the rationality used by the government institutions, b) internal and external influential forces, and c) timing and policy windows within the policy process. This understanding can shape the effective communication strategy for public deliberation, including alternative arguments, different interpretation, appropriate timing, etc.

b) Policy Sector or Policy Network

Since, in reality, the formal policy process does not occur in an authorized vacuum but is located in a policy domain or policy subsystem, which consists of a number of competing policy coalitions or networks, it is better to make an explicit understanding of these networks. In the Thai power sector, it is also obvious that policy networks have played crucial roles in policy-making, especially in the issues of privatization and the structure of the power market, as later shown in Chapter 4. They have employed different strategies in pursuing their policy directions within dynamic socio-economic and political situations, which are partly (or mainly) out of their control. On one hand, they always look for timing and tactics to push their ideas and block the others' idea. On the other hand, they also learn how the others develop and persuade different ideas and, thus, they adjust and develop their new idea over time.

This study will elaborate a) how different policy networks have been formed and have played roles in the Thai power sector, b) what are the main differences of interpretation in policy directions, c) what are their policy strategies in different socio-economic and political situations, d) how they interact and learn from each other, and e) how they shape or facilitate the policy interpretations (or framing the policy issue) in Thai society.

Therefore, the understanding of policy network is not only to identify active stakeholders, but also to understand their policy interpretations, the different rationalities they use and the different policy framings applied in communicating with others, both in the policy domain and at the societal level. Analyzing policy network also helps in understanding power relations both within and among the policy networks, which, in some ways, influence the rationalities that have been used and claimed in the formal policy process and in the societal domain.

c) Public Domain or Societal Level

Although the policy network analysis broadens our scope of understanding beyond the authorized decision-making, the focus is still limited on the number of policy actors and networks. Normally, in gaining social and political supports, each actor and policy network always communicates with the public outside the policy sector (or domain). Therefore, the analysis of policy process has to go beyond policy domain, in order to see the actions that have been taken in society and the actions (or responses) that society takes in order to shape the policy sector and the formal policy process and decision.

In moving into the societal level analysis, the focus should be on how policy issue has been interpreted and framed by various groups within the society, which may depend on historical and cultural influences, public perception and mood, socio-economic and political situations, and the communicative strategies of policy networks. Since the public may interpret and frame policy issue differently, thus, it is important to understand how the public will analyze and interpret the different evidence, information and story-lines regarding specific policy issues and situations. Moreover, since the public is not always certain to transform their ideas or opinions into policy actions, hence, it is necessary to understand how, when and why the public actions would take place and how the public actions affect or shape the previous two policy layers.

The objective of this understanding on policy interpretation framing should not only be limited to the persuasion of a specific policy proposal. According to deliberative policy analysis, policy-making can be viewed as a long-term social learning process. Thus, focusing too much on each decision-making may overlook the actual benefits of policy deliberation. Successful policy analyses and actions may lead to better social understanding and respectfulness rather than to expected policy changes. In this view, an unsuccessful attempt, in terms of present policy change, may become another accumulated opportunity or pressure for opening to desirable and more sustainable outcomes in the future. Therefore, this study will pay serious attention to the communication with and between policy actors in the policy sector and in the public domain.

Although the previous paragraphs seem to explain these policy layers, layer by layer, in reality, they are much more interconnected. As layers, they are located in the same specific policy situation. Hence, they can hardly be separated. Moreover, the concept of healthy public policy in Thailand's health system reform also aims to facilitate the discussions and deliberations across the three layers.

To understand the interactions between different actors, across three policy layers, by different interpretation of problems and policy directions, and the policy changes in the Thai power sector, the historical analysis of the sector and its policy movements and changes will be presented in Chapter 4. Concluding Chapter 4, four policy discourse coalitions will be summarized with the explanation in terms of their policy interpretation, policy languages and communication, and also actual practices.

2.8.2 Impact Assessment of Policy Options

The second part of the research will apply the concept of strategic environmental assessment (SEA) with HIA as the main analytical framework in order to (a) conceptualize different policy discourses in terms of future policy directions and their consequences or impacts, (b) communicate between different policy discourse coalitions for the creation of mutual understanding and the possibilities of agreement and disagreement in future policy directions and impacts, (c) identify the further analyses and the developments of policy practices, which are necessary for deliberative policy discussion and to facilitate the development of a healthy public policy in the Thai power sector.

The concepts of SEA will be discussed in detail in Chapter 5. In principle, the analyses in this part require (a) energy modeling exercises in connection with different policy directions, (b) impact assessment of the consequences of different policy directions and practices, (c) an interactive communication process through policy analysis documents, discussion in policy workshops and (d) reflections or reinterpretations during the communication process.

Although, at the end of Chapter 6, the most desirable policy option in health and other perspectives will be identified as an outcome of the impact analyses, it is very important to note that this is not the final answer to Thai society. In many cases, SEA has been used for 'settling' the discussion and 'providing' the definite answers to the societies or policymakers, but in this study, it will certainly be used for 'stimulating' the further policy discussions and argumentation in order to pursue the development of deliberative democracy in the Thai power policy arena.

2.8.3 Institutional frameworks and Public Regulations Analysis

To emphasize the "practice-oriented" aspect of deliberative policy analysis, this study will analyze the changed and unchanged institutional frameworks and public regulations within Thai power policy during and after the impact assessment and communication process.

Institutional frameworks and public regulations are considered in this study as the actual "practices" of policy process, because the power sector, even within the more liberalized market, is highly regulated by the institutional framework. The development of new technologies (and producers) and the continuation of the old technologies (and producers) depend very much on the structure of market, barriers to the market, pricing mechanisms (including subsidies and taxation), and environmental regulations, which are certainly institutionalized in the power system. The changes (and non-changes) in the institutional framework, therefore, are very crucial to the support or inhibition of specific policy directions in the power sector. Without any changes in the institutional framework and public regulation, we can consider that, in action, there is no policy change at all. Even though there may be some political announcement regarding policy changes, it can be perceived as a "non-action policy", which can happen in every policy sector, not only in the power sector. This idea also refers to the concept of "discourse institutionalization", which is the main condition for every discourse to be meaningfully implemented and dominate the policy direction, as previously mentioned.

With the further analysis, both changes and non-changes in the institutional framework and public regulation can represent the reflections, understandings (and misunderstandings), influential and conflicting values and interests, and practical judgments of, as well as the interaction between different policy actors or networks within the policy process. This study has followed the institutional and regulation changes (and non-changes) taken place in 2005-2006 or within one and a half year after the first policy communication was introduced in Thailand in the end of 2004.

However, in practice, the institutional and regulation changes may require a wider time frame. Some non-changes may be in process of institutional changing. Thus, to overcome this time frame limitation, this study needs to cover in-process changes (and non-changes) through an analysis of agreement and conflicting ideas between different policy discourses in institutional frameworks.

To understand and foresee the areas of agreement and conflict within the institutional changing process, an analysis of the institutional framework in a multi-dimensional nature must be conducted. According to Scott, three main dimensions of institution can be identified; namely cognitive, normative and regulative pillars[229]. Usually, people look at the institutional framework as a set of rules or the regulative dimension of institution. However, in fact, behind this set of rules, the normative and cognitive dimensions represent the values and interpretations of this institution. Between different policy discourses, agreement (and disagreement) normally occur or emerge from the cognitive and normative dimensions, and consequently, lead to agreement (and disagreement) in the regulative dimension.

Hence, this study will analyze the changing institutional framework, the policy proposals for changes and non-changes, and the reactions to these proposals of different policy discourses. The analysis will be conducted at all levels of the institutional framework and public regulation, beginning with market structure, governance structure, market access, pricing structure, supportive mechanisms for renewable energy, planning process, research and development schemes, and environmental regulations. At each level, each proposal for changes and non-changes in regulative pillars will be analyzed and compared in order to understand the normative and cognitive differences and similarities between these proposals and between different policy discourses. The analysis will also show where and how the changes occur, or are likely to occur in the near future, as well as the areas in which and the reasons why the changes are not likely to take place. The results of this analysis will be presented in Chapter 7.

At the end, the interactions of different policy networks and discourses in changing processes of institutional and public regulation provide an insight into how well this policy issue has been publicly deliberated in the Thai power sector and Thai society. It can show how communicative and learning processes are working (or not working) in the formulation and dynamics of the Thai power policy, as wished in the deliberative policy analysis. Hopefully, it can show the possibility of opening the policy process and turning it into a social learning process. Therefore, from this viewpoint, these interactions and insights can provide a “societal validity test” of these research findings, of deliberative policy analysis, and of the healthy public policy notion, which will be presented in the last chapter.

2.9 Healthy Public Policy Movements in the Power Sector

The last part of this Chapter will provide an introduction to healthy public policy movements in the power sector, both in Thailand and in other countries. The main objective of this part is to provide an initial idea on how the concept of healthy public policy has been operationalized in different countries and situations and how this study plans to position itself, make the connection with others, and contribute to the movement of a healthy public policy.

2.9.1 International Experiences

In comparison with environmental movement in energy policy, the concept of healthy public policy is quite new in the world community. It is emerging under the great debate on global warming and global environmental politics. Moreover, since the health impacts of the power sector are highly derived from negative environmental changes, in various cases, it is hard to separate healthy public policy movements from general environmental movement. However, there are a number of cases that clearly show the attempts to put health on the top of the policy agenda in the power sector and provide a systematic assessment of health impacts, as suggested in the healthy public policy concept. Some examples of these cases are discussed below;

- **Clear the air, USA.**

Clear the air is a US public education campaign to improve air quality and combat global warming by reducing emissions from coal-fired power plants. 'Clear the air' is the joint efforts of grassroots organizations, environmental groups and policy experts to implement stricter pollution control and present this aim to communities, government agencies, elected representatives and the media[230].

'Clear the air' publishes several reports, presenting concrete information on the health impacts of coal-fired power plants in the US. One of the most influential reports is "Dirty Air, Dirty Power: Mortality and Health Damage Due to Air pollution from Power Plants"[231]. In this report, the quantification of future health impacts and the cost-benefit analysis of four alternative bills, which purposed to mitigate health problems caused by power plant emissions, are presented.

'Clear the air' also provides other interesting reports on the health impacts of coal-fired power plants [232]and organizes interactive campaigns to strengthen the Clean Air act and force local capacities to control air pollution.

- **Energy, Sustainable Development, and Health, WHO-Europe.**

The concerns of health impacts of power generation have been well-known in Europe, especially when they link to urban air pollution and climate change. In the 4th Ministerial Conference on Environment and Health, the issues of energy, sustainable development and health were addressed as one of the priority issues of emerging or increasing importance. WHO-Europe has co-ordinated a multidisciplinary team of experts to produce a scientific technical overview of the impact on health of the energy cycle, the future perspective on human health impacts of energy systems, and policy recommendations to protect human health[233].

This conference leads to the ministerial declaration which calls upon WHO-Europe and other relevant organizations to follow up developments on this issue, monitoring progress in reducing the burden of disease and reporting back to intergovernmental meeting in 2007[234].

- **London Mayoral Strategies**

In London Mayoral Strategy, health has been set up as the cross-cutting issue in all mayoral specific strategies, including energy strategy. Therefore, to ensure the better health outcomes, in 2002, the London Health Commission together with the Environment Commission decided to use HIA to assess the Mayor's draft energy strategy. According to the Mayor's draft, the energy strategy addresses three primary goals; namely the reduction of London's contribution to climate change, the eradication of fuel poverty, and the promotion of London's economic development through a wide range of renewable and energy-efficient technologies[235].

The results of HIA confirm the health benefits of the Mayoral energy strategy, with the suggestion to show more explicit links to the health outcomes and other Mayoral strategies. HIA also highlights the interconnection between fuel poverty and health inequalities and the actions needed to tackle these relating problems. HIA also recommends the Mayoral energy strategy to set up clear policy priorities and targets, for example “consideration should first be given to exploiting renewable energy on site and then to purchasing electricity from renewables over the grid”, “where fossil fuels are used, their conversion and distribution should be as efficient as possible, e.g. using combined heat and power, community heating”, or “the nuclear component of the energy supply should be no more than the national average” [236].

- **Lessons Learnt from International Experiences**

These examples show that the concept of healthy public policy can be integrated into the policy formulation process in the power sector. However, the ways to integrate health aspect are different in these three cases. In the case of ‘Clear the air’, its policy strategy is to advocate for stronger environmental regulations by presenting advanced scientific information on the health impacts of power generation to the general public and politicians, in the popular manner. At the same time, ‘Clear the air’ also aims to provide interactive channels for Americans to participate in monitoring their environmental and health impacts and supporting a more progressive legislation for health protection. For WHO-Europe, its main work is to establish a broad policy framework for healthy public policy and provide their member countries with general scientific understandings of the health impact of the power sector. WHO-Europe’s attempt is related to more inter-governmental discussion forums, and therefore, less specific policy proposals and public advocacy are presented. Last, for the London Mayor strategy, it is certainly an authorized policy process (for London), which is not seen in the first two cases. Interestingly, the level of policy information is much less technical and more integrated with other strategies in its policy contexts compared to the first two cases[237].

These differences in policy strategies of healthy public policy movement show that healthy public policy initiatives can take place with different actors, from different platforms, and through different languages (i.e., technical or general information) roles, and actions. Unfortunately, policy analyses or evaluations of these initiatives and strategies are still very rare. Thus, the most effective strategy for a healthy public policy movement in the power sector cannot be concluded within the near future, giving more rooms and asking more efforts to learn from the previous attempts.

2.9.2 Thailand’s Experiences

Although Thai environmental movement in the power policy arena emerged in 1988 (discussed in detail in Chapter 4), the healthy public policy movement in the Thai power sector has a much shorter history. Before the national health system reform, only the case of the Mae-Moh Lignite power plant, which causes severe health impacts through its emission, gave rise to public concern. However, this concern plays an important role in protesting against the coal-fired power plants in Prachaub Kiri Khun (also discussed in Chapter 4) in 1999-2001.

After the launching of healthy public policy and HIA under the health system reform in 2001, the health impacts of several power plants and projects have been reported to the local communities, the health assemblies, and to the Thai public. These include the HIA of the Pak Mun hydro power plant, the Thai-Malaysia gas pipeline, the Wiang Hang lignite mining project, the Lamtaklong pump storage, and two biomass power plants in the central plain. All of these HIA studies are at the project level of HIA. Although some of them can be linked to policy suggestions, HIA and healthy public policy movement in Thailand never touch upon comprehensive policy or planning changes in the Thai power sector.

Concurrently, outside the health system reform process, the Greenpeace and other local NGOs have coordinately worked on the campaign against coal-fired power plants in Thailand and neighboring countries. Some NGOs, like the International River Network (South-east Asia region) and The Foundation for Ecological Recovery have worked on the issues of health and human rights in relation to the hydro power dam projects both in Thailand and neighboring countries (which sell most of their power outputs to Thailand). However, all these efforts both within and outside the health system reform have never had the chance to develop an overview assessment of the different policy directions and alternative proposals for a healthy public policy in the Thai power sector. Moreover, this movement still lacks in-depth policy analysis and a common policy strategy to develop a healthy public policy.

This study is, therefore, in the position to develop a deliberative policy analysis of the Thai power sector, as well as to conduct an overview assessment of different policy directions. The aim of this study is to seek for healthier policy directions and, at the same time, to understand the opportunities and obstacles in making it happen in the real policy politics. Furthermore, this study also aims to be a forum for policy discussions and joint implementation for further policy deliberation and social learning process. All these attempts are expected to be essential components of the development of a healthy public policy in the Thai power sector.

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Chapter 3
Sustainable Energy and Health:
Impacts, Assessment, and Potentials

While Chapter 2 provides the theoretical background for analyzing the public policy process, this chapter will focus on the technical background for the analysis of the strategic impacts of different energy policy options on environmental, social, economic and health aspects. As this study is in the quest for better health consequences of power policy options, this chapter will begin by explaining energy and health linkages from household and community to the global scales. These linkages will provide a background concept for the analysis of health impacts of different power policy options.

Although, it is quite clear from the literature reviews in the first part of this chapter that renewable energy technologies usually have positive impacts on human health, these healthier solutions have not always been chosen in the policy process. The second part of this chapter (from 3.2 to 3.6) will criticize the conventional policy assessment, which, consequently, leads to a number of suggestions for more appropriate policy assessment methods. These proposed assessments include a) the feasibility study and public regulation for innovation, b) strategic environmental assessment and c) institutional analysis based on Scott's three main pillars. The insight gained from these sections will be applied to the analysis of strategic impact assessment (in Chapter 5 and 6) and the analysis of the institutional framework for healthy policy options (in Chapter 7)

Since appropriate sustainable energy solutions depend very much on the local resource potentials, the last part of this chapter will provide the concise review of sustainable energy options in Thailand, which is necessary for identifying the suitable policy options for the Thai power sector in Chapter 5 and, later, compare it with the government's and the utilities' policy options in Chapter 6.

3.1 Energy and Health Linkages

Energy has certainly been one of the key factors in human development. It allows many people to enjoy unprecedented comfort, mobility, and productivity. In industrialized countries, people use more than 100 times as much energy, on a capita basis, than before humans learned to exploit the energy potential of fire.[1]

However, the harvesting, processing, distribution and use of fuels and other sources of energy have major environmental consequences. Table 3.1 shows the human disruption index of various pollutants released into the environment by human activities. From this table, it is clear that energy systems significantly affect the cycling of important chemical species on the global scale, especially in terms of the carbon dioxide and sulphur emissions, which then, in turn, have led to a global climate change crisis. Obviously, the expansion of environmental impacts, which have grown from local perturbations to global disruptions, has been driven by a more than 20-fold growth in the use of fossil fuels, and augmented by a tripling in the use of traditional energy sources such as biomass in the 20th century[2].

Table 3.1 Environmental Damage Caused by Human Activities by Sector in the mid-1990s

Insult	Human disruption index *(a)*	Share of human disruption caused by	
		Commercial Energy supply	**Other Main Source**
Lead emissions to atmosphere	18	41% (fossil fuel burning, including additives	59% (metal processing, manufacturing, refuse burning
Oil added to oceans	10	44% (petroleum harvesting, processing and transport)	56% (disposal of oil waste, including motor oil changes)
Cadmium emissions to atmosphere	5.4	13% (fossil fuel burning)	70% (metals processing, manufacturing, refuse burning) 12% (agricultural burning)
Sulphur emissions to atmosphere	2.7	85% (fossil fuel burning)	13% (smelting refuse burning)
Methane flow to atmosphere	2.3	18% (fossil fuel harvesting and processing	65% (rice paddies, domestic animals, land clearing) 12% (landfill)
Nitrogen fixation (as nitrogen oxide and ammonium)	1.5	30% (fossil fuel burning)	67% (fertilizer, agricultural burning)
Mercury emissions to atmosphere	1.4	20% (fossil fuel burning)	77% (metals processing, manufacturing, refuse burning)
Nitrous oxide flows to atmosphere	0.5	12% (fossil fuel burning)	80% (fertilizer, land clearing, aquifer disruption) 8% (traditional fuel burning)
Particulate emissions to atmosphere	0.12	35% (fossil fuel burning)	40% (agricultural burning) 15% (smelting, non-agricultural land clearing, refuse burning) 10% (traditional fuel burning)
Non-methane hydrocarbon emissions to atmosphere	0.12	35% (fossil fuel processing and burning)	40% (agricultural burning) 20% (non-agricultural land clearing, refuse burning)
Carbon dioxide flows to atmosphere	0.05*(b)*	75% (fossil fuel burning)	15% (net deforestation for land clearing)

Note: *(a)* The human disruption index is the ratio of human-generated flow to the natural (baseline) flow. *(b)* Although seemingly small, because of the long atmospheric lifetime and other characteristics of carbon dioxide, this slight imbalance in natural flow is causing a 0.4 percent annual increase in the global atmospheric concentration of carbon dioxide.

Source: Adapted from J.P.Holdren and K.R.Smith (2000, p.64).

3.1.1 Human Health Effects

Inevitably, human health is threatened both directly and indirectly by high levels of pollution and ecosystem degradation resulting from the harvesting, processing, distribution, and use of energy. According to the world energy assessment, the human health impacts of energy systems occur on all scales: household, workplace, community, regional, and global scales, as presented in Table 3.2. Fossil fuels, in particular, cause a range of human health impacts, from individual impacts on the health of coal miners to global impacts such as global climate change.

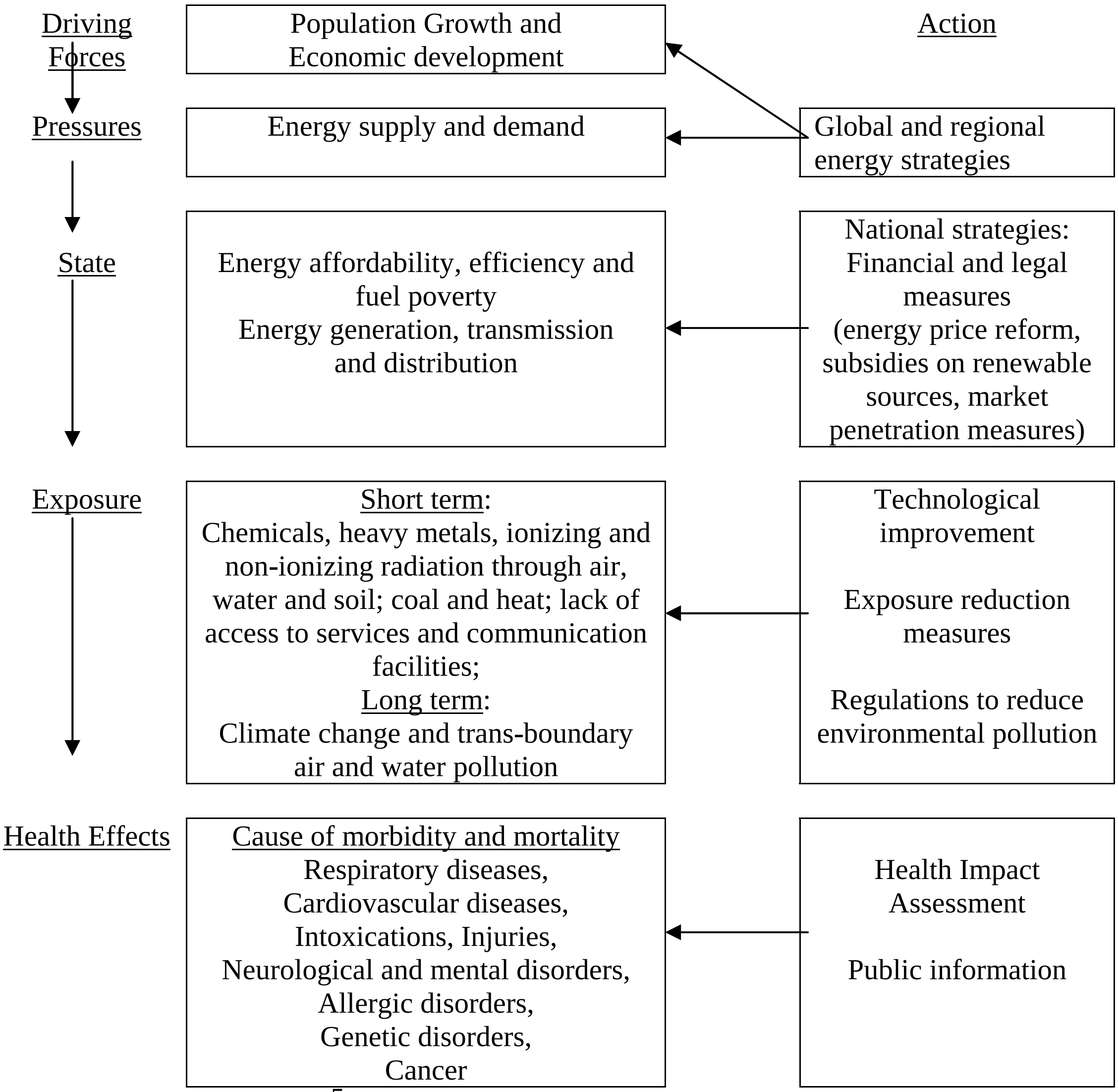
Table 3.2 The Environmental and Health Impacts of Energy Systems, Classified by the Scales on Which They Occur and the Characteristics of Impacts.

Scale	Environmental Health Impacts (Direct Impacts)	Ecosystem Health Impacts (Indirect Impacts)
Household scale	• Indoor air pollution from using solid fuels for cooking and heating	• Inappropriate charcoal production and fuel wood harvesting
Workplace scale	• Significant risks for workers, due to injuries and poor working conditions including exposure to dust and radioactive materials.	• Squalid living conditions of workers
Community scale	• Urban air pollution from fuel use • Stress from large population resettlement due to large-scale hydro power projects and risks of accidents related to nuclear power plants and their waste	• Ecological damages from large-scale hydro power projects • Ecological damages from surface mining and squalid living conditions of workers
Regional scale	• Various human health impacts, especially respiratory diseases from fine particles, ozone, and nitrogen and sulphur emissions	• Crop yield reduction due to the exposure of a high Ozone level • Damage of natural ecosystem and human-made structures from nitrogen and sulphur emissions
Global scale	• Global warming will expand the ranges of variety of diseases, including malaria, cholera, and dengue fever • Global warming will enhance the health impacts of certain air pollutants, which increases allergic responses and cardio-respiratory disorders.	• Global warming from greenhouse gas emissions will affect the food production and increase the frequency of extreme weather conditions and natural disaster.

Source: Summarized from J.R. Holdren and K. R. Smith, 2000[3].

Although indirect impacts are already included in the human health impacts presented in Table 3.2, those impacts still basically derive from the negative environmental changes. However, in reality, socio-economic factors within the energy system can also be an important determinant for health. WHO Europe-region stresses that energy affordability, efficiency, and fuel poverty have serious impacts on the health of the population in the region, especially in the case of the poor and disadvantaged groups within the society[4]. At the same time, the energy system can create more jobs within society, which may have a strong positive impact on health.

Figure 3.1 Inter-Connections Between Health and Energy



Source: WHO Europe, 2004[5]

Based on the WHO's DPSEEA model, WHO-Europe develops a systematic pathway of energy and health linkage, as shown in Figure 3.1. In this figure, population growth and economic development is perceived as the driving forces in this linkage, which create the pressures on energy supply and demand. Consequently, through the existing and new-coming institutions and conditions, the energy system will lead to the state of energy affordability, efficiency, and fuel poverty, and, at the same time, the state of energy generation, transmission, and distribution, including energy technological applications and organizations, within society. As a result of the good and bad state of the energy system, the human exposures can be seen clearly both in the short run and in the longer term. Certainly, with the matters of scale, time, and personal conditions in mind, these exposures can, in the end, lead to the serious health problems, from respiratory diseases to cancer.

The objective of developing this systematic pathway is to identify the potential actions at different levels, as shown at the right-hand side of Figure 3.1. The potential actions can be ranged from the global and regional energy strategies down to the release of public information on health impacts. In principle, the more upstream the actions, the more effective they are in terms of health protection and promotion.

In this study, two main human health impacts will be highlighted; namely the health impacts of air pollutions and climate changes, which are now great concerns in Thai society.

3.1.2 Health Impacts of Air Pollution

Human health impacts of the air pollution of energy systems have been highly evident in the last decades, though the quantified scales of impacts are somehow debatable. Moreover, the knowledge on human health impacts is still expanding in several areas, leading to more understanding and concerns over existing and future energy systems[6].

Through the acidification problem, sulfur dioxide and nitrogen oxide is the most well-known pollutants, which cause impacts on health. Both of them can cause respiratory system disorders with several symptoms and on different scales. SO_2 can also link to cardio-vascular problems, low birth weight and increased risk of infant death. Children, elderly, and asthmatics are among the most vulnerable groups within society.

Moreover, both SO_2 and NO_X can form a mixture of small solid particles and tiny sulfuric droplets. Combining with particulate matter which is directly emitted from the power plants, this fine particle becomes the serious concerns at the national and regional levels, since it can travel over long distances and, due to its small size, it can reach the blood system resulting in inflammation of the cardiac system. The inflammation of the cardiac system is the main cause of cardiac diseases, including heart attacks and strokes, leading to premature death. This particulate matter also links to low birth weight, premature birth, chronic airway obstruction and remodeling and sudden infant death. Again, children, elderly, children, and asthmatics are among the most vulnerable groups.

The effects of ozone and mercury on human health are relatively new concerns. Ozone can create several respiratory system disorders and negative infant development. Mercury has strong negative developmental effects on infants, including poor performance in tests of the nervous system and learning abilities. In adults, mercury may affect blood pressure regulation and heart rate. Since, mercury emissions are deposited in watershed and transformed into methylmercury, which contaminates fish, the risk of mercury exposure is high to babies whose mothers have eaten contaminated fish during the pregnancy. In principle, pregnant women, children, and women of child-bearing age need to aviod mercury exposure, i.e. avoid eating contaminated fish.

Table 3.3 Health Effects of Power Plant Pollutants

Pollutants	What is it?	How is it produced?	Health effects	Most Vulnerable populations
Sulfur Dioxide (SO_2)	SO_2 is a highly corrosive, invisible gas. Sulfur occurs naturally in fuels, especially coal and fuel oil	SO_2 is formed in the gases when fuel is burned. SO_2 reacts with the air to form sulfuric acid, sulfates, and in combination with NO_X, acidic particles	Coughing, wheezing, shortness of breath, nasal congestion and inflammation. Make asthma worse. SO_2 can de-stabilize heart rhythms. Low birth weight, increased risk of infant death	Children and adults with asthma or other respiratory diseases.
Nitrogen Oxide (NO_X)	A family of chemical compound including nitrogen oxide and nitrogen dioxide.	NO_X is formed in combustion process. In the atmosphere, NO_X can convert to nitrates and form fine acidic particles. Reacts in the presence of sunlight to form ozone smog.	NO_X decreases lung function and is associated with respiratory diseases in children. Convert to ozone and acidic PM particle in the atmosphere.	Elderly, children, astmatics
Particulate Matter (PM)	A mixture of small solid particles (soot) and tiny sulfuric acid droplets. Small particles are complex and harmful mixtures of sulfur, nitrogen, carbon, acids, metal, and airborne toxic.	Directly emitted from fuel burning in power plants. Formed from SO_2 and NO_X in the atmosphere.	PM crosses the lung into the blood circulation resulting in inflamation of the cardiac system, a root cause of cardiac disease including heart attack and stroke leading to premature death. PM exposure is also linked to low birth weight, premature birth, chronic airway obstruction and remodeling and sudden infant death.	Elderly, children, asthmatics
Ozone	Ozone is a highly corrosive, invisible gas.	Ozone is formed when NO_X reacts with other pollutants in the presence of sunlight.	Rapid shallow breathing, airway irritation, coughing, wheezing, shortness of breath. Make asthma worse. May be related to premature birth, cardiac birth defects, low birth weight and stunted lung growth	Children, elderly, people with astma or other respiratory disease. People who exercise outdoors.
Mercury	A metal that occurs naturally in fuel, especially coal.	Mercury is released when fuel is burned. Mercury emissions are deposited in watershed and transformed into methylmercury, which contaminate fish. Human exposure is primarily the result of the consumption of contaminated fish.	Developmental effects on babies, who are born by women who ate contaminated fish while pregnant. Poor performance on test of nervous system and learning. In adults, it may affect blood pressure regulation and heart rate.	Fetuses and children are directly at risk. Pregnant women, children, and women of child-bearing age need to aviod mercury exposure.

Source: Adapted from Schneider, 2004[7].

In the United States, a recent study show the health impacts of fine particle pollution of power plants. The study found that this fine particle pollution shortens the lives of nearly 24,000 people each year, including 2,800 due to lung cancer. Moreover, hundreds of thousands of Americans suffer each year from asthma attacks, cardiac problems, and respiratory problems associated with fine particles from power plants. These illnesses result in tens of thousands of emergency room visits, hospitalizations, and lost work days each year. The study also found that the elderly, children, and people suffering from respiratory diseases are most severely affected by the fine particle pollution. People who live in metropolitan areas near coal-fired power plants are highly and acutely affected, and their attributable death rate is much higher than the rates in areas with few or no coal-fired power plants[8].

In Thailand, there is no comprehensive and quantitative study like this. However, Thailand has an obvious experience in the case of the Mae Moh lignite-fired power plant, as ealier shown in Chapter 1. The air pollution from the power plant and other impacts of lignite mining have caused severe environmental and health problems around the mining and power plant area. Local people suffer from respiratory system disorders, including premature death[9]. In 2004, the court ruled EGAT to pay a compensation to the local affected people. In the same year, the Thai government also decided to relocate 4,000 villagers from the area after 10 years of local campaign for new healthy places of living [10].

3.1.3 Health Impacts of Global Climate Change

Apart from air pollution, another emerging and expanding concern on human health impacts is the climate change problem. Figure 3.2 outlines the connection between climate change and human health. Based on this figure, population dynamics and unsustainble economic development lead to higher greenhouse gas emissions. The greenhouse gas emissions constitute the main cause for climate and weather changes on global and regional scales. The state of undesirable changes can be seen in terms of heatwaves, extreme weather, temperature, and precipitation. These weather changes can have human health effects through four main ways; namely the changes of the microbial contamination pathways, disease transmission dynamics, the deterioration of agro-ecosystem hydrology, and socio-economic and demographic changes. These four main ways may then have several health impacts, as presented in the right-hand side of the figure.

In Thailand, the great concerns are identified in three main areas;

- **Extreme weather-related health effects**; Thailand is now obviously facing an increase in weather-related natural disasters both in terms of scale and frequency. Flooding, landslide mudding, drought, and forest fire have increased throughtout the last decade[11]. Since Thailand still lacks coping capacities, both at the national and local levels, the increase in extreme weather events will lead to significantly negative impacts on health.

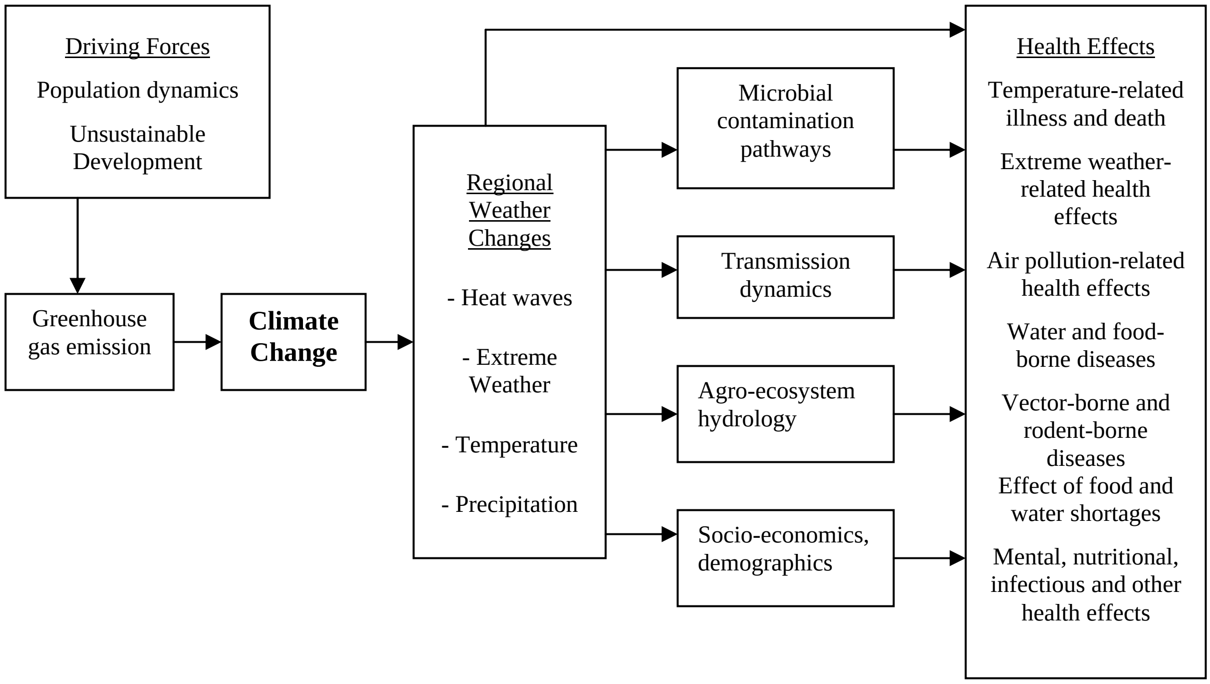


Figure 3.2 Climate Change and Health: Pathway from Driving Forces, through Exposures to Potential Health Impacts

Source: Adapted from McMichael et al, 2003[12].

- **Vector-borne diseases**; Although, in general, conditions of infectious diseases have improved in the last three decades, the vector-borne diseases are still the great concern in Thai society. Malaria and dengue are the most important diseases in the south-east asian countries in general and in Thailand in particular. A small increase in temperature can greatly increase the risk of malaria transmission. In terms of dengue, the increased rainfall in many locations can affect the vector density and transmission density. In Viet Nam, there is an evidence that the number of dengue cases increased in the year of El Niño[13]. Although, no specific study has been conducted on the relationship between climate change impacts and these diseases, the increasing appearance of cases in recent years should be sufficient to raise public concern on this issue.

- **Effect on food and water shortage**; 60% of the Thai population still base their livelihoods, mainly or partly, on the agricultural sector. Although Thailand is one of the greatest food exporters in the world, some of the Thai people are still facing a food security problem. Combined with the deforestation and increasing demand for water in the industrial and urban sectors, water shortage is also more prominent in these recent years, leading to great impacts on agricultural production, food security, and conflicts over access and control of water resources[14]. Therefore, the climate change impacts on food and water shortage can greatly affect the health and well-being of the Thai population.

Apart from these three areas, the air-pollution-related health effects and temperature-related illness (including mental disorders) can also be a future serious impact for the Thai population, especially for those who live in the big cities and industrial areas. However, the information on these effects are still lacking in the country.

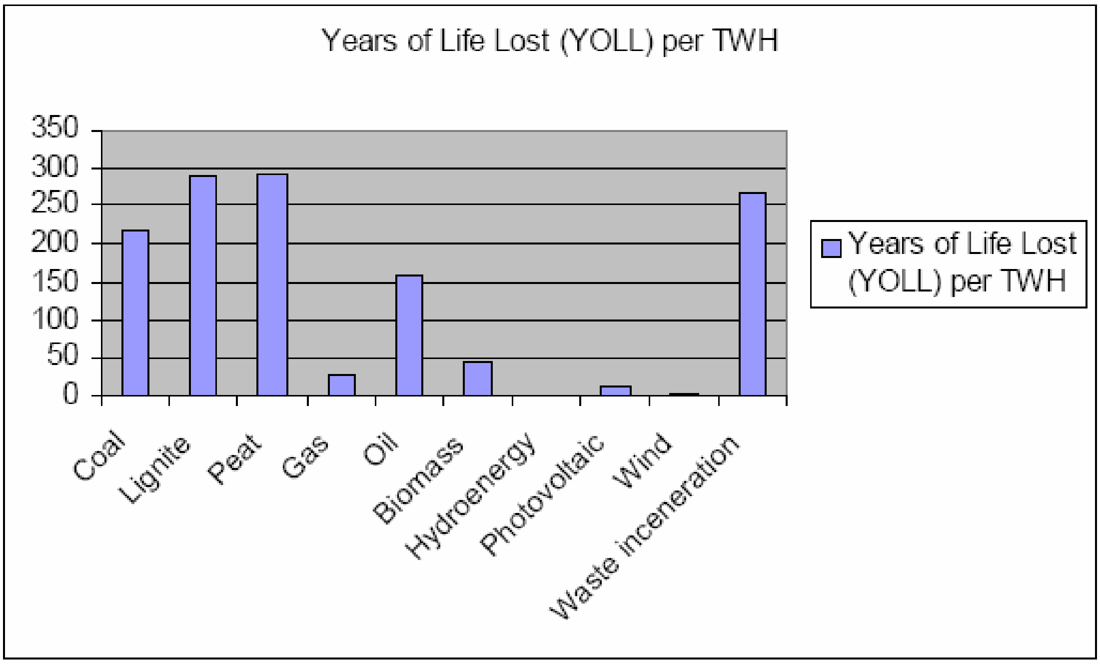
3.1.4 Sustainable Energy and Positive Health Impacts

If sustainable energy means "energy produced and used in the ways that support human development over the long term in all its social, economic and environmental dimensions," sustainable energy systems must support both human and ecosystem health over the long term[15]. Therefore, due to their environmental disruptions and human health impacts, it is clear that current energy systems fail to meet this definition. As stated in Agenda 21, "Much of the world energy is currently produced and consumed in the ways that could not be sustained if technology were to remain constant and overall quantities were to increase substantially"[16].

The Extern-E project, which was later quoted by WHO-Europe, provides important information on human health impacts of different power technologies. As shown in Figure 3.3, years of life loss from acute and chronic mortality from air pollution are high in the conventional fossil-fuel technologies (except natural gas). Obviously, renewable technologies, especially wind, PV and hydro power, provide power with much lower negative impacts on human health. Concurrently, occupation accidents (death per TWH) are very high in coal and lignite cycles for power generation, as presented in Figure 3.4. In this aspect, renewable energy can also significantly reduce occupational accidents. As summarized in Table 3.4, renewable energy technologies have positive impacts on human health both in direct and indirect ways. Among renewable technologies, wind and solar energy technologies seem to be the most desiarable technologies in a health perspective.

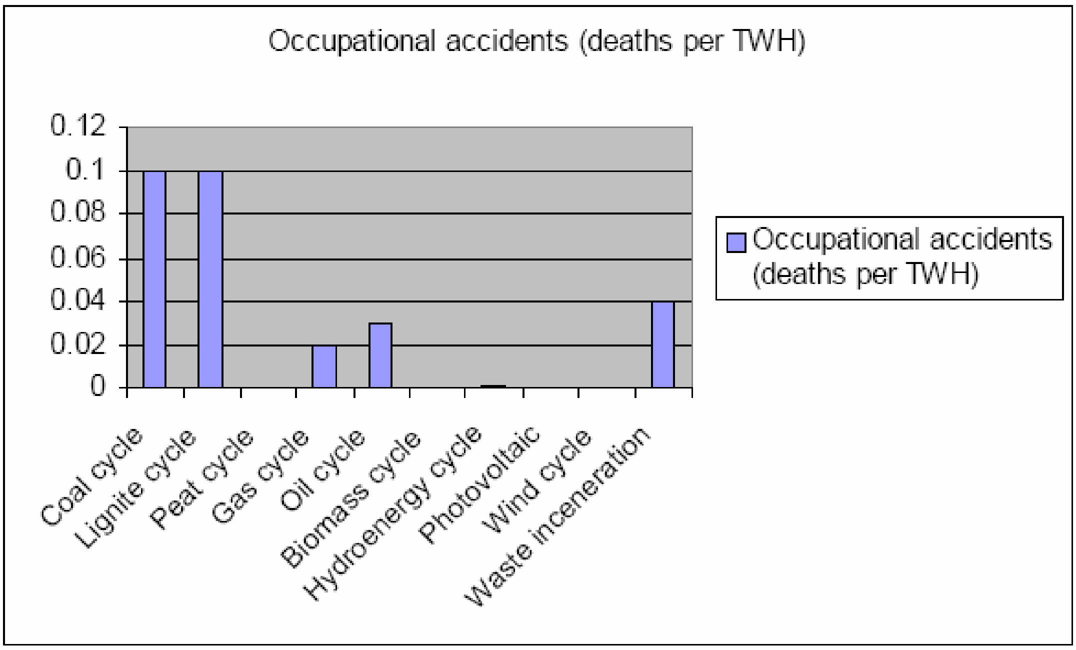
It is essential to recognize that the use of renewable energy provides opportunities for achieving benefits on more than one scale. In other words, if renewable energy and energy efficiency can reduce the consumption of fossil fuels, especially for those who use these fuels for transportation or power generation of large negative health impacts, significant improvements can be made at the local, national, regional, and global levels. As stated in the world energy assessment[17], "with greenhouse gas reduction targets on the order of 10-20 percent, the scale of emissions of health damaging pollutants and associated reduction of ill health could lead to the same range or somewhat higher-perhaps a 250,000-750,000 annual reduction in premature death world-wide." However, to achieve these mutual benefits, the energy, environmental and human health linkages must be stressed and become an integral part of energy and environmental assessment.

Figure 3.3 Years of Life Lost from acute and chronic air pollution effects per TWH by different power technologies



Source: CIMAT, 1998 quoted by WHO-Europe, 2004.

Figure 3.4 Occupational accidents (death per TWH) by Different Power Technologies



Source: CIMAT, 1998 quoted by WHO-Europe, 2004.

Table 3.4 Summary of Health Impacts of the Different Forms of Electrical Power Generation

ENERGY-GENERATING-RESOURCE	DIRECT HEALTH IMPACTS	INDIRECT HEALTH IMPACTS (CONTRIBUTION TO CLIMATE CHANGE)	POTENTIAL FOR ACCIDENTAL INJURIES AND/OR FATALITIES
Biomass	Mainly from acute and chronic effects of outdoor air pollution, but magnitude of health impact depends on combustion process and technology	Little net contribution to greenhouse gases over the medium term provided renewable sources used.	Usually small and containable risks
Coal	As for biomass; additional burdens from occupational exposures	Forms greenhouse gases, but separate contribution to climate change and resultant health impacts difficult to quantify; impacts delayed	Appreciable occupational risks associated with extraction
Geothermal	No significant harmful emissions	Negligible	Minimal
Hydroelectric	No significant harmful emissions, but can lead to risks through altered ecology	Significant during construction phase; negligible during operation	Generally small, except to workers during construction
Lignite	As for coal; higher pollutant emissions and hence probably greater health impacts	As for coal	As for coal
Marine	Negligible	Small/negligible	Small (mainly occupational)
Natural gas	Cleaner burning than other fossil fuels, but health effects primarily from air pollution	Forms greenhouse gases but generally lower than for other fossil fuels	Some risks mainly during extraction
Oil	As for biomass; additional burdens from occupational exposures	Forms greenhouse gases, but separate contribution to climate change and resultant health impacts difficult to quantify and delayed	Appreciable occupational risks associated with extraction
Peat	Similar to lignite	Comparatively high greenhouse emissions versus coal	Usually small and containable risks
Photovoltaic	Small	Negligible	Negligible
Nuclear	Small risks from release of radioactive material, but containable by effective control systems. Debate about long term effects from exposure during mining.	Minimal (some during reprocessing).	Risk from uncontrolled releases of radiation usually small, but finite potential for catastrophic accident or terrorist threat
Waste incineration	Mainly from acute and chronic effects of outdoor air pollution, but magnitude of health impact depends on combustion process and technology	Contributes to greenhouse gases	Usually small
Wind power	No significant harmful emissions	Negligible	Negligible

Source: WHO-Europe, 2004[18].

3.2 Conventional Assessments and the Missing Link

As mentioned earlier, this section concerns the limitation of conventional economic and environmental management approaches to link sustainable energy with its health and environmental benefits in decision-making processes.

3.2.1 Conventional Project Assessment Tools

Currently, there are two main conventional assessments which have been used for justifying any energy development project: cost-benefit analysis (CBA) and environmental impact assessment (EIA). CBA attempts to compare the financial benefits and costs of a project to the project owner, as well as socio-economic benefits and costs to the whole society. EIA focuses on anticipating and analyzing environmental impacts derived from specific energy projects and providing mitigation plans to prevent such impacts.

Unfortunately, these two important tools are typically used independently of each other. Normally, the CBA, which is often conducted at an early stage, does not include the external costs identified in the EIA. Therefore, the critical links between environmental aspects and energy aspects are often missing in CBA.

Furthermore, these two conventional approaches are limited in analyzing long-term energy strategy, since they always apply to decision-making at the project level. Therefore, they do not cover overall or cumulative environmental impacts, such as climate change or acid deposition, which are the result of the cumulative long-term impacts of several energy projects. More importantly, selecting the most suitable energy technologies for society is not like catalog shopping. Sustainable energy technologies need time, investment, and the creation of appropriate institutional frameworks for their research, development, and application. Economic and environmental assessments need to go beyond the project level to focus more on long-term policy alternatives.

3.2.2 Conventional Sectoral Assessment Tool

At the sectoral policy level, the main conventional approaches to energy planning are least-cost utility planning (LCUP) and integrated resource planning (IRP), which were primarily developed for use by energy utilities. The LCUP focuses mainly on optimizing the economics of energy production, transmission, and distribution, without consideration for the environment. Conversely, since the objective of the IRP is to minimize the socio-economic expenses of energy systems, the IRP includes environmental impacts in its analysis.

However, in practice IRP is better suited for relatively short-term sub-optimization rather than long-term general planning of sustainable energy development[19]. This is mainly because: (a) due to its short-term and least-cost focus, it does not leave room for technologies under development; therefore, (b) most renewable energy resources are not included in IRP; and (c) its lack of consideration for institutional, organizational, and behavioral aspects does not allow for the fundamental changes which are required for a transition to sustainable energy. Therefore, "IRP is not worth very much in the long term. The power producers ought to focus their strength on Integrated Perspective Planning, extending 40-50 years into the future."[20].

3.2.3 Conventional Time Frame and Priority

This conclusion leads to another important weakness of conventional approaches at both the project and sectoral levels: time frame and time priority. Since the investments in energy systems are capital intensive, highly asset specific, and have very long technical lifetimes (often 20 to 40 years), the costs of the historic investment, which are built into the present technological systems, have a significant influence upon the way in which one should invest to reach the goals of energy systems of the future[21]. As often seen in economic assessments, the low short-term marginal costs of existing technologies always impede the penetration of new technological solutions, which need to generate adequate returns to cover their long-term marginal costs. Therefore, if economic assessment performs an analysis with a rather short time horizon without including the long-term replacement of capital costs of existing technical and organizational systems, good solutions which are relatively independent of existing technical systems cannot be found and no strategic development of energy systems can be achieved.

Furthermore, in conventional economic assessment, high interest rates, which are usually applied in order to discount the future benefits and costs into present values, will often devalue the future benefits of sustainable energy, as well as the external environmental costs of fossil fuel-based technologies. This is why the huge future benefits of renewable energy have always been evaluated as being much lower, in present value terms, than their high investment costs.

According to the basic assumptions in the theory of investment analysis, the investments should be comparable over a relevant time horizon. Therefore, when dealing with energy technologies using different rates of scarce resources and having different levels of environmental impacts, a market rate of 5-7% is problematic in assessing the socio-economic feasibility of long-term energy investment. With the rate of 7%, the future environmental costs and benefits will be discounted to less than 10% of their value within 35 years. In other words, after 35 years, future environmental benefits and costs, like long-term global climate change, will mean almost nothing in a conventional economic assessment. Hvelplund and Lund suggest that, to counteract this time priority bias, when comparing investments with different levels of pollution and use of scarce resources, a much lower interest rate (0 to 3%) must be used[22].

3.2.4 Conventional Single Purpose Planning

Last, in the conventional approach, the goals of energy planning focus mainly on utility costs and system reliability to support national economic growth, while in reality, the energy system development can lead to various long-term national or human development goals.

For example, investments in sustainable energy systems can create jobs and increase the national income. The development of renewable energy can stimulate technological progress and reduce the import burden of the country. The use of biomass and biofuels can increase the demand for agricultural products, thus raising farm product prices, and leading to decreased poverty and income inequality within the country. As mentioned earlier, renewable energy can also reduce environmental and health risks, leading to better long-term human development.

In other words, sustainable energy development provides benefits not only to the energy sector, but also to other economic and social sectors, including health, agriculture, and natural resource management. Concurrently, as mentioned earlier, the negative impacts of various existing energy technologies also occur across the traditional borders of these sectors.

Therefore, energy assessment and planning is not an exercise for the energy sector alone, as usually seen in the conventional approach. It is also clear that limiting the analysis to single purpose planning, as seen in a conventional approach, will not fully recognize the linkages of energy, socio-economic environment and human health. Energy planning should be conducted as an intersectoral policy assessment, with participation and analysis of different stakeholders. Otherwise, the potential benefits and costs of different energy technologies and development paths may be overlooked.

3.3 Feasibility Study and Public Regulation for Innovation

To overcome the hindrances of the conventional approach, Hvelplund and Lund have developed the new feasibility and public regulation assessment to support radical technological changes, where the changes in instutional, organizational and profit-sharing schemes must be involved, such as the development of renewable energy[23].

The core idea of this new approach is a) to link the feasibility study with the existing societal goals and relevant micro and macro institutional contexts and b) to change micro and macro institutional contexts in the directions that allow the benefits of radical technological development to be fully realized. In other words, this approach aims to create space or mechanism for innovative democracy, where society has the real “freedom of choice” between different technologies and organizational scenarios on the policy-making stage.

3.3.1 Radical Technological Change

Feasibility studies or economic assessment of energy planning should include both the design of technically feasible alternatives, and an evaluation of the social, environmental and economic costs of those alternatives. When performing feasibility studies of new technologies such as energy conservation, small CHP plants and renewable energy, one must emphasize the character of radical technological change[24].

In the power sector, the alternatives to uranium-, large coal-, oil-, and gas-fired power plants are electricity conservation, renewable energy and cogeneration technologies. Hvelplund has identified the main differences between these new “sunrise” technologies, and the old “sunset” technologies as presented in Table 3.5 below[25].

Table 3.5 Institutional characteristics of the "Sunset" and "Sunrise" technologies.

Old techniques "Sunset technologies"	**New techniques "Sunrise technologies"**
1) Based upon a high level of fossil fuel and uranium consumption.	(1) Based upon energy conservation, renewable energy and integrated efficient energy supply systems.
2) Technical solutions are not contextually adaptable.	(2) Technical solutions differ from place to place.
3) Implementation in single purpose organisations.	(3) Implementation in multipurpose organisations.
(4) Sectored energy systems.	(4) Integrated energy systems.
(5) High degree of asset specificity; long technical lifetime, high capital costs and large strong organisations.	(5) High asset specificity, medium long technical lifetime, moderately strong organisations.
(6) Historically strong from financial and political points of view.	(6) Historically weak from financial and political points of view.
(7) Mostly using known techniques.	(7) Often demand new techniques.
(8) Often linked to existing knowledge.	(8) Often require new knowledge.
(9) Often based upon existing organisations.	(9) Often require new organisations.

Source: Adapted from Hvelplund, 2001

These different characteristics are presented in various aspects of technological development. They do not differ only in technical basis, but also in knowledge, and organizational basis, including the way they earn the profit. According to Hvelplund, these differences indicate that the new technologies do not fit well into the organisation of the old fossil fuel and uranium technologies; which means that the organisations linked to these old technologies will be badly equipped to compete in the arena of the new technologies.

3.3.2 Micro Institutional Context (Analysis of Value-Added Structure)

Consequently, Hvelplund suggests that one might expect heavy organisational resistance from the old technologies against the new technologies. He proved this assumption by analyzing 25 years of experiences of Danish Energy Policy and Development with the emphasis on the value-added changes of old and new organisations, when participating in this radical technological change, as presented in Figure 3.5.

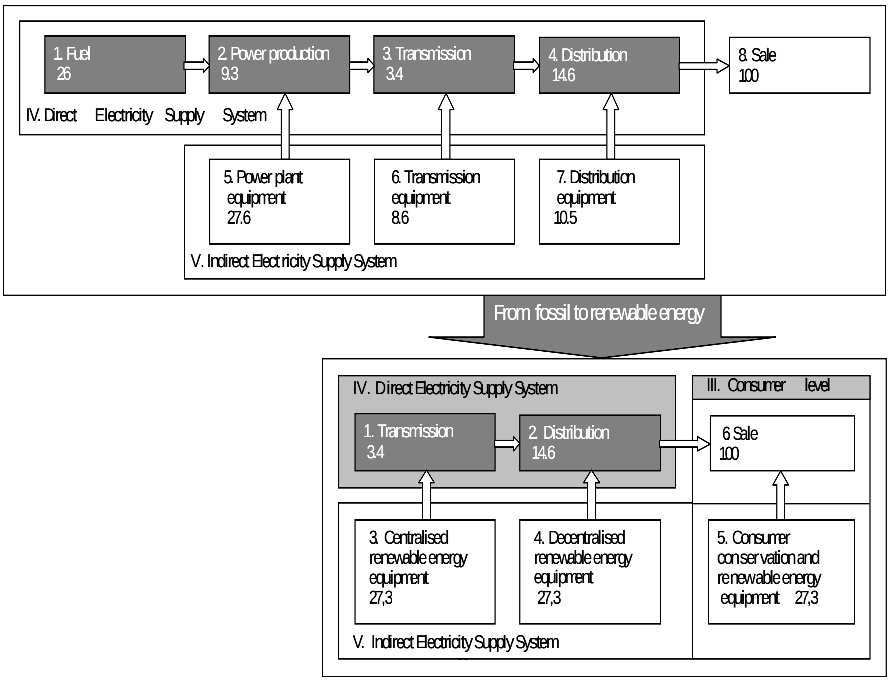


Figure 3.5 The change in value-added profile connected to the change from uranium and fossil fuel, to renewable energy and energy conservation systems.

Source: Hvelplund 2001[26].

From Figure 3.5, the changes in the value-added chain from old technology (figures based on coal-fired power plant) to the renewable energy and conservation (REC) technologies (figures based on wind energy) can be clearly seen within two main areas[27]:

a. In the REC value-added chain, the fossil fuel value-added part has disappeared, and is replaced by investment in renewable energy capital equipment.

b. In the REC value-added chain, the power production value-added part in a specific direct electricity supply system organisation has been replaced by "renewable energy system automation", where it is probable that the maintenance, at least at the decentralised and consumer levels, will be performed by the suppliers of the wind turbines, the photovoltaic cells, the hydrogen production system, the electricity battery charging system, etc. The need for a specific power production organisation might decrease or disappear, as the day to day work on a power plant has been replaced by automatons requiring maintenance from, for instance, the wind turbine factory.

It is naturally possible that the existing power company organisations will take over the maintenance of the renewable energy automatons, especially those connected with the large renewable energy plants, like off-shore wind farms. But even in this case, the added value directly linked to the power sector will only be halved compared to the present day[28].

According to Hvelplund, as a consequence of (a) and (b), the direct electricity supply system organisation might reduce its size until it only consists of the transmission organisation and the distribution network organisation. In his estimation, in case of the Danish electricity system, the value added would be decreased from around 27% to around 18% of the electricity price[29].

3.3.3 Macro Institutional Context

With this analysis, Hvelplund concludes that, due to their inevitable loss of value added and the competitive disadvantage of moving towards the new technologies, the old technology industries would organize resistance against the development of new technologies. Since the old techonology industries are historically strong from financial and political points of view, this organized resistance cannot simply ignore sustainable energy planning and development. Therefore, "the political system should be aware that a green innovation policy would meet systematic resistance from the old uranium and fossil fuel companies".

To cope with the resistance, Hvelplund further suggests the process of "**political liberalization**". This process can also be termed a "bottom up-top down-bottom action" process, which has nothing to do with a rigid central planning technique, but is more of an open-up procedure by means of which grassroots organisations, the general public, and local heat companies by parliamentary intervention are given the opportunity to introduce and implement innovations in the energy field.

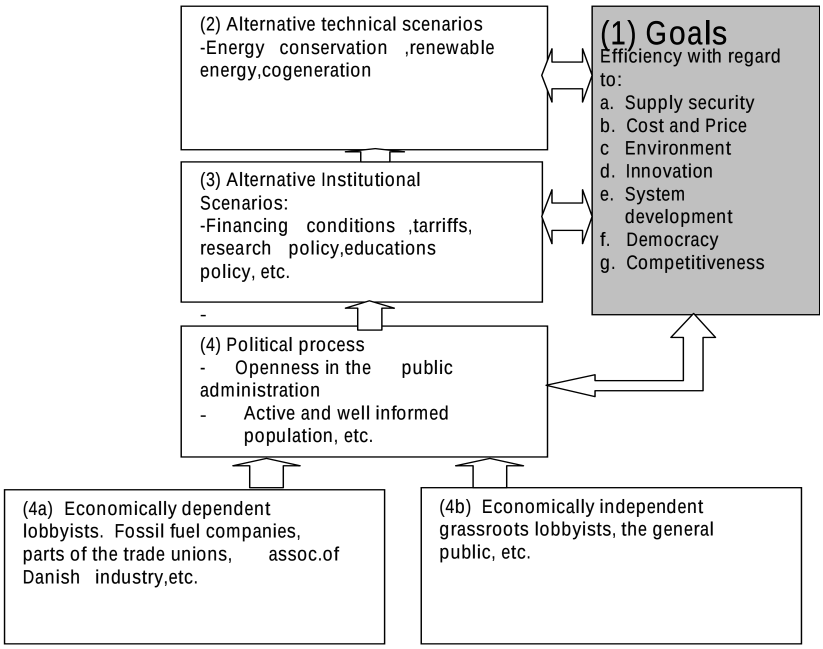


Figure 3.6 "Green innovation" and political liberalisation
Source: Hvelplund, 2006.

In box (1), the discourse regarding goals and norms is performed.

In box (2), the discourse regarding the realistic technical scenarios is carried through.

In box (3), the discussion regarding concrete institutional reforms is taken.

In box (4), the discussion with regard to the design of political institutions is of importance.

In boxes (4a and 4b) the design of the information and resource balance between lobbyists is linked to the old uranium and fossil fuel interests (4a), and the lobbyists are presented who are economically independent from the interests of the uranium and fossil fuel companies.

From the Danish experience, Hveluplund concludes, that if the parliamentarians want to have different political scenarios to chose in between, they must ***establish a resource and information balance*** between the economically dependent and the economically independent lobbyists. The establishment of this balance is essential, if a successful transformation from uranium and fossil fuel technologies to energy conservation and renewable energy technologies should be fulfilled. According to Hvelplund, the institutions constituting this balance ***can be the institutions of political liberalisation.***

They are for instance:

- The presence or establishment of *independent research units*, for instance independent universities, which have the freedom and the resources required to design technical scenarios which are independent of the present central administration and the large energy companies.
- Extensive *openness of information* both with regard to public plans and the cost and capacity structure of existing energy plants.
- The establishment of independent energy offices and test centres, which can give advises to the public regarding the possibilities and potentials of energy conservation and renewable energy.
- Supply public funds to institutions, where the board is independent of the old fossil fuel interests.

If these "political liberalisation" reforms are introduced and persistently secured, the public and the parliamentarians will get the "freedom of choice" between different technological and organisational scenarios on the energy stage. This is termed the process of ***innovative democracy.***

3.3.4 The Applications of Feasibility Studies and Public Regulation for Innovation

To facilitate the policy discussions within innovative democracy, Hvelplund and Lund suggest that the feasibility studies should be carried out within the present macro and micro institutional contexts, not just the calculation of costs and benefits as is usually the procedure of mainstream economic analysis.

In their view, *Socioeconomic feasibility studies* and *Public Regulation analysis* should[30]:

- perform analyses with a very long time horizon, in order to find the best solutions relatively independent of existing technical systems.
- relate to the specific goals of organizations or society. Therefore, the goals must be made explicit and open. If the organizational goals include demands for technological innovation, job creation, national independence, and environmental sustainability, then the feasibility study should focus on the effects of these areas.
- analyze the bindings of existing technical systems. This is particularly important in cases in which the existing energy system has an overcapacity. A system with overcapacity tends to result in either energy prices close to the short term marginal costs, or pressure from the energy companies upon the political process, urging the politicians to protect the existing energy companies from the competition of newer technologies.
- analyze the links between the economy of a project and future changes in the technical energy system. For example, if we are dealing with an energy conservation plan, what impact would a period of overcapacity have upon our plan? This is called "a technical sensibility analyses".
- analyze the links between the economy of the project and the legislation needed to make it feasibile. For example, what happens if CO_2 taxation is introduced? What happens if the rules assuring the right to sell electricity to the public grid are abolished? This is called "an institutional sensibility analyses".
- analyze the links between the above institutional sensibility analysis and the political process. For example, which agents on the energy market have the financial and political motivation to "kill" newcomer technologies? Are there counter forces which can support the newcomer technologies? How can the political balance of power on the energy stage be described? Which political scenarios can be developed, and what effect will they have upon our project? This is called "a political sensibility analyses".
- be aware of the asymmetry of financial power between the old fossil fuel-based technologies and the new energy conservation technologies. Often public regulation measures will not require subsidies for the new technologies, but just equal terms with regard to financial possibilities, by removing the capital advantages of the existing energy companies.
- be aware of the imbalance in political power between the old fossil fuel-based technologies and the new energy conservation technologies. Often it is necessary to create organizations within research, price and monopoly

control, advisory committees and funding, which are totally independent of the established fossil fuel companies.

In this study, the application of this line of thought will be used a) for analyzing policy-making processes in Chapter 4, b) for analyzing Thailand's societal goals and their relevant impact indicators which should be used for comparing different policy options in the policy process in Chapter 5, and c) for analyzing existing institutional and public regulation frameworks in Chapter 7.

3.4 Strategic Environmental Assessment (SEA)

As mentioned in the previous section, radical technological changes require an establishment of resource and information balance. Obviously, environmental and health consequences of different power technologies as seen in the first section constitute one of the most essential information balances that needs to be drawn in the policy process, especially when the concept of healthy public policy is emphasized. To provide an information balance on the impacts of different policy options in the Thai power sector, strategic environmental assessment (SEA) will be applied in this study.

3.4.1 Concept and General Application

SEA shares its original roots and common principles with EIA tools, which are normally applied to projects. However, instead of being used at the end of the decision-making cycle, with a limited number of feasible alternatives, the idea is to use SEA on earlier stages, when a wide range of potential alternatives can be considered. SEA focuses on a sustainability agenda and uses sources of environmental degradation, rather than focusing on a standard agenda and treating symptoms of environmental degradation. Unlike EIA, SEA uses a broad perspective with a low level of details to provide a vision and overall framework[31]. The key differences between SEA and EIA are shown in Table 3.6

The word "strategy" in SEA implies visions that look beyond existing facts. It also implies a long-term perspective, with objectives to be achieved in that time period. It identifies a roadmap or possible pathway that enables the achievement of these objectives within the long-range time frame[32]. In other words, SEA, including in this study, provides an assessment of an action plan that will enable the achievement of vision and shared objectives.

The application of SEA has been expanded dramatically during the 1990s. The EU and countries such as China, South Africa and Canada have established legal provisions for SEA. To fit within diverse decision-making processes, the applications of SEA vary from place to place and from one case to another[33].

Table 3.6 Key Differences Between SEA and EIA

Aspects	SEA	EIA
Nature of action	Strategy, vision, concepts	Construction/operational actions
Level of decision	Policy, planning, programming	Mainly project
Focus	Strategic choices or decisions about **"doing the right things"**	Project decisions about **"doing things right"**
Issues	Territory-wide sustainability issues, conflicts between objectives	Impacts of projects; community specific
Time Scales	Long to medium	Medium to short
Assessment	Fuzzy but important judgment or educated guess; qualitative and semi-quantitative	More quantitative and specific
Relation to decision	Facilitator	Evaluator, often only to meet administrative requirement
Post-evaluation	Other Strategic actions or project planning	Objective evidence from construction and operation

Source: Adapted from Au (2003)[34] and Partidario (2003)[35]

SEA can apply to sector-specific plans and programs, spatial and land use planning, regional development programs, natural resource management strategies, international and development assistance, legislative and regulatory bills, and investment and lending activities. The forms of SEA which are most relevant to sustainable energy planning are policy EA and sectoral planning SEA[36]. In general, there are five key elements in the SEA process[37]:

- **Vision:** In the SEA process, sustainability frameworks of each case or each society must be reviewed. The review of sustainability frameworks leads to a shared set of strategic objectives and goals, which are used as benchmarks in each SEA process. At this stage, all sustainable development aspects (i.e., social, economic, environmental, and health aspects) have been included and well intergrated.
- **Options:** SEA aims to facilitate the identification of development options and alternative proposals that are more suitable. Thus, in SEA processes, different policy and technological options to meet sustainable frameworks have to be reviewed, analyzed, discussed, and developed in participatory and transparent ways.
- **Analysis or Appraisals:** At this stage, it is very important that the scoping of the sustainability assessment should be clearly defined for all stakeholders. The appraisals of options and policies should be done through the participatory process with independent and public review. This ensures a good policy combination according to sustainability frameworks, objectives, and indicators.
- **Actions:** Action is needed to facilitate the decision-making process by providing the necessary information, at the right time and in a quick, short and readable format. Action also requires the determination of the chain of events and institutional frameworks required to promote sustainable solutions in practice. It is important to establish targets and indicators for follow-up and evaluation of proposed policy actions.

- **Participation:** SEA has to inform and involve interested and affected public and government bodies throughout the decision-making process. It has to explicitly address their inputs and concerns in SEA documentation and decision-making. To facilitate their meaningful participation, SEA has to provide clear, easily understood information requirements and ensure sufficient access to all relevant information.

Based on these five key elements, Figure 3.7 presents an example of the SEA process and its interconnection with sectoral planning process. Within this process, the benefits of sustainable energy development will be clearly seen and highlighted, by connecting them to the national development vision. Then, all sustainable energy options will be analyzed to find the best ways to meet the national development goals over the long-term. Finally, all the benefits and opportunities of sustainable energy development will be translated into a policy document and action plan for public decision-making.

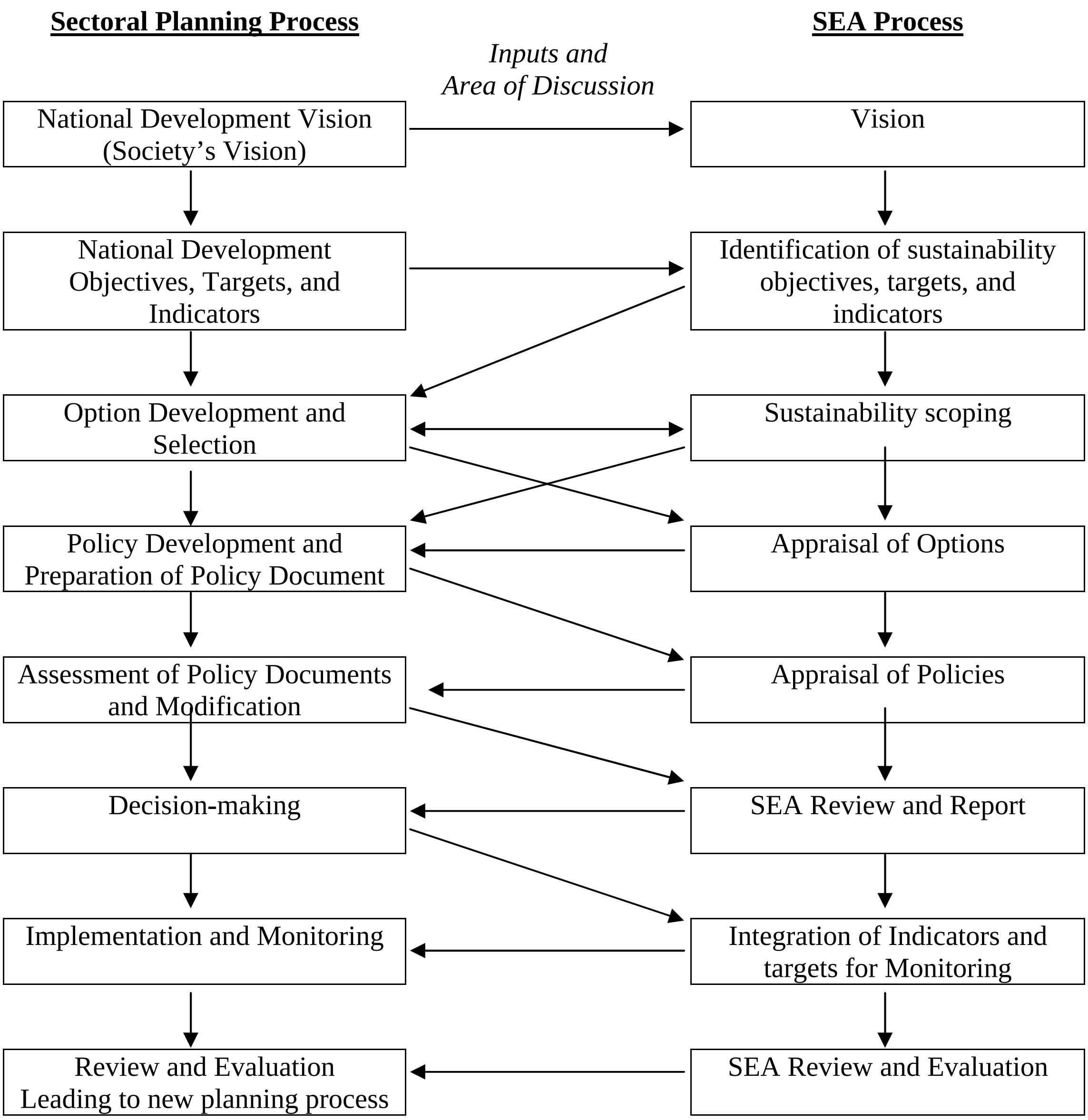


Figure 3.7 An Example of Interconnection Between SEA and Sectoral Planning Process, which can be applied to sustainable energy planning.

Source: Adapted from Partidario, 2003b.

3.4.2 SEA and Decision-making Processes

As mentioned in Chapter 1 and this chapter, the relationship between impact assessment and policy processes is crucial to the effectiveness of SEA contributions. Partadario summarizes the four models of relationship between SEA and decision-making processes, as shown in Figure 3.8 and discussed below[38].

- **Standard EIA-based model**. This model refers to the totally separate processes between SEA and decision-making. The connection between these two processes is only present when the SEA report is finalized and presented to decision-makers or stakeholders in the decision-making process. In practice, the main problem of this model is that the decision-makers do not pay enough attention to SEA report, because, normally, they already have a solution in their minds (or even in action). Moreover, submitting a report is also far from being a sufficient effort to encourage stakeholders to deliberately consider the issue and to take serious action.

- **Standard SEA parallel model**. The second model is still influenced from the standard EIA process, but with the attempt to have more interactions between SEA and the decision-making process. However, the interactions are basically determined by the perspective of the SEA process. In other words, this is an attempt to create a standard SEA process for all policy issues. The main problem is that, normally, each policy sector has its own policy process, style, and context. Thus, in reality, it is difficult to develop one standard SEA process which fits all.

- **Fully integrated model**. This third model is completely different from the first two models in the sense that it is fully integrated into the decision-making process. This is mainly because this model was first developed as a planning tool, not for an environmental protection procedure. Although, logically, this model can lead to better chances in influencing the decision-making process, it can oppositely raise a question about transparency and accountability, especially when it is done in very closed ways and decision-makers already have a solution in their minds.

- **Decision-centered model**. The last model was also first developed as a planning tool. However, unlike the previous model, the SEA process is not fully combined in the decision-making process. The distinction between these two processes is clear, but the individual SEA process is designed to fit and have a strong relationship with the decision-making process (which is opposite to the standard SEA parallel model). By this way, to design an effective SEA process, it is very important to analyze the decision-making process and search for critical points so that SEA can contribute some insights to the decision-making process. Thus, SEA is more likely to be a process of continuous communication which needs to be readjusted along the decision-making process. On one hand, in practice, this model provides flexibility for both SEA and decision-making processes. On the other hand, it can also be a quite complicated and demanding process.

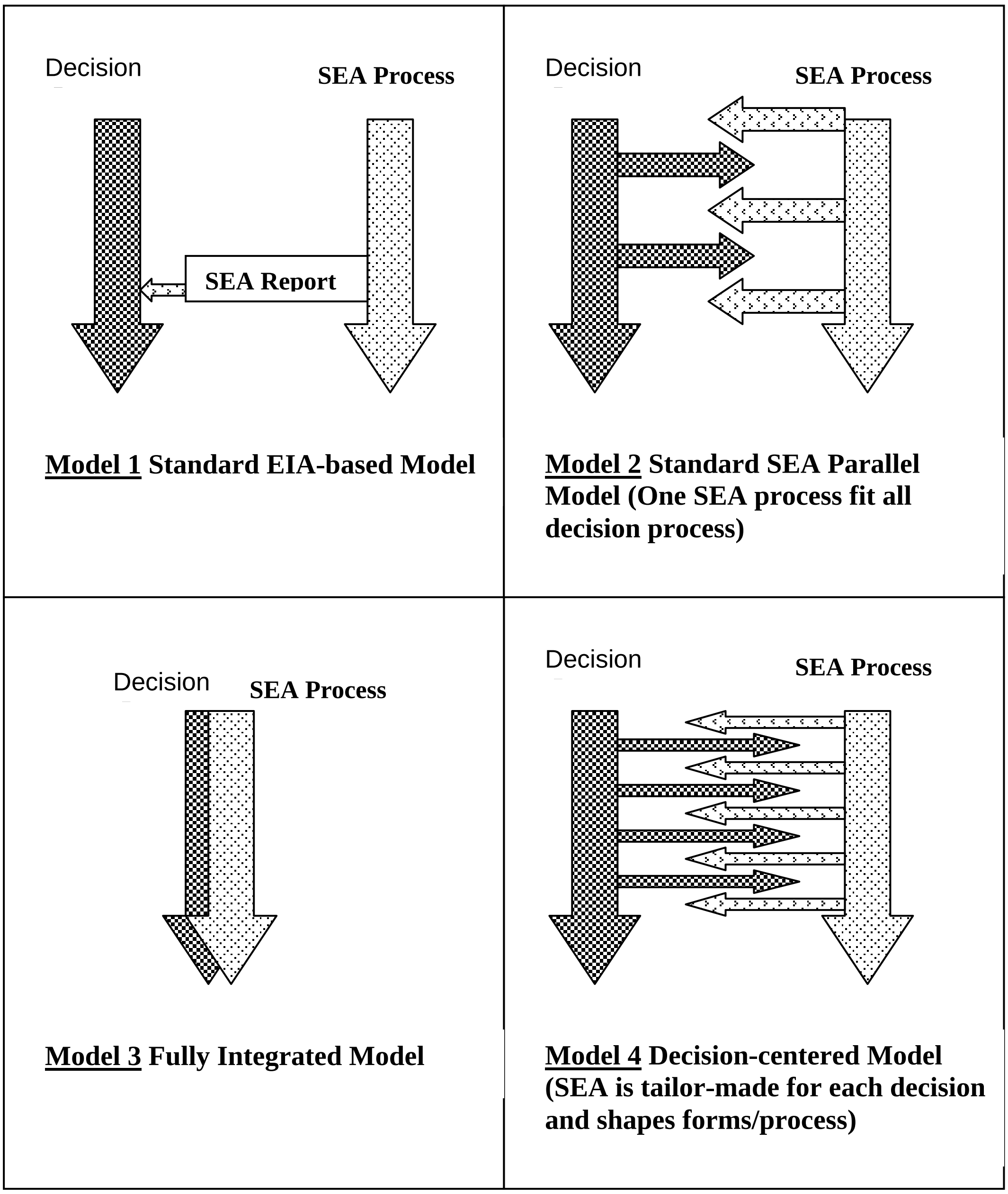


Figure 3.8 The Four Models of Relationship between SEA and the Decision-making Process

Source: Adapted from Partadario 2003[39]

3.4.3 The Applications to this study

In this study, SEA is mainly used for providing the essential information on strategic impacts of different policy options in the Thai power sector. In other words, it is part of the operational concepts of deliberative and innovatiave democracy, according to which the economic, environmental, social, and health consequences of a policy decision will be better realized and discussed within society. The detailed elaboration on how SEA will be applied in this study will be presented in Chapter 5, where the strategic impact analysis of this study will be comprehensively explained.

3.5 Institutional Analysis in Three Main Pillars

The concepts of feasibility study and public regulation for innovation emphasize the importance of institutional frameworks for public policy processes and the necessity to create new institutional frameworks to facilitate a radical technological development. However, this approach does not provide an insight into how institutional frameworks have been formed and firmed. Therefore, a framework for institutional analysis must be provided in order to understand how the changes may or may not occur at the institutional level.

Scott provides the insightful notion that regulative systems, normative systems, and cultural-cognitive systems are the vital ingredient of institutions[40]. According to Hoffman, “these three elements form a continuum moving from the conscious to unconscious, from the legal enforced to the take for granted”[41]. Therefore, it is possible to view these three elements “as contributing in interdependent and mutually reinforcing ways” to a powerful social framework[42].

3.5.1 Three Pillars of Institutions

According to Scott, the progress in institutional analysis can be made “by distinguishing among several component elements and identifying their different underlying assumptions, mechanisms, and indicators”[43]. Therefore, he suggests us to understand the differences of three pillars of institutions, namely regulative, normative, and cognitive pillars, as shown in Table 3.7.

- **Regulative Pillar**: Since institutions constrain and regularize behavior, the regulative pillar refers to the regulative aspect of institutions. In his concept, “regulatory processes involve the capacity to establish rules, inspect others’ conformity to them, and as necessary, manipulate sanctions –rewards or punishments- in an attempt to influence future behavior”. According to North, institutions consist of both formal written rules as well as typical unwritten codes of conduct that underlie and supplement formal rules[44]. The focus of the analysis at this level is how regulative institutions function and how they interact with other institutional elements[45].

- **Normative Pillar:** The emphasis of the normative pillar “is placed on normative rules that introduce a prescriptive, evaluative, and obligatory dimension into social life”[46]. Normative dimensions include both values and norms. Values refer to “conceptions of the preferred or the desirable, together with the construction of standards to which existing structures or behaviors can be compared and assessed”[47], while “norms specify how things should be done; they define legitimate means to pursue valued ends”[48]. Therefore, in Scott’s view, the normative pillar defines goals or objectives but also designates appropriate ways to pursue them. In other words, normative systems both impose constraints on social behavior and, at the same time, empower and enable social action[49]. Normative pillars confer “rights as well as responsibilities, privilege as well as duties, license as well as mandates”[50].

- **Cultural-cognitive pillar**: the centrality of the cultural-cognitive pillar is the constitution of social reality and the frames through which meaning is made[51]. In the cultural-cognitive dimension, every human institution is a sedimentation of meanings or a crystallization of meaning in objective form[52]. The cultural-cognitive dimension recognizes that internal interpretive processes are shaped by an external cultural framework. In this view, “compliance occurs in many circumstances because other types of behavior are inconceivable” and “the routines are followed because they are taken for granted as the way we do these things”[53]. Therefore, cultural-cognitive analysis focuses on the understanding of “cognitive containers in which social interests are defined and classified, argued, negotiated, and fought out”[54].

Table 3.7 Three Pillars of Institutions

Characteristics	**Pillar**		
	Regulative	**Normative**	**Cultural-Cognitive**
Basis of Compliances	Expedience	Social Obligation	Taken-for-grantedness Shared understanding
Basic of order	Regulative rules	Binding expectations	Constitutive schema
Mechanisms	Coercive	Normative	Mimetic
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules Laws Sanctions	Certifications Accreditation	Common belief Shared logic of action
Basis of legitimacy	Legally sanctioned	Morally governed	Comprehensible Recognizable Culturally Supported

Source: Scott, 2001. p.52.

3.5.2 The Application to this Study

This study found that the concept of three pillars of institutions is very useful for analyzing institutional frameworks in Chapter 7. The approach highlights the connection between the cognitive, normative and regulative levels, which provides a better understanding of the different existing and proposed institutions contested in the Thai power sector. In this view, different institutions will be analyzed in connection to their policy discourses (as a cognitive dimension), their normative judgments, and the existing and alternative rules and regulations, in Chapter 7.

3.6 Potentials for Sustainable Energy Solutions in Thailand

This section provides the overall picture of the potential of sustainable energy solutions in Thailand, the present situation, and the Thai government's target for renewable energy development. This section will be divided by each main renewable source, the overall picture, and the energy conservation, which can be part of healthier energy solutions in the Thai power sector.

3.6.1 Biomass Resources

Thailand has abundant biomass resources. Rice, sugar, palm oil, and wood-related industries constitute the main potential biomass energy resources. According to the Department of Alternative Energy Development and Energy Conservation (DEDE), an estimated 64.5 million tons of agricultural and wood residuals are produced each year in Thailand (Table 3.8). Presently, most of these residues are disposed of through open burning and dumping, except for bagasse, rice husk, fiber and shell of palm oil, and shell of coconut. In total, only 16 million tons (25% of total residues) is used for energy production, at the present. The remaining biomass resources, which can be used for energy purposes, is about 42 million tons, which equals 605 PJ or 2.5 times higher than the present biomass used for energy purposes. Later, DEDE also estimated the unused potential of all agricultural residuals, as shown in Table 3.9, and found that the overall resource potential of biomass is equal to 721,935.9 TJ or 9,630 MW in terms of electric power.

However, not all resource potentials are be commercially viable, especially with the regard to the difficulties in collecting agricultural residuals, such as leaf and top of sugar cane or rice straw, and their financial returns. Peter du Pont analyzes the commercial conditions of biomass resource utilization in Thailand and estimates that, within 2011, 2,463 MW of biomass resource will be commercial available. He also discounts this commercial potential by technological factor (25% lower) and institutional factor (50% lower) and concludes that 897 MW of new installed biomass power should be practically achievable during 2005-2011[55].

Now, only the sugar industry, the pulp and paper industry, rice mills, wood industries, and palm oil mills have invested in biomass cogeneration and power plants. The current installed capacity from 44 Small Power Producers (SPPs) and 5 Very Small Power Producers (VSPPs) reaches about 938.5 MW, of which 432.4 MW export excess electric power to the grid. Furthermore, other 260.2 MW of biomass power is now already contract signed and in the process of approving power purchasing contracts, which is expected to sell 167.9 MW of power to the grid in the coming years. Therefore, in the near future, biomass power will reach 1,200 MW installed capacity with 600 MW of power sold to the grid.

The Ministry of Energy expects the power generation potential of Biomass resources to be as high as 7,000 MW and sets up a clear target to stimulate biomass power generation up to 1,600 MW by 2011[56].

Table 3.8 Assessment of the Biomass Energy Potential of Agricultural Residuals in Thailand in 2000

Products and Production (Million Tons)		Residuals	Quantity (Thousand Tons)	Utilization Rate (%)		Quantity (Thousand Tons)		Energy (PJ)	
				Used	Unused	used	Unused	used	Unused
Sugarcane	53.5	Bagasse	15,567	79.3	20.7	12,344	3,222	177.76	46.40
		Leaf & Top	16,155	0.0	98.6	0	15,929	0.00	277.01
Rice	24.2	Rice husk	5,560	50.7	49.3	2,819	2,741	40.23	39.11
		Upper Straw	10,805	0.0	68.4	0	7,391	0.00	75.67
Palm oil	3.26	Empty Bunch	1,394	3.0	58.4	42	814	0.75	14.54
		Fiber	479	85.8	13.4	411	64	7.24	1.13
		Shell	160	58.8	3.7	94	6	1.76	0.11
		Leaf Stem	8,479	0.0	100.0	0	8,479	0.00	83.35
		Stamen Bunch	759	0.0	100.0	0	759	0.00	12.39
Coconut	1.40	Fiber	507	28.9	59.5	146	595	2.37	4.89
		Shell	224	41.3	37.8	93	85	1.69	1.52
		Bunch	69	14.4	84.3	10	58	0.15	0.89
		Leaf	315	15.9	80.9	50	255	0.80	4.08
Cassava	19.1	Stem	1,678	0.0	40.7	0	683	0.00	12.58
Maize	4.29	Corncob	1,170	19.3	67.0	226	784	4.08	14.14
Groundnut	0.14	Shell	45	0.0	100.0	0	45	0.00	0.56
Cotton	0.03	Stem	116	0.0	100.0	0	116	0.00	1.69
Soybean	0.32	Shell	849	0.7	76.0	6	646	0.12	12.55
Sorghum	0.14	Leaf, Stem	178	11.8	64.8	21	115	0.40	2.22
TOTAL RESIDUALS			64,509			16,262	42,494	237.31	604.82

Source: DEDE, 2003, *Alternative Energy Situation*. www.dede.go.th

Table 3.9 Assessment of Unused Biomass Energy Potential of Agricultural Residuals in Thailand in 2001/2002

Raw Material	Production (million ton)	Residuals	Quantity (million ton)	Calorific Value (MJ/Kg)	Energy (TJ)	Power (MW)
Sugarcane	60.013	Bagasse	3.616	14.40	52,056.04	764.21
		Leaf & Top	17.087	17.39	310,762.62	4,105.92
Rice	26.514	Rice husk	3.006	14.27	42,901.65	566.83
		Upper Straw	8.106	10.24	83,011.61	1,096.78
Palm Oil	4.089	Empty Bunch	1.002	17.86	18,253.88	241.18
		Fiber	0.081	17.62	1,419.21	18.75
		Shell	0.007	18.46	136.85	1.81
		Leaf Stem	10.648	9.83	104,667.44	1,382.91
		Stamen Bunch	0.953	16.33	15,558.20	205.56
Cassava	16.868	Stem	0.604	18.42	11,128.34	147.03
Maize	4.466	Corncob	0.816	18.04	14,736.44	194.71
Groundnut	0.129	Shell	0.042	12.66	527.50	6.97
Cotton	0.036	Stem	0.116	14.49	1,685.94	22.27
Soybean	0.292	Shell	0.591	19.44	11,488.51	151.79
Sorghum	0.145	Leaf, Stem	0.118	19.23	2,262.18	45.14
Wood	10.268	Wood residual	2.670	14.98	39,991.81	528.39
Total Residuals					***721,935.91***	***9,630.18***

Source: DEDE, 2003, *Alternative Energy Situation*. www.dede.go.th

3.6.2 Biogas Resources

Apart from solid biomass residues, waste water containing organic matters from livestock farms, landfill site, and agro-industries has increasingly been used for energy production. The biogas systems can be locally produced and installed by several techniques such as UASB and Fixed Film Technology. The production of biogas can alleviate not only the energy costs by substituting the on-site use of fuel oil, LPG, or electricity, but also the local water pollution problems[57].

DEDE estimates that the biogas production potential of three main sources, animal farm, landfill, and agro-industrials, equals 2,179 Mm^3/year (Table 3.10). If it is assumed that 1 m^3 of biogas can produce 1.2 kWh of electricity with 8 operation hours a day, the potential power generation would be around 900 MW. However, there are two important notes to keep in mind. First, in various cases, biogas energy is better used or should be used in other forms of energy, such as LPG on-site consumption. Second, if better biogas technology and waste management would be explored, instead of landfill biogas, the biogas potential would probably be much higher.

Another source of resource potential estimation is presented by David Donnelly, the general manager of Clean Energy Development Co, Ltd., (Clean THAI), a firm which develops and finances biogas system fuels by waste products from cassava-processing industries and pig farms. With the existing SPP's electricity purchasing price (detail in Chapter 7), the commercial potential of biogas exceeds 1,200 MW. It consists of 300 MW from cassava waste water, 900 MW from cassava wet cake (or a fibrous waste byproduct of tapioca production), 50 MW from pig farms, and 15 MW from palm oil factories[58].

Peter du Pont uses this estimation as commercially viable power by counting only the 365 MW biogas productions from cassava waste water, pig farms and palm oil factories, which have already been implemented in actual cases in Thailand. He also estimates that, from this commercial potential, 245 MW of biogas power plants should be practically achievable in 2011[59].

At present, a total capacity of 12.4 MW can be generated from 8 VSPPs and 3 Clean THAI biogas power plants. Recently, the Thai government has aimed to increase the power generation from biogas to 100 MW by 2011.

Table 3.10 Assessment of the Biogas Energy Potential of Waste in Thailand in 2000

Waste	Quantity	Biogas Production (mill. m^3 / year)	Energy (PJ)
1. **Animal waste** (dry manual thousand ton /year)	**2,886.55**	**559.54**	**11.75**
1.1 Cattle	1,015.10	238.91	5.01
1.2 Buffalo	441.63	96.95	2.04
1.3 Swine	879.95	134.67	2.83
1.4 Chicken	512.87	81.57	1.71
1.5 Others[1]	37.00	7.43	0.16
2. **Domestic Landfill Waste** (Thousand ton/year)	**11,842.24**	**1,184.00**	**23.09**
2.1 Greater Bangkok	2,832.58	283.26	5.52
2.2 Other Municipalities	3,656.30	365.63	7.13
2.3 Outside Municipal area	5,353.36	535.34	10.44
3. Agro-industrial Waste water (thousand m^3 / year)	**205,942.30**	**435.33**	**10.45**
3.1 Tapioca Starch Industry	55,005.09	166.27	3.99
3.2 Sugar Industry	76,203.54	89.37	2.15
3.3 Palm Oil Industry	3,256.00	67.72	1.63
3.4 Seafood Canning	17,385.37	47.30	1.14
3.5 Others[2]	54,092.30	64.67	1.55
4. Total Biogas Potential		**2,178.87**	**45.29**

Source: DEDE, 2003a, *Alternative Energy Situation*. www.dede.go.th

Note: 1. Others include Duck and Elephant

2. Others include frozen seafood Industry, slaughterhouses, pineapple canning industry, carbonated soft drink industry, beer and liquor industry, and milk industry.

3.6.3 Solar PV Energy

Thailand is endowed with solar energy all year long. For the whole country, the average energy from sunlight amounted to 18 MJ/m^2/day. Moreover, 14% of the country received the most intensive energy with the average of 20 MJ/m2/day. From April to May, most areas in Thailand received maximum energy from sunlight ranging from 20 to 24 MJ/m^2/day. Thus, the potential for exploiting solar energy in Thailand is considerable[60]. DEDE stresses that the power potential of solar PV energy can be as high as 5,000 MW. Peter du Pont estimates the practically achievable potential to be 100 MW in 2011[61].

Until now, only about 23.3 MW PV for stand-alone and grid-connected application have been reported. Most of these MW (95%) are found in remote areas and are off-grid, such as solar cell battery charging stations and PV pumping for village water supply.

In 2003, the Ministry of Energy has set up the target for 2011 of 250 MW installation of solar PV.

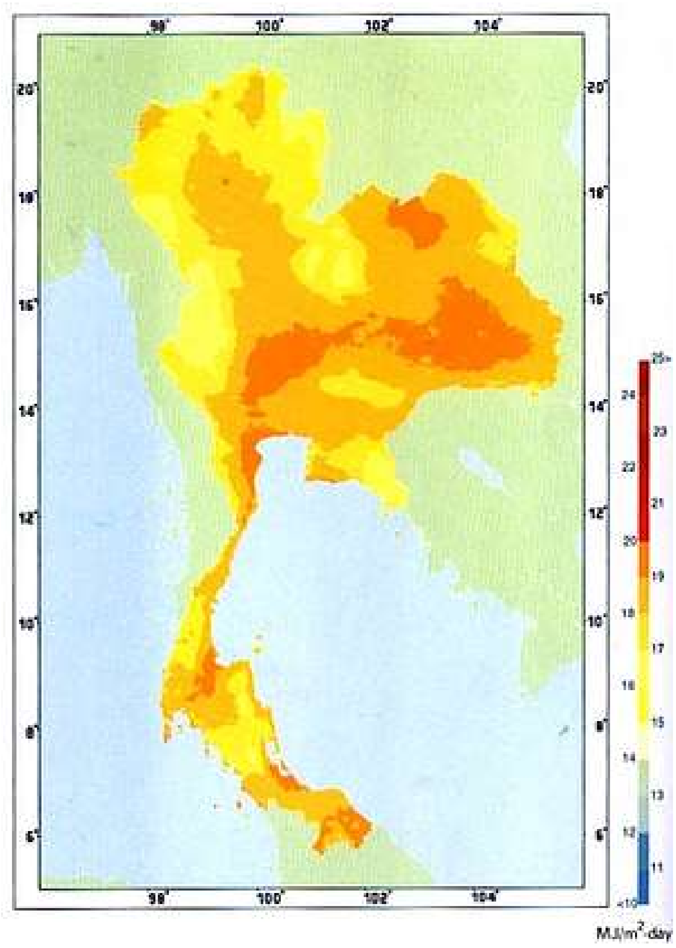


Figure 3.9 Solar Resource Map
Energy Intensity (MJ/m2-day)
Source: DEDE, 2006
http://www.dede.go.th/dede/index.php?id=222

3.6.4 Wind Energy

Thailand is not located in a windy area of the world. However, according to a report on wind resource assessment doned by DEDE in 2001, there are good wind areas with an annual average wind speed of 6.4 m/s or higher at 50 m height. These areas, around 7.4% of the country, are influenced by monsoons and are loacted along the eastern coastline of the southern part of Thailand and in the mountains of the western and southern regions of the country[62]. If the assumption of an average wind turbine density of 4 MW/km^2 is applied, all these areas could be converted into an area of 3,044 MW wind turbine capacity (Table 3.11). At the present, DEDE has recognized a wind power potential of 1,600 MW in Thailand[63].

Due to the limited areas of potential and associated high investment costs, so far, only 192 kw of electricity produced by wind turbines have been installed in the Phuket Province in the southern part of Thailand. Recently, the Thai government has stated that it expects to increase the power generation of wind turbines to 100 MW by 2011[64].

Table 3.11 Assessment of Wind Energy Potential in Thailand

Item	Wind Potential Characteristics				
	Poor (< 6 m/s)	Fair (6-7 m/s)	Good (7-8 m/s)	Very Good (8-9 m/s)	Excellent (> 9 m/s)
% of Total Land Area	92.60	7.20	0.20	0.00	0.00
Land Area (sq. km)	477,157	37,337	748	13	0
MW Potential	NA	(149, 348)	2,992	52	0

Source: Wind Energy Resource Atlas of Southeast Asia, Quoted by Thai Net Metering Project, 2004. www.netmeter.org

Note : For Large Wind Turbines Only. Potential MW assumes an average wind turbine density of 4 MW per square kilometer and no exclusion of parks, urban, or inaccessible areas. Wind speeds are for 65 m height in the predominant land cover with no obstruction.

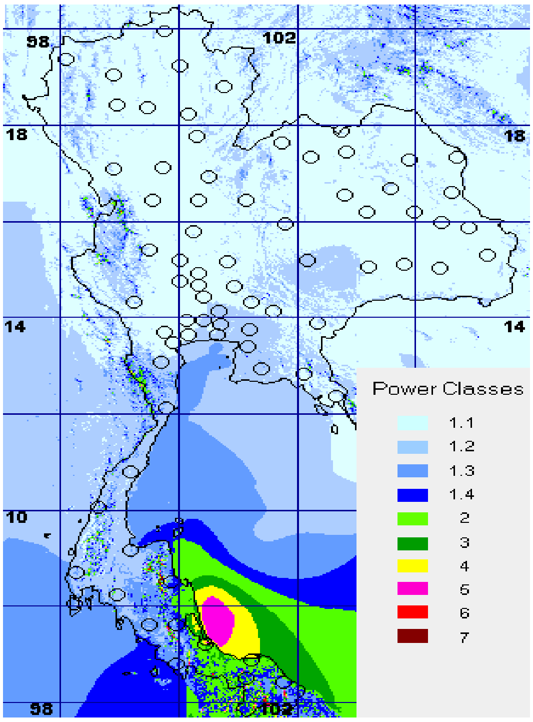


Figure 3.10 Wind Resource Map indicate the areas which have very good and good potential of wind energy in the southern part of Thailand
Source DEDE, 2006
http://www2.dede.go.th/dede/renew/Twm/main.htm

3.6.5 Small and Micro Hydro power

Since 1983, 59 micro-hydro power generators of a size below 200 kW have been installed in the rural communities, mainly in the northern part of Thailand, beyond the reach of the grid. Although the total installed capacity is approximately 2 MW, only half of this remains in service. The rest has fallen into disrepair or was abandoned when the electrical grid reached these villages. This is mainly due to the fact that in the past the villages were not allowed to connect their micro-hydro systems to the grid, forcing the villagers to choose either micro-hydro power or grid power[65]. Now, the Thai government hopes that the regulations for power purchasing from VSPP will encourage these communities to keep the micro-hydro power system and generate the revenue from selling power to the grid.

Apart from micro-hydro power generation, there is a number of small hydro power plants in the country, with the overall installed capacity of around 40 MW. In November 2004, the Royal Irrigation Department (RID) issued the results of the studies of production costs of electricity from small hydro power project in Thailand, planned by DEDE, by PEA, and by RID in some of the 6,000 irrigation dams in Thailand. In total, 728 projects are planned with the installed capacity of 369 MW. Of these 728 projects, electricity generation costs have been estimated for 100 projects (totalizing of 271.3 MW). The weighted average cost of these 100 projcts is 1.74 THB/kWh (see Table 3.12). According to du Pont, most of these 100 best projects should be commercially viable, operating as non-subsidised, non-firm SPP[66].

Overall, the Thai government plans to have 350 MW of small and micro-hydro power plants by 2011, which is about half of the 700 MW power generation potential estimated by DEDE[67].

Table 3.12 Planned Small Hydro Development by DEDE, RID, and PEA by 2010

Project Owners	**No. of projects**	**Power (MW)**	**Range of Production costs (THB/kWh)**	**Average production costs(THB/Kwh)**
DEDE (Feasibility study completed)	23	70.2	0.78-3.12	1.91
DEDE (Pre-feasibility study completed)	26	44.8	1.06-4.15	1.69
RID (medium size)	51	156.3	0.87-3.67	1.67
SUB TOTAL	100	271.3	0.78-4.15	1.74
DEDE (others)	72	19.29	n.a.	n.a.
RID (Small size)	550	20	n.a.	n.a.
PEA	6	38.67	n.a.	n.a.
TOTAL	728	369	n.a.	n.a.

Source: RID, 2004[68]

3.6.6 Overall Potential of Renewable Energy

Table 3.13 presents the overall picture of the renewable energy potential and targets from 5 major sources already discussed, plus geothermal source, of which Thailand has limited resource potential in the Northern part of the country. All together, the total power generation potential of renewable energy can be as high as 15,200 MW.

However, the present total capacity of all these energy sources is only 1,018.3 MW. In fact, only biomass resource can be developed on the commercial scale. Apart from biomass, the development of other renewable sources contributes only with 80 MW to the Thai power system.

The Thai government aims to resolve the situation of "high potential, low development" by setting up the target of renewable power generation in 2011. For the period of 2003-2011, the Thai government aims to reach 2,400 MW of renewable distributed generation, of which around 1,800 MW of new capacity have to be developed during this period.

Table 3.13 Resource and Power Generation Potential, Total Installed Power Capacity, Government's Target for Renewable Power Generation

Energy Technology	Resource Potential	Power gen. Potential[1] (MW)	Present capacity (MW)	Target (MW) 2011[2]
Biomass	842 PJ	7,000	938.5	1,600
Biogas	2,180 Mm^3 or 45 PJ	900[3]	12.4	100
Solar PV	18 MJ/ m^2/day	5,000	23.3	250
Wind Power	See Table3	1,600	0.2	100
Hydropower	N/A	700	43.6	350
Geothermal	N/A	N/A	0.3	10[4]
Total	N/A	15,200	1,018.3	2,410

Note & Source:

1 and 2 DEDE, 2003b. *Policy Concept for Sustainable Energy Development: One Tumbol One Megawatt*. www.dede.go.th

3. Include landfill biogas and Calculated by assuming power generation per biogas is 1.2 kWh/m^3 and operation time 2,920 hours/year

4. EGAT, 2003, *Fang Geothermal Power Plant.* www.egat.co.th/rdo/geothermal.html

3.6.7 Potential for Demand Side Management

Since 1991, Thailand has become the first Asian country to formally approve a country-wide demand-side management (DSM) plan. In 1992, Thailand also initiated a national energy conservation law, supplemented by financial incentives and an environmental conservation fund. In 1993, the DSM office was established as a department of EGAT and the program implementation began in 1995[69].

While the analysis showed a potential of 2,000-3,000 MW reduction of peak demand, the first five-year DSM plan (1993-1997) aimed to avoid a demand of 1,080 GWh annually and 225 MW, respectively. Until June 2001, the DSM program had achieved a peak demand reduction of 638 MW and an energy reduction of 3,589 GWh, annually. On average, the costs of peak demand saving was 2,404 THB/kW and the cost of energy saving was 0.5 THB/kWh. The current DSM plan of EGAT (2002-2006) also aims to achieve a peak demand reduction of 632 MW and an energy reduction of 2,508 GWh, annually[70].

Although the previous experience of DSM in Thailand is impressive, obviously, the current target is still moderate especially compared to the estimated DSM potential. Moreover, the long-term plan and financial support to DSM after 2006 is still unclear.

In 2005, Peter du Pont estimated an economic potential of DSM in Thailand and found that the total economic potential of DSM in 2011 is 2,459 MW in peak demand reduction and 15,820 GWh in energy saving with the average cost of 0.92 THB/kWh. More than 60% of the total potential is DSM in the industrial sector (Table 3.14). He suggests that, if the implementation capacities of government agencies were taken into account, 2,207 MW in peak demand saving and 11,181 GWh in energy saving should be achieved by 2011[71].

Based on this information, DSM can be one of the important sustainable energy options for the Thai power sector, both in terms of its potentials and cost effectiveness.

Table 3.14 Economic Potential of DSM in Thailand by Sector in 2011

Sector	Saving in GWh	Saving in MW
Industry	9,687	1,499
Commercial	3,431	537
Residential	2,702	423
TOTAL	**15,820**	**2,459**

Source: Du Pont, 2005[72].

3.7 The Present Situation of Sustainable Energy Development

The last section of this chapter provides information on the present situation of sustainable energy development in Thailand. The objective of this part is to show that several sustainable energy solutions have actually been developed in Thailand for a number of years. In other words, the quest for a sustainable energy future in Thailand is not based on a dream, but on real action.

3.7.1 Present Renewable Power Producers

Presently, there are five main groups of renewable power producers in Thailand, as explained below;

- **Firm SPP**s are renewable energy producers, who account for less than 90 MW of the power sold to the grid and have to meet the following criteria: a) to generate electricity 4,670 hours/year, b) to include March, April, May and June (the peak period in Thailand), c) to have monthly capacity factors from 0.51 to 1.00, and d) to set their maintenance shut down during off-peak months with the maximum of 35 days in a 12 month cycle. The payment to firm SPPs includes the monthly capacity or availability payment (in THB/kW/month) and energy payment (in THB/kWh), which are based on EGAT's long-run avoided capacity and energy costs[73]
- **Non Firm SPPs** are normally those who fail to meet the criteria for firm SPPs. Therefore, due to the EGAT criteria, they can only get an energy payment based on EGAT's short-run avoided energy costs[74]. Normally, the payment they get is much lower than the one which firm SPPs receive (discussed in detail in Chapter 7).
- **VSPPs** are renewable power producers with less than 1 MW capacity sold to the grid, which, due to their smaller size, have great difficulties in applying for firm or non-firm SPPs. The VSPP pricing scheme is similar to the net metering system in the USA, where the excess capacity generated by renewable producers will spin the existing customer's electricity meters backwards and bank it until it is needed by the customers. In Thailand, in the case of excess generation, the payment will be based on EGAT's wholesale Time of Use (TOU) rate (including Ft or fuel adjustment tariff)[75].
- **EGAT Own Projects** include several renewable power generation projects invested and run by EGAT, such as the solar PV project in Mae Hong Son, the Geothermal project in Chiang Mai, or the wind energy in Phuket.
- **Other Producers** include renewable power generation invested by PEA (normally solar PV in the remote area), DEDE (both solar PV in the remote area and micro-hydro power in the mountainous area), and some private projects (such as biogas plants), which do not sell power to the grid (thus, they are not part of VSPPs or SPPs).

3.7.2 Present Power Generation Capacity

Table 3.15 presents the overall power generation capacity of renewable energy in Thailand. Presently, in Thailand, the installed capacity of renewable energy is 1,018.3 MW at present. Of these, 480.7 MW of power capacity is sold to the grid. Most of the existing installed capacity (938.5 MW or 92.1%) is biomass power generation. The second largest renewable source is micro-hydro power with 43.6 MW installed capacity. In terms of power producer types, more than half of the installed capacity comes from non-firm SPP (571.2 MW). However, in terms of power sold, firm SPPs constitute the largest renewable energy type with more than 50% (244.2 MW) of the overall power sold produced by renewable energy.

Apart from the existing producers, there are several renewable energy projects, which already have a signed contract or are currently in the approval process. All together, these newcomers will be expected to contribute with 274.5 MW of installed capacity, with 173.4 MW power sold, to the Thai power system. The majority of these newcomers are still biomass energy and non-firm SPP. Combined with the existing renewable power producers, the overall installed capacity is likely to reach 1,300 MW, with more than 650 MW of power sold to the grid. However, of these figures, nearly 1,200 MW of installed capacity will be based on biomass energy.

Interestingly, half of today's installed capacity and power sold to the grid has been developed in the last three years, as shown in Figure 3.11. In 2001, the total installed capacity of renewable power generation was only around 320 MW, before being expanded to around 650 MW in 2003 and beyond 1,000 MW today. As earlier mentioned, the fast growing trend is more likely to continue in the coming years. The explanations of this fast growing development will be discussed in Chapters 4 and 7.

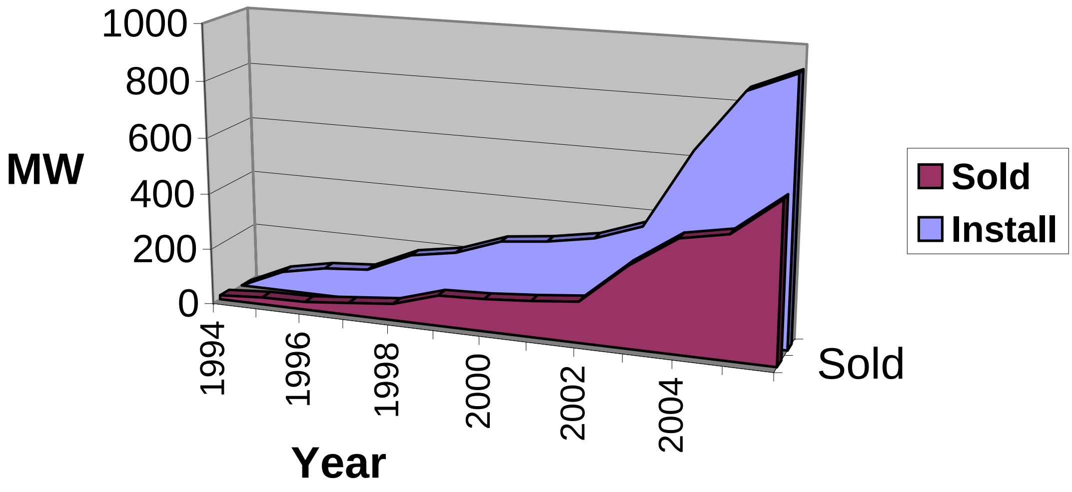
Apart from renewable energy generation, DSM has also been implemented in Thailand as earlier mentioned. The latest evaluation in June 2001 showed that DSM in Thailand's DSM program had reached a peak demand reduction of 638 MW and an energy reduction of 3,589 GWh, annually. Combining the DSM achievement with the present renewable energy generation capacity, the total capacity of sustainable energy solutions in Thailand is likely to reach 2,000 MW within the near future.

Table 3.15 Present Renewable Generation by Installed Capacity and Power Sold to the Grid

Types of RE Project	Installed Capacity						Power Sold to the Grid					
	Biomass	Biogas	PV	Micro-hydro	Wind& Geo	All RES	Biomass	Biogas	PV	Micro-hydro	Wind& Geo	All RES
Already Sold to the Grid or to Users												
Firm SPP	357.2	-	-	-	-	357.2	244.2	-	-	-	-	244.2
Non-Firm SPP	571.2	-	-	-	-	571.2	184.3	-	-	-	-	184.3
VSPP	10.1	5.4	0.5	-	-	16.0	3.9	3.3	0.5	-	-	7.7
EGAT	-	-	0.5	-	0.5	1.0	-	-	0.5	-	0.5	1.0
Others	-	7.0	22.2	43.6	-	72.9	-	-	-	43.6	-	43.6
Total	938.5	12.4	23.3	43.6	0.5	1,018.3	432.4	3.3	1.0	43.6	0.5	480.7
Only Contract Signed & In Process												
Firm SPP	81.3	-	-	-	-	81.3	61.8	-	-	-	-	61.8
Non-Firm SPP	175.7	-	-	6.7	-	182.4	104.3	-	-	-	-	104.3
VSPP	3.2	7.5	0.1	-	-	10.8	1.8	5.5	0.1	-	-	7.3
EGAT	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	-
Total	260.2	7.5	0.1	6.7	-	274.5	167.9	5.5	0.1	-	-	173.4
Overall RE Projects												
Firm SPP	438.5	-	-	-	-	438.5	306.0	-	-	-	-	306.0
Non-Firm SPP	746.9	-	-	6.7	-	753.6	288.6	-	-	-	-	288.6
VSPP	13.4	12.9	0.6	-	-	26.9	5.6	8.8	0.6	-	-	15.0
EGAT	-	-	0.5	-	0.5	1.0	-	-	0.5	-	0.5	1.0
Others	-	7.0	22.2	43.6	-	72.9	-	-	-	43.6	-	43.6
Total	1,198.8	19.9	23.4	50.3	0.5	1,292.8	600.2	8.8	1.1	43.6	0.5	654.2

Source: Compiled from EPPO, 2006[76].

Figure 3.11 Installed Capacity and Power Sold to the Grid by Renewable SPPs



Source: Compiled from EPPO, 2006[77].

3.7.3 Present Generation Costs

Table 3.16 presents the existing generation costs of renewable energy technologies. Although the calculations of generation costs of three references vary due to assumptions used on plant factor, investment cost, and fuel cost, to some extent, it still provides a good overview of the economic potentials and possibilities of renewable energy development in Thailand.

Notably, based on this cost estimation, biomass and biogas are quite competitive renewable options, especially when compared to 1.93 THB/kWh of present marginal costs at the low voltage line, where most of renewable power generations are connected. This is certainly part of the reason why biomass energy has been growing so fast in these recent years. It is also highly foreseeable that biogas energy will follow the same pattern in the coming years.

Micro-hydro power is, in fact, also competitive, though its generation cost depends very much on its location. However, the problem with micro-hydro, compared to biomass and biogas, is the investment possibility, since most of the potential resources belong to the royal irrigation department and local communities. If we can turn this limitation around by providing supportive investment scheme, it can also be a good opportunity for local communities to participate more meaningfully in the Thai power system.

Obviously, in the Thai context, wind and solar PV energy are still expensive options for the Thai power sector, though, as already mentioned in the beginning of this chapter, it provides the best outcomes in a human health perspective.

Apart from renewable energy, DSM is also an economically attractive option for the Thai power sector. From the latest evaluation in June 2001, the average costs of DSM peak demand saving was 2,404 THB/kW and the cost of energy saving is 0.5 THB/kWh. For the near future (up to 2011), the average cost of DSM's energy saving is estimated to be 0.92 THB/kWh[78].

Based on the high resource potentials, the existing power capacity, the fast growing trend, and the competitive investment options, it is likely to conclude that renewable energy and DSM can really be a policy option for health public policy in the Thai power sector.

Table 3.16 Recent Cost Estimations of Renewable Power Generation (unit: THB/kWh)

Renewable Energy	E for E (2004)	Du Pont (2005)	EGAT (2003)
Biomass	1.81	1.74-1.85	2.63
Biogas	-	1.54-1.80	-
Municipal Waste	-	-	5.12
Micro-hydro	2.13	1.74	-
Wind	4.59	5.20	7.32
Solar PV	10.74	10.10	21.36
DSM	-	0.92	-

Source: E for E (2003)[79], du Pont (2005)[80], and EGAT (2003)[81]

3.8 Conclusion

The information in this chapter shows that health and energy have linked together in several aspects and levels. Obviously, sustainable energy, such as renewable energy and energy conservation, can significantly reduce the negative health impacts of fossil fuel-based power generation, and can therefore provide healthier solutions in a healthy public policy perspective.

Unfortunately, the conventional assessments, like cost-benefit analysis and EIA, do not pay enough attention to health and energy linkages and, consequently, they do not take the actual advantages of these healthy policy solutions into account. Therefore, the alternative frameworks are required to overcome this hindrance.

In this chapter, the feasibility and public regulation for innovation, strategic environmental assessment, and institutional analysis have been introduced. The core notions of these alternative assessments are to look beyond a) the present market and governmental decisions to understand the influential institutional frameworks behind them, b) the specific consequences at project levels to foresee strategic impacts at the policy level, and c) the existing regulative frameworks to realize underlying values, norms, and cultural-cognitive frameworks behind them. The insights from these frameworks will be applied in a) understanding the policy process of the Thai power sector in Chapter 4, b) identifying strategic impact assessment framework in Chapters 5 and 6, and c) analyzing present institutional framework and public regulations in the Thai power sector in Chapter 7.

Last, apart from energy and health linkages and alternative assessment frameworks, this chapter also provides the clear picture of the overall potentials of these sustainable energy solutions in Thailand as well as their current statuses. In short, Thailand has both potential and experiences in sustainable energy development. Most of these sustainable energy solutions are also economically viable. Therefore, these sustainable energy developments or, in healthy public policy perspective, these healthier solutions can certainly be possible policy options for the Thai power sector. Moreover, to facilitate deliberative and innovative democracy, these policy options need to be compared, in various aspects, with the existing policy directions and search for opportunities for desirable policy changes, as later shown in the remaining chapters.

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Chapter 4
Historical Development and Policy Discourse Analysis of the Thai Power Sector

This chapter takes history as a point of departure in deliberative policy analysis. The main idea is to understand how different policy discourses have been developed and evolved in the dynamic socio-political contexts. In the historical development analysis, the development and interactions of different actors within the Thai power sector will be divided into six main periods. In each period, the driving forces of policy, both internationally and domestically, will be analyzed. Then, the general situation of energy policy will be summarized and followed by information on the important actions and interactions between different policy actors, before a short conclusion will be provided of each period.

After the historical development analysis, the structure of the Thai power sector and the evolution of policy processes in the Thai power sector will be summarized. From this evolution, it is clear that policy processes in the Thai power sector have become much more complex due to policy negotiation, public resistance, and public deliberation. From the analysis, it is obvious that, in the Thai power sector, policy contestation has been intensified by different policy discourses. In this study, four policy discourses have been identified and explained. At the end, the comparison between different policy discourses is provided. To analyze different impacts of different policy directions, the differences of these four policy discourses will constitute a point of departure for the strategic impact assessment in Chapters 5 and 6.

4.1 Before the National Development Plan (From 1855-1956)

Before the end of the nineteenth century, Thailand initially adopted modern energy systems. It was a period when King Chulalongkorn had to struggle against western colonialism. There were three main strategies for this struggling. The first strategy was to develop the Siamese Nation State with a high degree of centralization. Second, the politics of being a neutral buffer state between French and British colonial states was effectively applied. Last, to be a civilized country, modernizing the country had been planned.

In this period, the development of modern energy can be seen in three main ways. First, as seen in the railway system, energy was one of the main mechanisms and symbols of national consolidation. Second, energy was used for expanding the potential and capacity of economic initiatives and trade activities. The steam engine was applied to the rice milling industry (started in 1858), leading to big expansion in rice export. Last, it was clear that the investment in two power plants (started in 1898), the electric tram system, and the introduction of the car (in 1904) gave the opportunities for elite groups in Bangkok to enjoy new western lifestyle and, therefore, energy became a symbol of modern living[1].

After World War I, the development path told a completely different story. The expansion of modern energy systems was stunted by political and economic instability around the world. The recession of rice export and the deficit in the government budget limited the potential of the Thai government to continue investing in energy facilities. It was clear in the power sector that, apart from the two power plants mentioned above, there was no more investment in big power stations, only in the small decentralized power plants owned by local private investors in some cities, towns, factories, and mines.

After World War II, Bangkok was in crisis of power shortage. The Thai government tried to solve this problem by establishing state-owned enterprises, such as the Bangkok Electricity Authority or the Lignite Authority, and uniting electricity services. However, limited foreign investment and aid as well as economic hardship inhibited the opportunities for a significant improvement of the Thai power sector.

In this period, the Thai civil society sector still had a quite limited role. The change from monarchy to democratic system had just begun in 1932, followed by a number of military force interruptions. Probably, the modernizing state in itself was not yet the question for Thai civil society at that time. Therefore, main contributions from the civil society sector to energy policy were hardly seen in this long period of time.

Table 4.1 Historical Events of the Power Sector Development and Policies in Thailand during the Period Before the National Development Plan (1884-1954)

Time Period	Historical Events
1884	The first power generator in Thailand was in operation and provided the royal palace in Bangkok with light
1898	The Danish company, Siam Electric Co., Ltd., was established and received concession for electricity generation and distribution in Bangkok with the steam turbine engine power plant (normally called the Wat Leab power plant), fuelled by fuel wood, coal, oil, and rice husk.
1912	The new power plant (normally referred to as the Sam Sen power plant) was built and operated two years after with the responsibility to supply electricity to the northern part of Bangkok.
1927	Ratchaburi municipality operated and sold electricity for the first time outside Bangkok.
1929	The Electricity Division was set up within the Ministry of Interior to take care of the expansion of electricity service areas outside Bangkok.
1945	During World War II, the Wat Leab and Sam Sen power plants were heavily affected by bombing, leading to the great electricity shortage in Bangkok.
1948	The Thai government introduced the "Power Development Plan and System in Thailand" to overcome the electricity shortage problem.
1950	The Thai government set up the state-owned enterprise, Bangkok Electricity Authority, to operate the Wat Leab Power Plant after the end of concession .
1953	The Thai government established the "National Energy Authority" for national energy policy and planning.
1954	The Lignite Electricity Organization was set up to operate the Mae Moh lignite mining in Lampang (the North of Thailand) and another lignite mining in Krabi (the South of Thailand)
1954	The Provincial Electricity Organization was founded as a state-owned enterprise to expand electricity services outside Bangkok and to take over the electricity companies from the private sector.

Source: Compiled from Ministry of Energy, 2004[2].

It is clearly seen that, during this long period, the policy capacity of the energy sector did not develop much, neither in the state nor the civil society sector. Energy investment was still highly subjected to external forces, without its own trajectories. Possibly, the main outcome of this era, which would affect the formation of the energy sector and policy in later periods, is the establishment of the centralized government system and the creation of national, economic, and modernized symbols of the modern energy system.

4.2 Modernization and National Development Plan (1957-1972)

a) Modernization Driving Force

This is the period in which the existing Thai power system was first developed as an individual policy sector. The structure of the Thai energy systems was developed as a part of the National Development Plan. Both the National Development Plan and energy policy were highly and explicitly influenced by the Modernization theory, as a manifesto for non-communist countries in the Cold War era. Especially, since Thailand became one of the strategic points for anti-Communist strategy in the Indo-Chinese war, the international support in various forms to the modernization of the country was enormous. Between 1958 and 1967, Thailand received 321.4 million USD in economic aid and 379.5 million USD in military aid from the US, which was a significant addition compared to the about 200 million USD of the Thai annual budget[3].

The starting point of the modernization period in Thailand can be recognized as the coup d' etat by Field Marshall Sarit Thanarat in 1957. The nationalist policy of Field Marshall's Pibulsongkram government was substituted by the modernization policy of the new government, with the support from the US government and the World Bank. The first National Development Plan was developed through the technical support from the World Bank. Various economic planning and policy organizations were established[4].

According to the First National Development plan, the main national agenda was to establish modern economic sectors by transferring economic surplus from the agricultural sector and investing in developmental infrastructures by government, with international financial and technical supports. Another main economic policy was the infrastructure development, described by the Thai slogan "*nam lai, fai sawang, tang dee*" (water flows, light shines, and good road)[5]. The plan was very successful in promoting agricultural commodification and export. The industrial, commercial and urban sectors were rapidly developed with a high degree of economic protection and subsidies. Unsurprisingly, in this period, the annual economic growth was generally high.

b) Establishment of the Centralized Power System

The development of energy systems, of course, was the main component of infrastructure development within the National Development Plan. In the power sector, during the period of 1960-1969, several new power plants were built all over the country to keep pace with the rapid demand growth (see Table 4.2 for detail). The total installed capacity was increased dramatically together with the expansion of the nation-wide transmission system[6].

Three state-owned enterprise models, recommended by the World Bank, were applied to take care of this mission. The establishment and reorganization of new state-owned enterprises were carried out throughout the period (see Table 4.2 for detail). Finally, in 1969, The Electricity Generation Authority of Thailand (EGAT) was established to take care of power generation, transmission systems and supply electricity to the Municipal Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) for distribution and services to Thai consumers in Greater Bangkok and the rest of Thailand, respectively. Like other governance systems in the country, the power sector in Thailand was initially developed as a highly centralized system[7]. All these state-owned enterprises, especially EGAT, assumed all responsibilities of policy, planning, operation, and regulation.

It should also be noted that, according to the World Bank model of state-owned enterprise, the good state-owned enterprise should not be under the control or intervention of politics and government. As explained by Mr. Kasem Jatikawanich, the founding governor of EGAT[8],

> *"It was the first time in history when we had a state-owned enterprise (i.e. EGAT) with its own Act. The Act was very strong and did not allow politicians to involve in EGAT administration. Absolutely no political involvement is the heart of EGAT. Even the appointed executive board could not be changed, except in case of death, resignation, and corruption. Apart from these, the board cannot be touched. After we did this, we can borrow 65 million USD from the World Bank for constructing the Yanhee hydro power dam".*

It was almost the ideal period of modernization, since the expansion of energy generation and consumption did not face any crucial resistance or limitations. The cheap oil, the external available financial resources, the high economic growth, and unseen (or unforeseen) environmental and social consequences allowed the energy systems to expand without any anticipated limits. The annual growth rate of energy consumption was around 20 percent during this period. Before the end of the period, the total peak demand for electricity was, for the first time, above 1,000 MW[9].

Therefore, energy planning in this period was really a matter of "predict and provide". The main method of planning in the power sector was a techno-economic perspective. The most important criterion for planning is the system reliability, or, in other words, to ensure enough power to be supplied to the demand at all time. In Mr. Kasem Jatikawanich's own words[10],

> *"The profound testament of EGAT people is* ***no shortage*** *(of electricity). We are always taught that there is no electricity as expensive than no electricity. No electricity is the most expensive one."*

Environmental and some socio-economic parameters were still far from being essential issues in power planning. To support rapid economic growth, available imported technology and fuels were adopted. At the end of this period, about 75% of the energy in power sector depended on imported oil and the rest came from large hydro power plants[11].

Table 4.2 Historical Events of the Power Sector Development and Policies in Thailand during the Modernization and National Development Plan (1957-1972)

Time Period	Historical Events
1957	The Yanhee Electricity Company was established to provide electricity services in the North and Central regions, including to develop the first two large modern power plant projects, namely the Northern Bangkok Power Plant and the Bhumibol Hydro power Dam (previously called the Yanhee Dam)
1958	The Bangkok Electricity Authority (operating the Wat Leab Power Plant) and the Sam Sen Electricity Authority (operating the Sam Sen Power Plant) were united into the Metropolitan Electricity Authority (MEA) providing electricity services in Bangkok and its vicinity.
1960	The Provincial Electricity Organization was changed into the Provincial Electricity Authority (PEA) with the responsibility for electricity services outside Bangkok.
1960	The Lignite Electricity Organization was changed into the Lignite Authority and the first lignite power plant in Lampang, with an installed capacity of 13.5 MW, was firstly operated and the construction of another lignite power plant in Krabi was begun.
1961	The Northern Bangkok Power Plant, with 75 MW installed capacity, firstly supplied electricity to Bangkok through MEA and became the largest power plant in the country at that time.
1962	The North-Eastern Electricity Authority was founded to provide electricity service in the northeastern Thailand.
1964	The Bhumibol Hydro power plant, with 70 MW installed capacity, firstly generated electricity to the North and Central regions. At the same time, the Krabi lignite power plant began its operation to supply electricity to the south of Thailand
1966	The Ubonrattana Hydro power dam was operated to supply electricity to the northeastern Thailand
1968	The high-voltage transmission line between Thai-Laos and the Nong khai province?? was firstly connected.
1969	The three state-owned enterprises, namely theLignite Authority, the Yanhee Electricity Authority and the North-Eastern Electricity Authority, were united into the Electricity Generating Authority of Thailand (EGAT) to take full responsibility and control over the electricity generation and transmission in the country.
1971	The Southern Bangkok Power Plant was, for the first time, operated with an installed capacity of 200 MW.

Source: Compiled from Ministry of Energy, 2004[12].

c) Emergence of Thai Civil Society

Thai civil society has gradually, but crucially, emerged during this period. Over two decades of authoritarian governments, Thai civil society increasingly demanded for a “better governance system”which recognizes and assures people’s rights, as well as, allows and facilitates the participation of the Thai people. The Thai democratic movement was begun by intellectuals and student activists in the late 1960s. However, the main focus of the movement was on the political systems and ideologies, rather than on development and environmental issues.

It is very important to note that, during this period, the concept of “development” as a “national progress” was very popular and less questionable in Thai society. The word “development” still generally meant something good for Thai people. The official request to “sacrifice for national development” could be raised without any strong resistance or even critical questions in the Thai public. In other words, the awareness of environmental degradation or, in a more political connotation, environmental exploitation was not clearly seen at this moment. However, the spirit of assuring people rights and meaningful participation within this democratic movement is certainly one of the core values of and also main contribution to the upcoming environmental movement in Thailand in the next period.

d) Conclusion

The favorable economic and political situation and problems which were still unforeseen made the development and planning process seem very optimistic. In this period, the energy policy capacity was initially established and developed on the basis of a centralized state system, ready-made imported technology, and techno-economic imported expertise. The notion of “national development” as national progress was very powerful. “Energy” itself also maintained its symbolic characters of “national development”, “economic expansion” and “modernized society”. In short, it was the perfect formation period for the existing dominating power within the Thai power sector.

4.3 Period of Political and Oil Crisis (1973-1986)

a) Crisis and Security Driving Forces

Just like a wave, the political and economic situation, both at the international and the national level, led Thai society into a difficult period. At the international level, the oil crisis in 1973/74 and again in 1980/81 caused economic problems to the Thai energy systems, which were previously based on cheap imported oil. Thailand’s oil import share had increased drastically from 10% to 30% of its total import. At the national level, under the situation of higher oil prices and higher military expenditures, the economic burden, in terms of the balance of payment, had undoubtedly increased, followed by high inflation and economic decline.

Moreover, the series of political conflicts within the country made Thai society unstable for more than a decade. First, it began with the October revolution in 1973 by the democratic movement mentioned above, leading to the new constitution and general election in 1975. However, in 1976, the military forces took over government again with an insurrection of bloodshed. Many intellectuals and student activists were forced to join the Communist Party of Thailand (CPT) in fighting against the Thai government. It was the strongest period of Thai communist movement. However, it did not last long. By 1981, the conflicts within CPT and the changes in the Thai-Chinese relationship had weakened the CPT and the party collapsed in the late 1980s.

b) Coping Strategy of the Thai Power Sector

Certainly, Thai energy policy had to cope with this tough situation. Thailand's coping strategies can be seen in four main ways. First, the Thai government aimed to reduce the oil import burden by focusing on domestic resources. The installed capacity of the Mae moh Lignite power plant, in Lampang, was increased from 150 MW in 1973 to 1,125 MW in 1989, leading to heavy air pollution problems and mining-related problems around the area, up to now. The hydro power plants still played an important role in the Thai power system. Then, in 1981, Thailand had successfully discovered its own natural gas in the Gulf of Thailand (see also Table 4.3). With all these attempts, at the end of this period, the share of oil in fuel used for power generation was reduced significantly from 75% to 20%. However, it is also obvious that the Thai power sector has still, and possibly more, firmly relied on large-scale and fossil-based technology.

Second, due to the increasing oil prices and thereby increasing electricity tariffs, Thai government had to face a high inflation problem, together with a high unemployment rate caused by economic recession. In this period, the oil price became one of the most influential "political indexes". In 1980, Prime Minister General Kriangsak had to resign from his positions since the parliament disagreed on his policy to increase oil taxes. Politically, the new Prime Minister, General Prem, had to decrease oil taxes and use the oil taxes fund to subsidy for lower electricity tariffs and retailed diesel prices. Even with the state subsidy, electricity tariffs increased four times during 1975-1981. The subsidy was abandoned in 1986, after the continuous reduction in the world oil prices. Therefore, the "compromising" mode of policy style forced the Thai government to avoid using pricing policy to reduce its import burden[13].

Third, the Thai government thus inevitably had to control electricity consumption by other means, especially, during the special dry period in 1979/80, when the water storage level in two large hydro power dams was historically low. The government initiated both voluntary programs and compulsory measures (for example, limiting service time for entertainment business, petrol station, and TV broadcasting). The famous slogan in this period was "*namman kadklan kuikubfan kortongdubfai*" (due to oil shortage, please switch off the light when talking with your lover).

Because of economic recession and strict demand side management measures, the annual energy growth rate was only about 5% during this period. Unfortunately, after this crisis and new economic booming, these demand side management measures were totally abandoned and became "the bitter story" of the Thai public. Moreover, in later periods, the Thai government also used this bitter story as a counter-argument against opposition groups in pursuing its power expansion projects

Last, like other oil-importing countries, during this period, the Thai government invested in the development of renewable technology as an alternative energy source. Regional centers for renewable energy development were established in all regions in Thailand. Various renewable energy projects, mainly with international support, were implemented all over the country. Solar PV, biogas plants, and efficient cooking stoves were quite popular by the beginning of the 1980s. However, without an appropriate technological adaptation process and a proper maintenance program, few years later, most of these energy projects became one of the monuments of unsuccessful experiences in many local Thai villages.

Table 4.3 Historical Events of the Power Sector Development and Policies in Thailand during the Political and Oil Crisis (1973-1986)

Time Period	Historical Events
1973	The first oil crisis hit the country leading to a sharp increasing of the trade deficit and generating costs of electricity.
1975-1981	The electricity tariff was raised four times in 1975, 1977, 1980, 1981.
1979-1981	The founding governor of EGAT became the Minister of Industry in the Prem Government
1980-1981	The strict demand side management measures were implemented to cope with high oil prices and low water levels in the two largest hydro power dams (Bhumibol and Sirikit Dams).
1981	The natural gas supply from the gulf of Thailand was operated for the first time and supplied fuel to the Bangpakong (in the central) and the Khanom (in the south) power plants to secure the electricity system in the central country and the southern region, respectively.
1973-1989	The Mae Moh lignite power plants were expanded from 150 MW in 1973 to 1,125 MW in 1989.
1981-1987	Two large hydro power dams, namely Srinakarin and Vachiralongkorn hydro power dams, were built and operated in the Kanchaburi province and the Ratchaprapha hydro power dam was built in the south.
1986	The National Energy Policy Office (NEPO) was formed under the Prime Minister's Office as a secretariat of the National Energy Policy Committee, to take care of the energy policy and planning process and to administrate the Energy Conservation Fund.

Source: Compiled from Ministry of Energy, 2004[14] and Chuanchom S. Greacen and Chris Greacen, 2004[15].

c) Refocusing Strategy of Thai Civic Movement

If the previous period was the initial step, this period is the crucial formation period of Thai civil society. The successful democratic movement against the dictatorial government in October 1973 led to the flourish of civic movement and networks. The main focuses of the movement were still on political and human rights of disadvantaged groups in Thai society and on establishing a democratic system which would become the legacy of Thai civic movement.

Due to the political situation, the movement had inevitably involved in the political ideology conflict and contest. This certainly increased the tension of society in relation to the future instability, and thus intensified the conflict within Thai society. Consequently, this situation stimulated the aggressive counter-revolution from conservative groups within the country. After the bloodshed in October 1979, many intellectuals and activists could not continue their roles and were forced to join the CPT.

However, joining the communist movement was not the right choice for them. Therefore, after the Thai government initiated the compromising policy, the intellectuals and activists returned to their works. Some of them began to work as civil intellectuals and activists, this time mostly at the grassroots level, rather than focusing on political structure as they did before.

This can be defined as an important refocusing strategy of Thai civic movement. Although the outcomes of the new strategy cannot be seen yet in this period, these strategic shifts become the backbone strategy for Thai civic movement, clearly shown in the next period. Under this strategy, it is clear that development critique gradually but firmly emerged from the bottom level, based on grounded evidence and knowledge.

d) Conclusion

Although the oil crisis proved that the newly established power system based on centralized and imported fuels and technology could be problematic, the lack of strong civic participation and alternative development concepts prevented this question from changing the direction of the Thai power system. The coping strategies were more or less the temporary measures. This is why all initiatives to cope with the crisis were quickly phased out from the agenda of Thai government and society. In general, the crisis did not lead to any significant improvement in the energy policy capacity, neither for the state nor society, contrary to what occurred in some countries, like Denmark for instance. The centralized power system and modernized symbol of energy still remained. However, the political crises helped Thai civic movement in refocusing the strategy and starting the new legacy of Thai civic movement, including the emerging of Thai environmental movement in the coming period.

4.4 Economic Miracle and the Emergence of Sustainable Development (1987-1996)

a) The Two Driving Forces

Thailand's economic wave was turned up again in this period. It became the period of high economic growth and quite stable and favorable political conditions for economic expansion. Internationally, the cold war was coming to an end. The conflicts within the Indo-china sub-region were quite successfully resolved. The Thai government's slogan of "*plian sanamrob pen sanam karnkar*" (changing the battle field to a trading place) was echoed. The influx of foreign investment boosted Thai economy to grow beyond 10% annually at the beginning of this period, before slightly slowing down to the rate of 8% of annual growth in the second half. The industrial sector clearly became the most important economic sector. The mindset was changed from "national security" to "opening-up" for economic opportunities and becoming one of the Newly Industrialized Countries (NICs).

Concurrently, the domination of "Neo-liberalism" came to Thailand together with the powerful notion of "globalization". The World Bank and IMF suggested the Thai government to open up the economy. The national economic strategy shifted from import-substitution to export-oriented industries. The Thai government actively reduced trade barriers and deregulated the financial market. The private sector invested increasingly in high profit public services, including telecommunication and power sectors. Privatization policy was also highly recommended by the World Bank[16].

However, the concepts of "sustainable development" and "public participation" were also echoed. They derived from both international and domestic movements and actions. The international community and forum persuaded and forced the Thai government to be more concerned about the environmental consequences of its development processes and activities. The new National Environmental Act came into force in 1992 with new government organizations for environmental protection and more influence of Thai civil society.

The Black May Uprising in 1992 has rooted the democratic and human rights principles and culture in Thai society. Various domestic experiences also confirm that, in many cases, the costs of development or the "sacrification for development" were usually too high, mostly unfair, and sometimes without sound justification. It was much clearer at that time that Thai society needed to internalize and operationalize our democratic culture into broader aspects and practices of public decision-making. Therefore, the emerging of both concepts has created the political opportunity structure and a new development language for upcoming environmental movement in Thailand.

b) Power Expansion and Privatization

Undoubtedly, this became a busy period for power generation and expansion again. The annual growth of energy consumption increased from 5% in 1986 to 10% in 1987 and 20% in 1989. The electricity peak demand increased from 4,000 MW in 1987 to 10,000 MW in 1991. According to EGAT's own words[17], more than 1,000 MW of new installed capacity was needed every year. Certainly, this rapid demand growth threatened the EGAT system's reliability. Especially, since in the previous period, EGAT also had to postpone some of their expansion projects to alleviate the foreign debt burden. To cope with this higher demand situation, EGAT had to speed up their investment plan and rely more on Natural Gas Combined-cycle power plants, which require a shorter installation time and also consume the domestic resource[18]. By 1992, the proportion of NGCC power plants in the total installed capacity had increased dramatically from zero to 35%.

The rapid demand expansion also offered a very good opportunity for economic liberalization policy advocates, especially the World Bank and the newly established National Energy Policy Office (or NEPO). Certainly, EGAT needed enormous financial resources to invest in its power expansion projects, including through the World Bank. Therefore, as conditions for EGAT's loans and guarantee, the World Bank suggested the Thai government to allow private power producers to join this highly profitable business, in order to reduce the public debt burden and keep pace with the increasing domestic demand[19].

However, EGAT and EGAT's labor union were aggressively against the proposal of privatization. In 1989, one minister, who supported the privatization policy, was forced to leave his position, after a big protest by EGAT's labor union. Under the Thai compromising policy style, in 1992, EGAT set up their private company subsidiary called EGCO, to run their two new NGCC power plants and sell electricity back to EGAT[20]. Then, NEPO succeeded in forcing EGAT to launch the power-purchasing program for independent power producers (or IPPs for large producers) and small power producers (or SPP)[21]. Therefore, in this period, private producers emerged and started playing their roles on this energy policy stage. However, EGAT still maintains its monopoly position as the largest producer, as well as a single buyer and a system operator for all producers and consumers.

Apart from private participation, economic liberalization policy advocates also succeeded in varying the energy prices, both domestic oil prices and electricity tariffs in 1992. However, there is a main difference between these two sectors. In the case of the domestic oil market, it is an oligopoly market with intense competition, especially when newcomer retailing petrol companies enter into the market. Oppositely, in the power sector, varying the energy price (called Fuel Adjustment Mechanism or Ft), without competition and an effective regulatory framework might allow EGAT to place all investment and operation costs in the hands of the Thai consumer.

c) Power Expansion, Resistance, and Responses

Unlike the modernization period in the 1960s, in this period, many power expansion projects, especially large hydro power dam projects, faced strong criticisms and resistances. It became more obvious to Thai society that previous large hydro power dams had caused serious negative impacts on ecosystems and human well-being. In 1988, the movement of environmental experts, NGOs, students and local activists succeeded in opposing against the Num Chon dam project, which planned to turn the heart of the largest national forest area (which later became a world heritage site) into a large water reservoir. This successful action of opposition presented the crucial roles and potentials of Thai civil society in the development processes and started the legacy of the Thai environmental movement.

In 1990, the movement accomplished again in pressuring the Thai government into canceling the Krang Krung hydro power dam project. Although the Pak Mun hydro power dam was finally built in 1992, after a long series of local protests together with a critical academic forum, EGAT had to pay a high compensation rate not only for private land, but also, for the first time, for common properties like fishery resources. After that, no large hydro power dam was built in Thailand[22]. Obviously, the contribution of hydro power to the overall power generation was sharply reduced from 20% in 1986 to 10% in 1996.

Certainly, both domestic and international movements have forced the Thai government organizations to change their practices. The Thai government had clearly seen the new actors, the civil society, entering the energy policy arena. On the one hand, the government has applied a compromising policy style, like canceling the Krang Krung dam, pursuing the Pak Mun dam or paying higher compensation. On the other hand, the government organizations began to apply the concept of “sustainable development” and “environmental management” to their practice. In 1992 and 1993, the Thai government pushed the Energy Conservation Law into force and encouraged EGAT to start the Demand Side Management (DSM) program. However, although some initiatives were quite successful, these attempts were too small to cope with the increasing serious environmental impacts of a rapidly growing economy[23].

It is also very important to note that, in this period, the Thai government began to open some rooms for renewable energy. The SPP purchasing program, started in 1994, was initially aimed to boost the renewable energy production. However, due to unfair buy-back rates and complicated purchasing procedures, renewable energy producers found great difficulties in developing and investing in these new technologies and in participating in the program. For the same amount of electricity produced, the renewable energy producers in the SPP program received less than EGAT’s own short-term avoided costs. There was no need to talk about the positive externalities. This is why the proportion of renewable energy in the SPP program was very low, only around 5% of the total SPP generation in this period.

Table 4.4 Historical Events of the Power Sector Development and Policies in Thailand during the economic miracle and the emergence of sustainable development. (1987-1996)

Time Period	Historical Events
1988	The big demonstrations and movement against the Nam Chon hydro power dam in Kanchanaburi emerged and led to the emergence of environmental movement in the Thai power sector.
1989	EGAT's Labor Union organized the big demonstration against the government's idea of EGAT Privatization
1992	The Anand government amended the EGAT act to allow private producers to supply electricity to the system
1992	EGAT established its first subsidiary private company, Electricity Generation Public Co., Ltd. (EGCO) by taking over EGAT's two natural gas combined cycle power plants.
1992	The Anand government introduced the automatic fuel adjustment mechanism (Ft), instead of the requirement for cabinet resolution for tariff adjustment.
1993	EGCO was capitalized in Thailand's stock Exchange
1993	EGAT started its DSM program to relieve the burden of high demand increasing during economic boom.
1994	EGAT announced Independent Power Producers (IPPs) and Small Power Producers (SPPs) offering to sell electricity to the grid.
1994	The big protest, organized by the Assembly of the Poor, claimed for the compensation of fishery income losses during the three years of construction of the Pak Mun dam. Later, the government accepted to pay a compensation.

Source: Compiled from Ministry of Energy, 2004[24], Chuanchom S. Greacen and Chris Greacen, 2004[25], and Decharut Suukumnoed et al., 1999[26].

d) The Emergence of the Thai Environmental Movement

As introduced earlier, the "Thai environmental movement" originally has its roots in the democratic movement of the 1970s. The refocusing strategy of intellectuals and activists in the beginning of the 1980s allowed this new movement to gain a firm ground, both in terms of local knowledge and experiences, and also local supports. In 1988, unacceptable expected negative impacts of the Num Chon dam project sparked the movement formation of various environmental experts at universities and government organizations and activists in NGOs who joined the anti-dam campaign and mobilized the environmental movement.

Through these networks and actions, the Thai environmental movement has introduced new words and new concepts to Thai society. The words "local wisdom", "intellectual villagers", "community rights", "people-centered development", "holistic approach", and "community research" have echoed during this period. All these concepts were introduced synchronously with the ongoing democratic movement, which had tried to develop more "transparent and accountable" governance systems, assure "citizen's rights" and allow "meaningful public participation". All these concepts from the two relating movements became the core of Thai civic movement in the 1990s.

With the supports of many academicis, the Thai environmental movement has increasingly participated in research and knowledge development. Although the knowledge derived from the movement is still recognized as an alternative to mainstream approach, it clearly shows a strong connection between “concepts”, “operational practices”, and “empirical outcomes”, leading Thai society to gradually apply these concepts to their attitudes and practices. By the end of this period, all these concepts became the core component of the 8th national development plan, which, for the first time, shifted its focus from economic expansion towards human-centered development. More importantly, in 1997, the Thai civic movement successfully pressured the Thai government and parliament into drafting the new constitution, which asserts and assures human, local and community rights and public participation in the public policy and development processes.

e) Conclusion

In this period, it was the first time that all three sectors; state, private, and civil society, played their roles together on the energy policy stage. The new mainstream concept of liberalization has introduced a new player, i.e. the private sector, which will share the high profits within the Thai power sector, though EGAT still maintain their superior monopoly power. Concurrently, from the part of civil society, a new development language was also developed around the world, challenging the mainstream practices and power rationality within Thai society. In general, the new environmental practices have been developed and adopted to various parts of Thai society. In energy policy, the costs of power expansion systems became clear to Thai society. Thus, the requests to “sacrifice for development” become more or less irrational. The symbols of “electricity” or the mindset of Thai society on “electricity” have been gradually changed. Electricity does no longer have an absolutely positive meaning. Costs have to be weighed. It was also clear that Thai society must initially demand a “sustainable development” of the new technology trajectory.

4.5 Economic Crisis and Recovery (1997-2000)

a) Contested Driving Forces

The Asian economic crisis in 1997 turned down the Thai economic wave again. In some aspects, it was even worse than the economic recession of the 1980s. High foreign debt and limited foreign reserves forced the Thai government to join the IMF restructuring program and follow a number of policy conditions suggested by the IMF. In 1998, Thai economic growth became negative (-8%). After that, the economic recovery began slowly and continued until 2002.

After the crisis, the financial market liberalization policy was blamed as the main booster for the expansion and collapse of the Thai “bubble” economy. The notion of “open-up” economy, thus, was somehow less powerful. The introduction of the king’s “sufficiency economy” philosophy, in December 1997, has influentially encouraged Thai society to find the moderate and more balanced path of economic development in order to self-immunize the country from the risky global economy. The concept of “sufficiency economy” emphasizes the notion of self-reliance (but not self-protection), moderate living, stability (both short term and long term), and mutual benefits (both among people and between people and nature). The application of this concept can be seen in various policy arenas, especially later in the 9th National Development Plan (2002-2006)[27].

However, liberalization was still on the top of the agenda of international organizations and also the Thai government. To many Thais, this economic crisis was just the outcome of “misconducting” economy, not a “misconception” of the development direction. Therefore, they just looked for “yesterday once more”, not an alternative direction. These two concepts (sufficiency economy VS liberalization) have contested in various forms, implicitly and explicitly, in various public spheres and policy arenas.

Another important event at the beginning of this period was the implementation of the New Constitution, in 1997, which asserted human and community rights, including the rights to participate in public policy formulation, administration processes, and environmental management. However, in practice, there are still a lot of obstacles for Thai people to exercise and protect their rights. Various independent organizations which appear in the constitution to protect the rights of the Thai people, for example an independent organization for consumer protection and an independent organization for environment assessment, have not yet been established at the present day. Similarly, the rules and the standard procedures for local community rights and public participations, as stressed in the constitution, are still undergoing very long procedures of preparation. In other words, the new basis is being formed, but without clear rules for all stakeholders.

b) Overcapacity and Liberalization

The main characteristic of the Thai energy sector, during this period, has been changed to an “overcapacity” situation. Due to economic contraction and recession, the demand for electricity decreased in 1998 and slightly increased after that. Apart from much lower demand growth, the hasty construction and contracting power expansion projects from the previous period have worsened the situation. The reserve margin of the Thai power system reached 40% from the normal criteria of 15%.

Since the policy direction in the previous period was to encourage the private sector to invest and participate in the power sectors, all projects and contracts were set up on the high profit-guarantee basis (15-20% internal rate of return guarantee), including guaranteed purchasing principle (or in Thailand, called the take-or-pay principle), exchange rate compensation, and front-end pricing system. Therefore, when demand was slowed down, all these benefits given to private enterprises became the high excessive costs for EGAT. As later mentioned by Prime Minister Thaksin, EGAT had over-invested, including already committed power-purchasing contracts, by 400 billion THB (or about 10 billion USD).

The overcapacity and higher cost situation pushed EGAT and NEPO to readjust the power demand forecasting and the power expansion plan. Their main limitation of the adjustment is still the “take-or-pay” principle in the purchasing contracts from private power producers and natural gas suppliers. What EGAT could do in this period was only to delay its own projects and, even, shut down its existing power plants. However, in 1998, the cabinet resolution prevented EGAT from accepting the offer (i.e. the purchasing contract) from non-renewable co-generation SPPs due to high electricity surplus, leading to the freezing of this previously rapid growth technology in the Thai power sector.

Although the energy situation was totally different, from high growth to overcapacity, and the negative effects of previous privatization policies became much clearer to Thai society, the advocacy for privatization policy from the World Bank and NEPO was still powerful. The liberalization policy, in general, and the restructuring of the power system towards the “power pool” model, in particular, were strongly supported by the Chuen government. The new arguments were, firstly, to use the state-owned enterprises’ assets for alleviating the national financial difficulty and, secondly, to break down EGAT’s monopoly structure as a main source of inefficiency in the viewpoint of the Chuan government[28].

Following, the power pool model, EGAT’s vertical integration between generation and transmission will be broken down. The power pool will be a new system operator instead of EGAT. In other words, EGAT will concentrate only on the generation sub-system. Moreover, to stimulate competition on the future power market, EGAT is recommended to separate into three generation companies[29]. To support this policy direction, in 1999-2000, EGAT also set up the new company for the Ratchaburi power plant, the new and largest power plant in the country, and capitalized it in the Stock Exchange of Thailand (SET) [30].In 1999, the Chuan government introduced the State Enterprise Corporatization Act, which allows the government to privatize state-owned enterprises without any amendment of each state enterprise act (i.e. without necessity to pass through the parliamentary process)[31].

As a result of its own financial hardship and the need for government credit guarantee, the resistance from EGAT was rather weak, especially compared to the previous one[32]. The main concerns came from Thai civic organizations, due to unclear regulation mechanisms to block or control well-known cross-sharing among existing and potential power producers in Thailand (later shown in Figure 4.3) as well as to control price manipulation within expected oligopolistic power markets[33].

In 2000, the Chuan government approved the master plan for the restructuring of the power sector and the establishment of the Thai power pool. Originally, the draft of the new energy act and power pool model was planned to be ready by 2003. However, after the Thaksin government came into power in 2001, this plan was blocked and finally cancelled in 2003.

c) Thai Civic Movement in the Energy Sector

In this period, Thai energy policy has changed significantly, after the emergence of specific civic movement in the energy sector, in two main ways.

First, it is clear that strong local protests against various energy-related projects have occurred all over the country, including coal-fired power plants, transnational gas pipeline, and coal mining projects. On the one hand, the local protests can lead to a better human rights protection in Thai society. However, the situation of "opening new ground without clear rules", due to the incomplete implementation of the new constitution, has turned protests into conflicts in most of the cases. Thus, almost all energy-related projects have reached deadlock in the "conflictual" mode of public decision-making. At least, two energy-related projects, the coal-fired power plants and the Thai-Malaysian Gas Pipeline, ended up with violation of local people.

Second, NGOs and academics, who work on different energy issues, have formed the Sustainable Energy Network for Thailand (SENT) in 1998, aiming to connect all energy-related issues and co-ordinate civic actions towards the development of sustainable and democratic energy systems. In 1998, SENT and the Foundation for Consumers (FFC) helped Thai society to discover the unfair electricity pricing system and excessive EGAT over-investment costs. This public disclosure forced the Thai government to adjust the Ft pricing mechanism structure, to allow the participation of customer representatives in the Ft pricing committee, and finally, to return an excessive and miscalculation payment back to Thai customers in 2001. More importantly, the movement has succeeded in changing the perceptions and attitudes of Thai society, that the investment in the power sector is not necessarily good for Thai economy, especially if it is made within a biased power structure and a closed system of vested interests.

Another important action for the Thai civic movement is the campaign against two coal-fired power plants in Prachuab Kiri Khun. Throughout the campaign, local protesters have successfully shown the Thai public the problematic of environmental management practices. Later in 2000 and 2001, local people, together with some academics, proved several mistakes and cases of misinformation in official EIA reports, leading to a stronger societal demand for an overall EIA system reform.

In 1999, inspired and supported by Danish renewable energy experiences, SENT succeeded in presenting an alternative energy development option, based on DSM, biomass, and micro-hydro power, to replace one coal-fired power plant. In the SENT report, the development objectives of the 8th National Development Plan were applied systematically for the comparison between the reference and alternative energy options. In other words, the sustainable development language was operationalized and the analysis showed the advantage of developing domestically based renewable technology, rather than imported coal-based technology and fuel. Apart from alternative solutions, SENT also suggested that the Thai government should change its way of power planning by emphasizing all related national development objectives, such as job creation, income distribution, or better environment, in the energy planning analysis, not only the least-cost solution as NEPO and EGAT always used to do[34].

Table 4.5 Historical Events of the Power Sector Development and Policies in Thailand During the Economic Crisis and Recovery (1997-2000)

Time Period	Historical Events
1997	The power-purchasing agreements (PPA) between EGAT and seven IPPs were signed in December 1997, although the economic crisis caused a huge reduction in power demand.
1997	The Mae Moh Lignite power plant installed FGD for the first time to tackle down air emission problems.
1997	The local protests against IPPs' Coal-fired Power Plants in Prachuab Kiri Khun began.
1998	Cabinet resolution was made to prevent the EGAT from accepting the offer from non-renewable co-generation SPPs due to a high reserve surplus.
1998	The Foundation for Consumers (FFC) and the Sustainable Energy Network for Thailand (SENT) criticized for the first time the unfair Ft and tariff mechanism.
1999	EGAT set up its second subsidiary, Ratchaburi Holding Public Co, Ltd. (RATCH) by taking over EGAT's Ratchburi NGCC power plant. Later, RATCH also capitalized in the Thailand stock exchange.
1999	The Chuan government introduced the State Enterprise Corporatization Act, which allow the government to privatize state-owned enterprises without any amendment to the individual state enterprise act.
1999	SENT launched the study of the alternative solution to the coal-fired power plant in Prachuab Kiri Khun and urged for more investment in renewable energy, together with more public participation and a broader focus in the planning process.
2000	The Chuan government announced the master plan for the electricity supply industry reform and the Thailand power pool with the aim to establish the power pool by 2003.

Source: Compiled from Ministry of Energy, 2004[35], Chuanchom S. Greacen and Chris Greacen, 2004[36], and Decharut Suukumnoed et al., 1999[37].

On the issue of privatization and power structure, SENT and FFC had criticized the power pool model. The oligopolistic structure of the power pool model was the main concern of SENT and FFC, since tight shareholding relations existed among EGAT and private power producers in Thailand. It became more obvious when the Thai government denied establishing a clear mechanism to regulate these shareholding relations between the IPPs in the draft of a new energy act[38].

d) Conclusion

The diverse policy-driving forces, the two contrasting development concepts, and the three societal sectors have played crucial roles in relation to Thai energy policy. In this period, thus, Thai energy policy becomes much more complicated and dynamic. Several issues in the Thai power sector, which were previously taken for granted, are now uncovered and discussed in Thai society. However, the state still maintains its power and determines the main policy direction in various aspects. The private sector still limits its role to the protection of its profits to a joined privatization policy. Although Thai civic movement has actively mobilized to implement changes and has already succeeded in some areas, it is still far from changing the whole structure of the Thai power sector and reaching a sustainable energy future.

4.6 The Thaksin Government and the Domination of the National Champion (2001-2006)

a) The Political Factor of the National Champion

The landslide election victory and the coming into power of the Thaksin government in 2001 have notably changed the development discourse and policy arena. The main focus of the Thaksin government is the "competitiveness of nations". The differences between these two related concepts, liberalization and competitiveness of the nation, are illustrated by the fact that the government has turned to support a "monopoly" model in some specific sectors, such as the power sector, for the sake of national competitiveness on the regional market. On the other hand, the government decided to liberalize air transportation services, also for the sake of "competitiveness of the nation". Since, to compete with other nations, this new concept does not comply with any particular theories or principles, it allows the Thaksin government to rationalize its diverse policy directions in various and sometimes opposite ways.

Due to a good economic situation and the populist policies of the Thaksin government, the vast majorities in the Parliament and the high popularity among Thai voters, , allow the government to introduce and implement various policy initiatives in order to increase "national competitiveness", including the reshuffle of the public administration system into a more "efficient centralized system". By 2003, the economic recovery seems to influence Thai society to believe more in the "competitiveness of the nation" model, which is later called "Thaksinomics". Other concepts discussed in society and stated in the 8th and the 9th National Development Plans, such as "sustainable development", "social capital", and "good governance", have now been reinterpreted by the government and included in the umbrella concept of the "competitiveness of the nation".

b) National Champion and New Privatization Idea

In terms of privatization of the Thai power sector, the Thaksin government decided to postpone and, then, cancel the implementation of the power pool model in 2003. In the perspective of the Thaksin government, EGAT should maintain its monopolistic power in power generation and transmission, but sell part of its shares in SET. According to the new model, the participation of the private sector would be as a single buyer under EGAT control and regulation, which is usually called the "enhanced single buyer" model[39].

The opposite policy direction change is the result of two main policy reasons. First, according to the main national competitiveness strategy, which plans to develop Thailand into the "hub" of the regions in various sectors, including the energy sector[40], the Thaksin government prefers EGAT to maintain its monopoly power and act as the strong national player on the future regional market or so-called ASEAN grid system.

Second, since the capitalization through SET was seen as one of the main instruments to accelerate national economic recovery, reduce public debt burden and improve the competitiveness of the nation, the Thaksin government has a clear plan to capitalize or sell part of the shares of highly profitable state-owned enterprises, like Petroleum Authority of Thailand (PTT) and EGAT, in SET[41]. Following this logic, it is clear that EGAT's monopoly power will ensure its future profitability and, therefore, raise the demand and the market values in the stock exchange.

According to the former governor of EGAT, this model is also acceptable and more preferable to EGAT than the power pool model, since EGAT can keep its own organization (instead of dividing into three generation firms and another transmission firm) and its monopolistic position within the Thai power system[42]. At the same time, according to the Minister of Energy, EGAT can mobilize the financial resources from the stock market to investment in the new expected economic growth period.

In 2001, the Petroleum Authority of Thailand (PTT) was the first state enterprise in the energy sector that has been privatized to become the PTT Public Company and successfully sold its shares on the stock market. The value of PTT's shares has increased from 35 Baht to 230 Baht in 4 years, which means that the PTT Public Company will serve as a model for other state enterprise privatizations.

Concurrently, the government restructured the administrative system with the new rearrangement of the central authority. The Ministry of Energy was established in 2002, merging all agencies related to the energy field. The National Energy Policy Office changed its name to the Energy Policy and Planning Office (EPPO). Under the new ministry, the roles regarding electricity policy have been transferred directly to the ministry and the executive body, rather than the delegation of NEPO. As the first step of the new ministry, the National Energy Strategy was announced in August 2003.

c) EGAT Privatization Process

At the end of 2003, the government proposed the Enhanced Single Buyers as a pilot model in the EGAT privatization and electricity system restructuring. This model was based on a study by Boston Consulting Group, which proposed to maintain the authority and the role of EGAT as a single buyer, responsible for the united power production and the transmission system in order to maintain power system stability. Under this model, the government would privatize the EGAT on the stock market to achieve sufficient investment capital to expand the power generation capacity and electricity system in response to increasing electricity demands of the future.

At the initial stage, the government expected to complete the EGAT privatization within 2004. The public hearing was conducted at the beginning of 2004. Later, civic groups together with State Enterprise Labor Unions (led by the EGAT Labor union) opposed the government proposal and held various demonstrations, resulting in critiques in society and in academic forums. During March 2004, the government announced the postponement of the EGAT privatization, stating that further study would be conducted before taking the next policy decision.

The civil society movement and public attention rapidly reduced its attention after the postponement. Public hearings were held and opinions were gathered from relating sectors such as the Ministry of Energy, EGAT, EGAT Labor Union and the civil society sector (including the National Economic and Social Advisory Council (NESAC) in June 2004. Unfortunately, the results of such hearings came out late (mid-2005), and it was not responded by any sectors in society[43].

After the second landslide victory in the general election in February 2005, the Taksin government once again initiated the EGAT privatization. Prior to the election, the EGAT governor (Mr. Kraisri Kannasoot) proposed a series of findings from studies of EGAT privatization alternatives. Hearings and a survey of the EGAT staff opinions led to internal negotiations between EGAT and the government. Several issues discussed were the integration of power production and transmission system into EGAT; the designation of EGAT's proportion for new power plant constructions at

50%; and extra benefits from the privatization to the EGAT staff[44]. At the same time, the government announced the Regulation of the Office of the Prime Minister on the Electricity Regulatory Commission in March 2005 to secure the issues previously criticized by various sectors. Finally, the EGAT Public Company was established on 23 June 2005.

Surprisingly, the EGAT privatization process in 2005 was carried out without strong public attentions compared with the reactions in 2004. The EGAT Labor union was much less powerful in its anti-privatization attempt, partly due to the reduced support from EGAT employees after receiving an extra benefit package from the government.

The position of the civil society sector became prominent in September 2005 when it was suggested to restructure electricity tariffs and to increase electricity tariffs to lessen the burden of EGAT prior to the sale of its shares on the stock market. The civic groups then began the movement against the EGAT privatization and against the increased burden of electricity tariffs. To relieve the political pressure, the government decided that EGAT should be responsible for 21,000 million baht of the Ft burden, while the electricity base tariff would be fixed for 3 years. The PTT Public Company should average part of the high natural gas price to be collected in the future, so that the electricity tariffs of October 2005-January 2006 would not be as high as to stimulate more opposition and would thus not become an obstacle to the EGAT privatization.

In November 2005, a group of researchers (including the author) presented the preliminary results of a governance assessment study, showing the lacks of public participation and accountability in the EGAT privatization process. Later, the Confederation of Consumer Organization (CCO) submitted the petition to the Administrative Court for the suspension of EGAT's stock allocation on the stock market due to its large-scale negative impacts on public interests. On 17 November 2005, the Administrative Court ordered the temporary suspensions of EGAT's share allocation, until there is any order deemed appropriate. Finally, in March 2006, the Supreme Administrative Court ruled to cancel the two royal decrees for the EGAT privatization due to unlawful actions, and therefore, the already privatized EGAT public company became EGAT again[45].

d) Target and Growth of Renewable Energy

Apart from the privatization policy, another important aspect of the Thaksin government's policy on the Thai power sector is the renewable energy development policy. Renewable energy and energy efficiency were the main components of the National Energy Strategy, announced in August 2003. Although earlier Thai governments have announced national energy policies or strategies, this was the first time that the government set up clear targets and policy mechanism for renewable energy development. It was also the first time that very high potentials of renewable energy (more than 15,000 MW, see Chapter 3 for details) were accepted by the government organizations[46], compared to less than 3,000 MW in most of the NEPO documents published during public debates on the controversial coal-fired power plants.

The two main targets in the National Energy Strategy were a) the reduction of energy intensity from 1.4 to 1 (between the growth of energy consumption and GDP) and b) the 8% contribution of modern renewable energy in total energy consumption by 2011. For the power sector, the target of 6% renewable contribution in total electricity generation by 2011 was also set up[47]. In other words, the Thai government aimed to reach 2,400 MW of renewable power generation by 2011.

In fact, the Thai government has created a space for renewable energy, since the introduction of SPPs in 1994. However, because the criteria of firm and non-firm SPPs with different buying prices make renewable energy investment less attractive (detailed discussion provided in Chapter 7), in 2002, the Encon Fund decided to provide a five-year subsidy through the bidding program for 300 MW. Although the subsidy was limited to the first 5 years of operation, the cheaper solutions (due to the bidding system) and only for one round offer, it provided good initiatives for investment and for access to the grid.

In the National Energy Strategy, apart from existing SPPs, the Renewable Portfolio Standard (RPS) was announced as the main policy mechanism without any prior public consultation. This has led to the strong criticism of several organizations, including academic organizations, NGOs, and even EPPO. According to these organizations, RPS will create complications and uncertainties for renewable energy producers. They suggest applying feed-in tariffs instead. In practice, up to 2006, RPS has not yet been applied and government tends to shift from RPS to feed-in tariffs after the 3 years of policy discussions about these two pricing regulations (detailed discussion in Chapters 7 and 8).

Although the main policy mechanism is not yet in place, renewable energy, especially biomass energy SPPs, has grown very fast. As presented in Chapter 3, the installed capacity of renewable SPPs has increased from less than 300 MW in 2000 to 928 MW in 2005. By mid-2006, the total installed capacity of all renewable energy producers reaches 1,000 MW. The main reasons for the rapid expansion are, a) the better utilization of renewable resources, b) the learning curve of technological development, and c) the increasing fuel prices and electricity tariffs. As a result of this impressive expansion, in 2005, the Federation of Thai Industry, one of the most influential business organizations in Thailand, set up a new group for renewable energy producers.

Concurrently, the Thai civic movement, led by the Appropriate Technology Association (ATA), also played a key role in renewable energy technology development. Local knowledge on renewable energy and local energy planning was begun, disseminated, and accumulated. According to the Thai civic movement, all these attempts have created the great connection between sustainable energy development and the king's philosophy of "sufficient economy", since the most important benefits of these renewable energy innovations are, a) the increase in demand for domestic agricultural products, b), thus, the raise in farm prices and increased price stability, and c) the reduction of the import bill. In other words, they pave the way for a self-immunization of Thai economy from global market variations, both on energy and agricultural markets.

e) The Expanding Roles of Civic Movement in the Thai Power Sector

The roles of civic movement have been continuously expanded in this period. During 2001-2002, SENT, FFC, and other civic groups were formallyinvited to participate in several decision-making processes. In 2001, SENT and FFC took part of a Ft revising sub-committee in pursuing a better tariff system. Later, in 2001, SENT also participated in the decision to open the Pak Mun dam gate for ecosystem and livelihood recovery. Lastly, in December 2001, SENT also took part in the televised public debates over the necessity of the coal-fired power plants in Prachaub Kiri Khun together with NEPO and environmental NGOs.

In case of the coal-fired power plants in Prachaub Kiri Khun, when the Thai government was close to the decision-making deadline, SENT and FFC also amply informed the government and public that, “within the high overcapacity situation, over-demand forecasting and the excessive investment in these two coal-fired power plants would lead to the increasing of the electricity bill for Thai customers”. Finally, in 2002, the Thai government decided to cancel these two projects and change to natural gas.

Although during 2001-2002, the contributions of civic movement influenced the formal government decision in several cases, it was still mainly on a case-by-case basis. In other words, the overall power structure could not be significantly changed. From 2003, Palangthai, CCO, NESAC, and the Health Systems Research Institute (HSRI) became the leading actors in civic movement and they moved towards more structural issues and renewable energy policy.

In the civic movement perspective, the proposed “enhanced single buyer” model, based on a private monopoly structure, will worsen the situation, especially in relation to consumer protection and sustainable energy development. In 2004, Palangthai and CCO succeeded in the prediction that the Thaksin government would allow EGAT to raise the electricity tariff before launching in the Stock Exchange of Thailand, and it did happen in February 2004. Subsequently, the civic groups and the EGAT Labor Union joined hands in protesting against the EGAT privatization, leading to the postponement of the privatization process in March 2004, as mentioned before.

It is interesting to note that, although the civic groups and the EGAT Labor Union protested against the same privatization proposal in 2004, they used somehow different languages, as shown in Figure 4.1, which contained different policy meanings or interpretations. In the case of the EGAT Labor Union, the main message is “*selling (privatizing) Water and Power Utilities will kill the whole Thai nation*”. In other words, the union highlights the whole Thai nation, as linked to the concept of nationalism and national security. And, at the same time, the word “sell” or “privatize” is highlighted. Contrastingly, the message of the civic group emphasizes the competitive priorities between “people” and “profit”, which implicitly means that the extra profit, even within the existing EGAT monopoly structure, should also be eliminated not only stopping its privatization.

Figure 4.1 Different Policy Messages in Anti EGAT Privatization Campaign

EGAT Labor Union's Message
"*Selling Water and Power Utilities will kill the whole* ***Thai nation***"

Civic groups' Message
"***People*** *before the Profit*"

Note: The highlights are made by the author.

After the postponement of the EGAT privatization, NESAC developed the first alternative model of the Thai power structure, introduced by the civil society group (later in this study, the model will be termed decentralization model) and presented to the Senate commission in June 2004[48]. Later, NESAC, by Mr. Witoon Permpongsacharoen, also proposed the alternative power development plan mainly to reduce EGAT's investment burden, which is used by the Thaksin government as a main argument for EGAT privatization[49].

Concurrently, Palangthai and HSRI also organized the policy forum suggesting the Thai government to move from RPS mechanisms to a feed-in tariff system (the detailed discussion of these two regulations will be presented in Chapter 7). These activities represent an attempt of the Thai civic movement to move towards more structural changes.

However, Thai civic groups still have the limited ability to raise public attention to the EGAT privatization and other issues, leading to the government's fast move in the privatization process in 2005. This is also partly due to the fact that EGAT's Labor Union looses its strong supports and, thereby, its influential power. Fortunately, by September 2005, Thai civic groups are able to gain public attention again, when the government proposes to raise electricity tariffs before launching EGAT in SET. As already mentioned, this attempt finally leads to the stronger protests, the petition to the Court, and the cancellation of the EGAT privatization.

Through this long story, it is quite clear that the roles of Thai civic movement in the power sector have been expanded into more structural issues and moved in a policy direction. The final judgment of the Supreme Administrative court to cancel the two royal decrees is certainly a significant step for the Thai public on the way to gaining more control of their own power system.

Table 4.6 Historical Events of the Power Sector Development and Policies in Thailand during the Thaksin Government (2001-2006)

Time Period	**Historical Events**
2001	FFC and SENT organized a public forum and later protest against unfair tariff surging after the commissioning of the Ratchaburi power plant, leading to the set-up of an ad hoc committee to review the Ft mechanism.
2001	The Thaksin government announced a one-year Pak Mun dam's gate opening for ecosystem and livelihood recovery after the World Commission's study on the dam had presented significant negative impacts of the dam on the local people and ecosystem in 2000.
2001	The televised public debates over the necessity of the coal-fired power plants in Prachaub Kiri Khun between NEPO and Environmental NGOs, SENT.
2001	The Petroleum Authority of Thailand (PTT) was privatized under the State Enterprise Corporatization Act and later capitalized in the stock exchange.
2002	The Energy Conservation Fund (Encon Fund) offered the 5-years subsidy for new renewable SPPs for 300 MW under the tendering system.
2002	The Ministry of Energy was established under the Thaksin government's bureaucratic reform, uniting all government organizations and state-enterprises working on energy issues.
2002	Two coal-fired power plants in Prachaub Kiri Khun were cancelled and changed their fuel to natural gas and their location to Ratchaburi and Saraburi.
2003	The Thaksin government proposed the master plan for establishing the power pool and later announced the Enhanced Single Buyer (ESB) model as the structural model for the Thai power system and the EGAT privatization
2003	The Ministry of Energy announced the National Energy Strategy for competitiveness with the targets of 6% renewable energy in power generation and 1:1 energy intensity in comparison to GDP growth.
2004	The Thaksin government initiated the EGAT privatization process with the target to capitalize EGAT in the stock exchange by mid-2004.
2004	The EGAT Labor Union and civic groups organized a big protest against the EGAT privatization plan, leading to the government's cancellation of this plan.
2004	The National Economic and Social Advisory Council (NESAC) introduced the decentralization model as an alternative to the ESB model and also introduced an alternative PDP in comparison to EGAT's PDP-2004.
2005	After winning a landslide election, the Thaksin government began the EGAT privatization process again. In June, the government announced the completion of the EGAT privatization process, without strong opposition from the Labor Union or civic groups.
2005	From September 2005, FFC and CCO organized a protest against the EGAT privatization and accused the Thai government of unlawful actions in the Supreme Administrative Court. In November 2005, the Supreme Administrative Court took the decision to postpone the EGAT privatization process for the court's consideration.
2005	The Federation of Thai Industry (FTI) formed a network of renewable power producers and suggested the implementation of the feed-in tariff system.
2005	The Ministry of Energy established the Interim Regulator.
2006	The Supreme Administrative Court announced the final decision in cancelling the EGAT privatization process due to unlawful process.

f) Conclusion

The latest period becomes the period in which all policy actors play crucial roles in shaping the policy directions of the Thai power sector. It is the period in which we experience the strongest political powers and, at the same time, the more expanded roles of civic movement. It is a period in which policy-making is increasingly out of the full control of government or authorities and closed door negotiation is combined by more public negotiation and deliberation. However, it does not mean that the government and EGAT have lost their control and power. Oppositely, they are still more powerful than others, but their power is now limited through some specific political or public conditions. Evidently, their predominant power and rationality are now increasingly subject to questions and discussions, leading to more space for public participation, deliberation, and new policy directions.

4.7 The Structure of the Thai Power Sector

a) Centralized Power System in Thailand

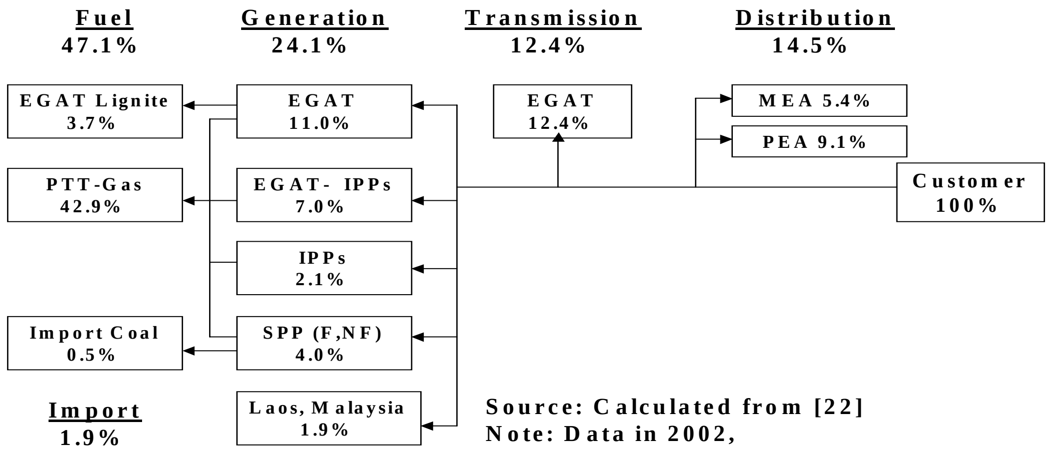
From the 1960s, the Thai power system has been based on three state-owned enterprises, namely the Electricity Generation Authority of Thailand (EGAT) for generation and transmission, the Metropolitan Electricity Authority (MEA), and the Provincial Electricity Authority (PEA) for distribution in the Greater Bangkok and other areas, respectively. Moreover, the supply of natural gas, the main fuel sources for power generation, is also controlled by the Petroleum Authority of Thailand (PTT)[50] .

From 1992, the private power producers have been allowed to generate power and sell power to the grid through EGAT. In 2005, around 50% of the power generation were still operated by EGAT and 39% were controlled by 6 independent power producers (IPPs)[51] , of which the 2 largest IPPs were EGAT's subsidiaries (equal to 27% of the total power generation). All of them relied on the centralized power and fossil fuel technology. The contribution of small power producers (SPP) using renewable energy and co-generation was only around 10%[52].

Of the total turnover of almost 240 billion THB in 2002, these four enterprises and subsidiaries absorbed more than 90% (Figure 4.2). The total profit margin within the system summed up to 38% of the turnover[53]. The high control of power and profit, combined with a new trend in vertical integration, like establishing new IPPs, and capitalization in the stock exchange market, encourage them to maintain the fossil fuel-based centralized power system, as their path dependency. Unsurprisingly, EGAT's contribution to renewable energy generation is only 0.54 MW and 1.8 GWh a year[54] .

Recently, EGAT has proposed a future structure of the power generation sector with even more centralized power plants[55]. In EGAT's Power Development Plan 2004 (PDP2004), the contribution of distributed generation will be reduced from 11.3% in 2003 to 6.9% in 2015. According to PDP2004, new installed power plants will mostly be developed by new IPPs based on centralized power generation, through the bidding program of the EGAT power purchasing agreement. It is quite clear that the market structure and the planning process of the Thai power sector provide little room for distributed generation, including renewable power generation.

Figure 4.2 Turn-over Structure in Thai Power System



Source: Calculated from [22]
Note: Data in 2002,

b) Private Sector: High Profit, But Not Yet High Power

As mentioned earlier, since the previous period, the liberalization process has introduced new players on the energy policy stage, the private sector. Due to the main differences in their structures, sizes, and interests, it is necessary to divide this sector into four main groups as follows;

- **EGAT subsidiaries power producers**, namely EGCO and RATCH, who share 22% of total installed capacity and 27% of total electricity sales. These EGAT subsidiaries become the largest private producers. Moreover, they still hold the major share in several IPPs and SPPs (see Figure 4.3). It is possible to perceive them as EGAT's key players to gain profit from privatization policy and maintain EGAT's power over the power market.
- **Independent Power Producers** (IPP) who are altogether now 4 companies and now share 9% of total installed capacity and 12% of total electricity sales. Their power plants are mostly larger than 700 MW, based on coal-fired and natural gas combined cycle technologies. These producers are mainly the joint venture between trans-national companies, Thai large business firms, and EGAT and PTT subsidiaries (also see figure 4.3).
- **Small Power Producers** (SPPs) who own the combined heat and power plants, which are lower than 90 MW of power sold to the grid. Generally, they are big industrial companies in Thailand. All together (31 firms), they share around 8% of installed capacity. These SPPs get the highest buying price because of, according to NEPO, their higher efficiency in producing both power and heat for industrial estates. However, these power producers are still based on fossil fuel technology. As mentioned earlier in 1998, Cabinet had a resolution for EGAT to stop buying power from new co-generation SPPs, due to a high reserve margin in the power system.
- **Renewable Small Power Producers** (Renewable SPPs) who are also small and very small power producers, based on biomass and other renewable resources. Mostly, they are recognized as the non-firm SPP,

since most of them cannot provide firm power generation to EGAT. Consequently, they get the lowest buying price from EGAT. According to this rule, it is clear that their environmental and social benefits are not included. Partly because they are small (all together 103 firms and share only 2% of install capacities) and, for some of them, power generation is only a by-product of their main business, they are less organized and also less powerful. Hopefully, the initiatives from FTI, in 2005, in setting renewable energy group will lead to more influential participation in the policy process.

It can be seen that, although the private sector becomes the new major player, this sector cannot change much the power relations in Thai energy policy, since more than 80% of the total installed capacity is still under control of EGAT and its subsidiaries. Furthermore, the centralized powerful organizations, like PTT and EGAT, also hold a major share in several private producers, both IPPs and SPPs as shown in Figure 4.3. In fact, they are less likely to be called “independent” power producers, due to their strong business connections with EGAT and PTT. Oppositely, the renewable energy producers are still too small, discriminated, and less powerful. Under this condition, without any new policy driving forces, it is hard to expect any significant changes in the Thai energy policy coming directly or mainly from this private sector, at least in the near future.

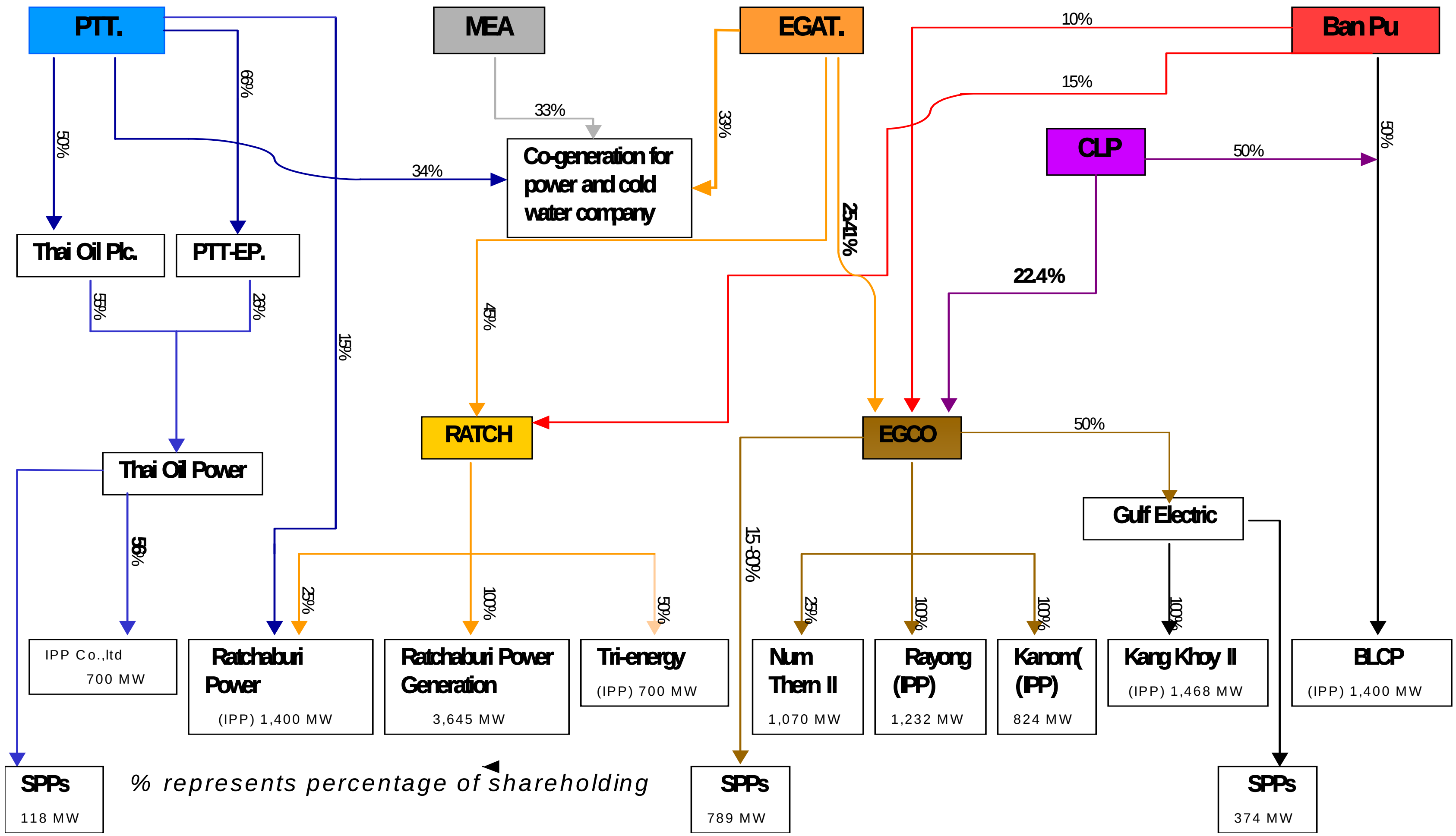
c) Confusing Policy Roles

Apart from a superior market structure, the powerful state-owned enterprises, like PTT and EGAT, also have crucial roles in regulation and policy formulation (the detailed discussion will be presented in Chapter 7), which can easily turn out to be an institutional barrier to other competitors. The EGAT’s authority in power plant approval is one good example of the conflicting roles of the Thai power sector. In the case of PTT, the obligation of EGAT to buy natural gas only from PTT is another good example. Before 2001, only NEPO had more or less balanced influences on the policy formulation in the Thai power sector.

After the establishment of the Ministry of Energy in the Thaksin government, many policy roles were transferred from both NEPO and EGAT to the minister. NEPO changed its name to Energy Policy and Planning Office (EPPO). Under the new ministry, roles regarding electricity policy have been transferred directly to the ministry and the executive body. Even though EPPO may still be considered the distinct agency for energy policy and planning, there is no condition to which the executive body must formally consult or respond in relation to its proposal. Moreover, the operation of EPPO and the annual budget allocation depend upon the consideration of the Ministry of Energy.

However, since there is no provision prohibiting key personnel in the Ministry to engage in electricity business, several officials from the Ministry of Energy were designated as committee members in various companies related to the electricity sector, including PTT and its subsidiaries, EGCO, and RATCH, which may easily lead to conflict of interest issues[56].

Figure 4.3 Business Connection between PTT, EGAT, and IPPs in Thai Power Sector



Source: Chuenchom Sangarasri Greacen, 2005[57]

4.8 Evolution of Policy Processes in the Thai Power Sector

4.8.1 Linear Policy Processes

Obviously, the Thai power sector was primarily designed for the linear policy and planning process, within the full control of EGAT. As mentioned by Dr. Kasem Chatikawanich, even politicians (which certainly included the Thai government) were blocked from involving in EGAT planning and administration. This linear policy model has been supported by several techno-economic planning models and criteria, including the power development plan and a 15% minimum reserved margin in order to find the best-rationalized solutions to society. This model worked as the sole policy model during the second and the third periods (from 1957-1986).

The challenges to this model occurred in the forth period (1987-1996), when a) the World Bank and the Thai government shifted their policy towards more private sector's participation, b) NEPO was established to take care of energy policy in Thailand, and c) the Thai people began to protest against several government projects. However, the outcomes of these challenges generally ended up with the policy negotiation within the formal policy process. One of the examples is the decision to allow EGAT to establish EGCO, as the first IPP, in order to push the IPP-purchasing policy. In other words, the other sectors in Thai society still never got involved in the policy process at that moment.

The real challenge to this model, perhaps, has been more clearly seen after the economic crisis, in the fifth and sixth periods (1997-presents). This is basically because the previous promises of the government seem to provide the opposite results and consequently economic hardship to Thai economy. The IPP policy with the fully attractive benefits to investors contributed to the tariff surge and EGAT's financial burden rather than to alleviate these, as claimed before. As discovered by SENT and FFC, the fuel adjustment mechanism incorporated several cost items apart from the fuel fluctuation as it used to be in the beginning, allowing EGAT to charge consumers for excessive costs. The load forecast was normally too high compared to the actual ones, leading to an over-investment and later tariff surging. The study of the World Commission on Dam in 2001 also questioned EGAT's and the government's decision criteria and analyses of the Pak Mun Hydro power plant project, because the dam hardly showed an economic justification (even without consideration of its negative external costs).

Despite the strong criticisms, both the Thai government and EGAT still try to keep the linear policy model, such as power development planning or later EGAT privatization, as the main policy process. They do not allow meaningful participation from other sectors in society, especially from the civil society sector.

In the latest period (2001-present), this linear policy model faces the strong political power of the Thaksin government. In the Thaksin government, the political vision like "the national champion" can change the policy direction without conventional rationalization model or analysis. The best example is the EGAT privatization, which was introduced without any policy comparative study. Consequently, the present EGAT power development plan (PDP2004) was set up to support the EGAT privatization and its deals (such as the EGAT's quota of 50% construction of new power plants) without the least-cost analysis, as normally done before.

4.8.2 Policy Negotiation

With the decline of the linear policy model, policy negotiation seems to be more obvious and perhaps becomes the most relevant policy model the in Thai power sector. In fact, the policy negotiation model has been increasingly visible through the struggles over the privatization (and anti-privatization) policy, as already explained before.

The policy negotiation model seems to start behind closed doors, before opening the doors to more public negotiation and participation. In the closed-door negotiation, obviously, the protection of vested interests and the profit sharing of powerful newcomers are discussed with clear threats to public interests. During 1992-1997, the IPP policy was developed to provide very attractive returns to private investors and the first private investors are EGAT's subsidiaries. In recent years, EGAT was forced by the Thaksin government to privatize and, in return, EGAT will hold the rights for 50% of the new power plant projects as well as maintain several state authorities.

Later, public negotiations become more important. Public negotiations were first linked to the project resistances and then expanded to more structural issues, such as privatization policy. However, the power of public negotiation depends very much on political and economic situations in Thai society. For example, the cancellation of coal-fired power plants was highly linked to the excessive reserve margin and over-investment problem. The success of the latest anti-privatization campaign was also coincident with the sharp decline of the political popularity of the Thaksin government in the late 2005.

4.8.3 Public Resistance

After 1988 and more obvious after 1997, Thai civic movements have increasingly played a role in Thai power policy. Usually, the dynamics of Thai civic movement is the history of resistance. In the power sector, it is resistance against government policy, planning, determination, and technological development, which cause power effect on them in different ways. The resistance comes from different parts of society, namely affected communities, consumers, NGOs, and academics, who act differently in their struggles.

According to Foucault[58], analyzing the resistance can be another way to understand a new economy of power relation, by "taking the forms of resistance against forms of power as a starting point". In his own words, he suggested to "use this resistance as a chemical catalyst so as to bring to light power relations, locate their position, finding out their points of application, and methods used". In other words, he suggested that, "we can analyze power relations through the antagonism of strategies".

a) Struggles Against Forms of Exploitation

It is clear in this case that, from the starting point, the struggles in the Thai power sector come from the power effects imposed on specific actors. For example, Thai consumer organizations did not start protesting against the privatization. They initially protested against the raising of tariffs, as an unfair burden imposed on them. Or Thai communities did not start a protest against large hydro power and fossil fuel technological development, they just resisted to defend their healthy living.

This can be viewed as the "immediate" struggles. In other words, people start to criticize instances of power that are closer to them". According to Foucault, they look for the "immediate enemy" rather than the "chief enemy". Possibly, they do not expect to find an ultimate solution to their problem on a future date. From this aspect, they struggle primarily "against forms of exploitation" that separate people from what they produce and live with[59].

From this perspective, at least, two main forms of exploitation can be clearly seen in the Thai power sector. The first form of exploitation is the pricing structure, which allows EGAT and private producers to set up and maintain their high profits at the expense of Thai consumers. The second form is the environmental and resource exploitation, which leads to serious difficulties of the affected communities.

b) Struggles Against Forms of Domination

Sooner or later, after their struggles against forms of exploitation, they have to face the domination or the privilege of knowledge, societal values, and power-rationality, which tries to maintain and defend the existing forms of exploitation. Inevitably, they are now struggling "against forms of domination". The new concepts, practices, and knowledge, or so-called policy discourses, have been developed to counteract the existing forms of domination. As already seen, local communities in Thailand are quite successful in showing how local action research can be more accurate than official EIA reports done by experts, which are certainly elaborated with the aim of implementing the projects. Or SENT has suggested NEPO and EGAT to change their planning perspective and practices in order to allow the Thai power sector to fulfill various related national sustainable development goals, not just power system reliability and utilities' least cost.

Of course, the existing dominant forms of knowledge, values and power-rationality have to respond to these emerging concepts, practices, and knowledge, both in aggressive and tactical ways. In aggressive ways, it means that they ignore or deny the claims or rationality and evidence of these emerging concepts, practices, and knowledge. In tactical ways, it means that they accept some aspects of the new emerging concepts, practices, and knowledge and, then, reinterpret or submerge these new concepts, practices, and knowledge into their own frameworks of thinking. It is clearly seen that the Thai government may accept to provide "additional" subsidy for renewable energy, as suggested by Thai civic movement, but without significant changes in the existing planning perspective and monopolistic structure.

On the one hand, this may be regarded as the difficulties to maintain the core values of their emerging concepts, practices, and knowledge. However, on the other hand, it may also be recognized as a process of fine-tuning their emerging discourses to be able to fit within specific institutional contexts and to be interactively appropriated by different actors in society.

c) Struggles Against Forms of Subjection

Probably, the most challenging struggling for Thai civic movement is the struggles "against forms of subjection", which control and manipulate their ways of thinking through the economic and social abstractions of who they are and what their lives should be and aim for. For example, Thai civic movement has challenged the subjection of the Thai government on "what should be the meaning of development and national progress" by questioning the concept of "pre-emptive expansion" and proposing the concept of "sustainable". Another example is the success of Thai local communities in moving beyond the subjection of "affected communities" to "resource owners", which can significantly shift the discussion from compensation issues into local rights, public participation, and rationality claims. It is also very important to sustainable energy development that Thai consumers look beyond the subjection of economic-textbook consumers, who pay their attention only to getting low cost electricity and consuming. For radical technological shifts, strong support is certainly needed from the "citizen quests" for a better future.

d) Transversal Struggles

One important note is that the struggles, as we saw in Thai energy policy, are "transversal" struggles. The struggles over the forms of exploitation, domination, and subjection have not been limited to one sector and to one country. In Thai society, these struggles have also happened in other sectors. In the energy sector, the international networks can bring new concepts, knowledge, and practices to Thai society. The success and failure of the struggles in one sector or country can be very good lessons learnt or spill-over effects useful to the struggles in other sectors and countries. This note asserts the importance of the integration of struggling processes in one specific area with other and broader struggling processes within human society in general.

4.8.4 Public Deliberation

It is hard to exclusively distinguish between public negotiation and public deliberation. Normally, due to the pre-domination of the linear policy model and the unbalance of power in the Thai power sector, public deliberation hardly occurred without public negotiation. Evidently, public deliberation is an outcome of, first, public resistance and, later, public negotiation. Although, in principle, public deliberation notably emphasizes intellectual activities of controversial decision-making processes, in reality, due to the mixes between power and rationalities, public deliberation always occurred in the nest of political conditions and negotiation.

It is clearly seen in the last period (2001-present) that some decision-making processes have become much more open, transparent, reflective and deliberative discussions within the public forum or space, than was previously the case. The televised three-hour debate over the two controversial coal-fired power plants in 2001 is one of the good examples. Moreover, as warned in Chapter 2, we should not limit the forms of public deliberation to only direct or face-to-face deliberation. Several attempts, which try to publicly analyze and achieve a better understanding of the policy issues in different perspectives, should also be included as activities in public deliberations. By this viewpoint, the petitions and protests of consumer organizations also brought further and better understanding of the privatization policy to Thai society.

However, in the present political conditions, the emerging of public deliberation cannot be ensured in all important policy issues. As earlier mentioned, the pre-domination of the linear policy model and the unbalance of power in the Thai power sector are two main obstacles to stimulating public deliberation in the Thai power sector. Moreover, the technically complicated nature of policy issues in the power sector also potentially inhibits the thoughtful public deliberation, especially when the technical complications are over-emphasized. Last, to be effective in terms of policy-making, public deliberation certainly requires public attention and, therefore, requires the active involvement of mass media, which is highly uncertain due to the competition of different public issues in the limited mass media space and resources.

The experience and potential of public deliberation in the Thai power sector during these three years of study will be analyzed and presented in Chapter 8.

4.9 Policy Discourse Analysis

Policy negotiation is not only the process of protecting specific interests but also a battlefield of policy ideas. Within the last four decades, Thailand's economic and power sector curves have been turned up and down. In each turn, new development languages or new concepts have been tried to provide the better explanations of the situation and the better perspectives to cope with the situation and search for a better future for Thai society. These new languages or concepts lead to the new practices in Thai energy policy in terms of agents, knowledge, and institutions. For example, in the last two periods, liberalization concepts have led to the introduction and growth of private power producers. Concurrently, the concepts of sustainable development and public accountability have led to new roles of civic movement in protecting environment from power expansion projects and in developing renewable energy technology and sustainable energy systems.

It is clear in the case of the Thai power sector that these new languages and concepts have been introduced and carried out by different actors according to different values and norms. Therefore, they usually refer to different policy directions and contest each other in gaining public and political support through public campaigns and deliberations. In their contestations, the different (or sometimes conflicting) series of evidence have been presented to the Thai public in connection with their underlying values and norms. The strong evidence (and its values) can certainly lead to changes in public opinions, societal values, and public policy over specific issues. As seen in Thailand, for the Thai public, power expansion projects are now no longer perceived as absolutely good for the Thai people, after the impacts of the previous projects have been clearly presented.

However, at the same time, this new evidence has normally been evaluated and criticized by pre-dominated knowledge forms, truth criteria, and societal values. In the short term, conflicts between the new evidence and the old forms of knowledge and truth criteria may end in any specific public decision-making, usually depending on the power rationality and political situation in each case. In the long term, the conflicts may lead to the development of new forms of knowledge, values, and truth criteria within society.

The interconnection of languages (or concepts), practices, and power rationality should be analyzed as "policy discourses". The discourses "are the process of articulation in specific vocabularies and transformation into social reality", both in terms of policies and practices, "through the actions of social agents within different institutional contexts"[60], including different and diverse policy driving forces.

In this study, four policy discourses, playing crucial roles in Thai power policy are summarized from the previous historical analysis. By analyzing the policy discourses, Thai society may achieve a better understanding of the connection of power rationality, concepts & practices in the Thai power sector, as explained above. Thus, it urges Thai society to take a closer and deeper look into the planning and development of the Thai power sector, instead of handing it over to the government and private sectors, as mainly done before. It also provides the alternative power rationality, concepts & practices for energy development in Thai contexts. To pursue the new power rationality, concepts & practices, the new forms of knowledge and truth criteria have been developed and established, leading Thai society to gain more tools to understand the different aspects of reality and to achieve a desirable future.

4.9.1 Policy Discourse I: State Monopoly Discourse

The first policy discourse, state monopoly discourse, was developed together with the formation of EGAT and the main structure of the Thai power sector during 1956-1969. As a result, this policy discourse has been embedded in EGAT's way of thinking, planning and managing the power system, as well as EGAT's positions in several policy debates. Both EGAT executives and the Labor Union have used this policy discourse in public discussions and debates in the last three decades.

The discourse represents the grand idea that "since the power sector is very essential to national security and economic growth, the power system reliability must always be ensured". As stressed by Dr. Kasem Chatikawanich, "the main testament for EGAT is no shortage of power". According to this discourse, the best way to ensure system reliability is to equip the state-owned enterprises with essential technical knowledge and skills and allow them to plan and manage the power system, without interruptions from politicians or uncontrollable market mechanism. This is why this discourse is referred as the state monopoly discourse, in this study.

In practice, EGAT has also fulfilled this mission with a very good record of system reliability. Therefore, during the EGAT privatization debates, the message linking to national security and power system reliability was always in focus, as shown before. Obviously, the failures of the power pool model in California and the privatization in Argentina were highly emphasized by this policy discourse. In various cases, the policy message or framing are closely linked to the notion of "economic nationality".

In terms of planning, the "predict and provide" approach is the main approach in this state monopoly discourse. The main idea is to predict demand growth and later to provide the increasing demands though new investment in the expansion of power-generating capacities. The 15% reserve margin has been set as a main criterion for ensuring the availability of power in the system. During the summer of almost every year, EGAT announces the new high record of power peak demand and persuades to the new investment. Since, as stressed before, this discourse believes that "no power is the most expensive one", the investment in the power sector is always recognized as a good deal for Thai economy.

Technologically, this policy discourse preferred the large fossil-fuelled and hydro power technologies. As represented in the EGAT power development plan, only these technologies are perceived by EGAT as dependable options. Apart from the dependability, the economy of scale of large fossil-fuelled and hydro power technologies has also been highlighted. The EGAT's technological choices always vary from oil, to lignite, hydro power, and gas. In today's facing of high natural gas prices and limited gas reserves, the imported coal technology is suggested.

The role of EGAT in the renewable energy development is thus unsurprisingly minimal. The concept of "dependable" capacity, or "firm VS Non-firm SPPs", was also used by EGAT as the main criterion for setting purchasing prices for SPPs, leading the renewable power producers into the inferior conditions due to their higher variations in resources and power generation (discussed in detail in Chapter 7).

At the same time, this policy discourse has always emphasized the importance of "cheap electricity" in stimulating the economy and societal welfare. EGAT always claims that the Thai electricity tariff is among the lowest ones in the Asia-Pacific region. This "cheap electricity" argument was used both in the debate on anti-privatization and in refusing more contributions from cogeneration SPPs and renewable energy in the Thai power system.

In this policy discourse, the environmental concerns basically work at the project level and are normally handled by end-of-pipe technologies. There is no space for environmental consideration in the PDP process or in other strategic planning processes.

In short, this policy discourse believes in the centralized power system with the authorized monopoly power of the state-owned enterprises in order to ensure power system reliability and cheap power, both in terms of planning and management. Certainly, privatization and renewable energy are not the right policy directions in their perspective.

The domination of this policy discourse was obvious until the beginning of 1990's, when the World Bank and the Thai government changed its policy directions towards more privatization process. This policy discourse was rather weak during the domination of the power pool model (discussed later) in 1997-2000, due to EGAT's financial hardship. Later, during the Thaksin government, the EGAT executive had given up on the predominant notion of state monopoly to join the Prime Minister's vision of private monopoly as a national champion. In other words, now only the EGAT Labor Union is still maintaining this discourse, but with support from the civic groups promoting the economic nationalism ideology.

Therefore, like other nationalism discourses, this policy discourse is still somehow powerful in Thai politics, especially when EGAT has now moved back to state monopoly after the court rule in March 2006. However, this model is now in difficulties in providing the long-term answer. The power market has been continuously changed in various dimensions. The centralized power system with large-scale and fossil fuel technologies is no longer the most appropriate answer to solve today's problems. The development of a decentralized power system and renewable technology is now forming part of reality, but is still blocked by existing institutions. The full utilization of the financial market needs more flexible organizations than state-owned enterprises. The democratization process asks the Thai government to make a clear distinction between the roles of operational, planning, and regulatory organizations. Certainly, the existing structure in the Thai power sector can no longer be the "bottleneck" in any perspective.

4.9.2 Policy Discourse II: Power Pool Discourse

The second policy discourse, the power pool discourse, has been strongly influenced by the ideology of liberalism during the 1990s. The suggestion of the World Bank and IMF, the policy direction of the Chuan government, and the dominant role of NEPO in policy-making are the three main forces that place the power pool model on the top of the policy agenda and dominate policy discussions, especially during 1997-2000.

In this policy discourse, like other liberalist discourses, monopoly is always blamed to be the main cause of inefficiency. In order to promote more efficiency, competition is needed. Furthermore, the market mechanism must be developed to stimulate and promote the competition within the power sector.

Practically, this policy discourse began with allowing private producers to take part in the power-generating business, as seen in IPPs, SPPs, and VSPPs regulation. The next step is to unbundle the power sector by separating generation and transmission, which according to this discourse will promote fairer competition between EGAT and other producers. Moreover, in order to promote more competition, EGAT is recommended to separate into three generating companies. Ultimately, this policy discourse aims to establish the "power pool" as the centralized system operator instead of EGAT.

Compared to the state monopoly discourse, this policy discourse has paid more attention to the development of renewable energy. Although this discourse seems to view renewable energy as a minor supplementary option, at least, the positive externality of renewable energy is recognized, leading to the later introduction of a 5-year subsidy to new SPPs and VSPPs. However, even within the 5-year subsidy program, the bidding, as a symbol of competition, must be implemented. In other words, according to this policy discourse, renewable energy must be developed within a competitive environment with some reasonable supports and market mechanisms will then determine the future of renewable energy.

This idea also implies that at least some environmental aspects are considered in the introduction of new public regulation. However, these environmental concerns still cannot go deeply into the planning stage, as they are still ignored by EGAT PDP. Perhaps, it is also partly because, according to market mechanisms, the centralized PDP will gradually lose its roles. Therefore, this policy discourse did not attempt to improve its practices.

As earlier mentioned, this policy direction gained fully support from the Chuan government and was planned to be fully implemented in 2003. However, after losing its ground together with the former Chuan government and later NEPO, the power pool model seemed to fall off the public agenda without any signs of return yet. Apart from political situations, the worst experiences in California and new academic finding have warned that possibly the power pool is still too complicated and risky to be implemented in Thai society.

Logically, since this model previously reached the top of the public agenda together with the "liberalization" policy, if it may return, it should return under the pressure of "liberalization". Although, in general, the pressure of liberalization seems to be lower according to Thailand's better economic status, the free-trade agreements with various developed countries may turn out to be the pressure for "liberalization" in the future.

Last, although its future domination is still unclear, several concepts such as fairer competition and the control of monopoly power are still influential in policy debates included in the latest anti-privatization under the private monopoly model.

4.9.3 Policy Discourse III: Private Monopoly Discourse

The third policy discourse, the private monopoly discourse, was introduced by the Thaksin government and rapidly dominated the policy direction and discussion due to the strong political power of the Thaksin government.

As a monopoly idea, this policy discourse shares several similar policy directions with the state monopoly discourse. In the national energy strategy launched in 2003, the first slide was a picture from New York's 2003 blackout, aiming to frame the importance of power system reliability. In this policy discourse, the centralized power system and the centralized authority, like EGAT, are very important and even more important if Thailand wishes to become an energy hub of the region. In fact, the concept of energy hub and regional market is explained as the way to further gain economy of scale for the Thai power system. Therefore, opposite to the power pool model, this policy discourse protects the monopoly structure of the existing power structure. This is also a key point that leads the EGAT executives to switch from state monopoly to private monopoly under the threat of the power pool model[61].

The main difference begins with the idea of the competitiveness of the nation and the energy hub. Both new policy framings suggest that the protecting of the monopoly structure for the sake of power system reliability is no longer adequate. To be competitive, EGAT needs to expand beyond the borders and create new forms of management. To fuel its expansion and new management, the private monopoly model and the capitalization in the stock exchange are therefore recommended.

With this logic, the EGAT privatization is certainly an inevitable policy direction. The notion of "national champion" has been introduced to provide a better policy framing or a better policy explanation of this model. The word "national champion" also aims to offset the strong opposition of nationalist activists. However, it does not seem to work well in this aspect. The strong protest against the selling of national public services still echoed during the recent anti-privatization campaign, as seen in Figure 4.1.

It is also different in terms of main fuel source. In the call for the national champion, the Thai power system is planned to be more dependant on natural gas, which also monopolized another national champion, PTT, as seen in PDP2004. In PDP 2004, the least-cost utilities planning, a main planning tool in the state monopoly discourse, was still applied but only within the scope of predetermined policy directions, including the more reliance on natural gas. This provides a clearer idea of how private monopoly businesses influence the policy direction and would run the Thai power sector.

Another main difference from the state monopoly discourse is the realization of renewable energy potentials and their benefits. In the private monopoly model, with the phase "high potential, but low development", the full potential of renewable energy (around 15,000 MW) has been highlighted by the Ministry of Energy. The benefits of renewable energy are also broader perceived including economic advantages in higher oil price situations and as a main source of competitiveness of the nation. Through the announcement of a national energy strategy, the target for renewable energy development was firstly set.

Undoubtedly, this policy discourse has strong political support from the present government. The explanation of the idea is based on the political and business vision rather than on any economic principle, as seen in the power pool model, or technical analysis, as seen in the state monopoly model. As the visionary model together with strong supports from the government, it always sounds nice. However, without clear and firm foundation, this kind of political vision model sometimes has difficulties in providing satisfactory and accountable answers to the whole society, both in principle and at the practical level. For example, it is hard to explain how the fair competition of other power producers will be ensured in this model or how public interest will be protected, while the private monopoly, like EGAT, also holds the state authorities.

Therefore, although political factors are powerful in supporting this policy discourse, due to its unclear principle, it is also quite politically fragile. Especially, if the opponent can raise the critical questions in the right timing and manner, as successfully done in the recent years.

4.9.4 Policy Discourse IV: Decentralization Discourse

The last discourse, the decentralization discourse, has emerged from the public resistance of the civic movement since 1988 and more obviously after 1997. As the outcomes of struggle processes, this discourse takes a longer time in emerging. It began with the opposition to specific projects and policies before developing alternative policy ideas and gradually accumulating them into the full set of the policy proposal in 2004, as explained already.

This discourse emphasizes three main concepts or principles. Firstly, "fairness" is always highlighted in this discourse. According to this discourse, the main cause of the problems in the Thai power sector is the monopoly power, which blocks more progressive solutions in the society. As mentioned by Chuenchom Sangarasri Greacen, the founder of the Palangthai group, "The main obstacles of renewable energy do not link to its cheap and expensive costs, but mainly link to the monopoly power in Thai power structure"[62]. Therefore, this policy discourse has suggested to break down centralized monopoly power by separating generation and distribution and providing fair grid access to all power producers, especially the less powerful ones (detailed will be discussed in Chapter 7).

However, this policy discourse disagrees with the power pool ideas in allowing market mechanisms to regulate the power market, since the word "fairness" in this discourse is interpreted beyond just price competition. Fairness must include the societal rights to protect and promote better public interests, including better environmental and social consequences of power generation. Moreover, under the domination of oligopolistic power and tensed business connections between IPPs, it is hard to imagine how the fairness will be ensured within the power pool model.

The second concept is "sustainability". Since the establishment of SENT in 1998, sustainability is always an issue in this policy discourse. In practice, this policy discourse fights for more contribution of distributed power and fair institutional framework for renewable energy. Apart from environmental sustainability, this discourse also criticizes the economic sustainability of the existing power system, by showing the expansion of its investment burden, fuel cost risks, and more imported burden, especially in a high oil price situation. After 2001, this discourse has also incorporated the concept of healthy public policy into their "sustainability principle", by presenting more evidence on the health impacts of different power development project.

The last main concept is the notion of "good governance", which includes three relating principles of transparency, participation, and accountability in the decision-making and regulating process. In general, this discourse urges transparency, public participation, and accountability in the decision-making process of the Thai power sector. In specific, the establishment of an independent regulatory body and an independent system operator is highly recommended. Moreover, the processes of demand forecasting, power development planning, renewable energy subsidies, and IPP bidding require more openness both in terms of participants and alternative proposals or inputs. In 2005-2006, this policy discourse succeeded in conducting the research on "Electricity Governance of Thai Power Sector", which elaborated in more detail how the concept of good governance should be interpreted and operationalized in the Thai power sector. As already mentioned, this attempt also links to the cancellation of the EGAT privatization.

This policy discourse is referred to as the "decentralization" discourse, because, unlike the three previous discourses, the centralized system has been criticized by this discourse as the main source of problems, no matter if it is run under state monopoly, private monopoly, or power pool's market mechanism. Therefore, it is very important to de-entrap the Thai power sector by allowing more producers and stakeholders, especially the smaller and powerless ones, to join in the fair, sustainable, and good governance bases.

Up to now, unlike the previous policy discourses, the decentralization discourse has never dominated the policy directions in the Thai power sector. It usually works as counterarguments of main policy discourses, which, in some cases, become inevitable facts or logics in the formal decision-making process, as recently seen in the establishment of an interim regulator or the cancellation of the EGAT privatization. In the near future, it is less likely that this policy discourse will be systematically translated into formal policy directions. It will be more likely to sporadically incorporate point-by-point into formal policy directions and institutions. Perhaps, this is a realistic way for a politically powerless policy discourse to operationalize its persuasive ideas under less favorable conditions.

4.10 Conclusion

Throughout the chapter, the policy processes in the Thai power sector have been historically and conceptually analyzed, based on a deliberative policy analysis. It is quite clear that through their dynamics, conflicts, and contestations, policy processes in Thailand become more complex and, at the same time, more open to broader participation and alternative policy directions. Although the external factors and government policy directions are still influential, the battle of ideas, interpretations, policy discourses, and public deliberations becomes a more powerful factor in the policy processes of the Thai power sector. Table 4.7 summarizes the key ideas, languages, actors, and policy proposals of the four policy discourses, which play their crucial roles in the recent history of policy changes.

In the future, the dynamics of driving forces and policy discourses will continue to play a crucial role in energy policy. The Thai government, the private sector, and the civic movement will continuously seek to explain the new situations and make suggestions for a desirable future. The relevance and appropriateness of the knowledge they make to connect and convey power rationality, concepts & practices within different future driving forces and situations will significantly determine the success of their attempts and shape the future of the Thai power system.

The next two chapters, Chapters 5 and 6, will apply strategic impact assessment to analyze the future impact of these different policy directions, with the focus on the power development planning. Although the aim is clearly to compare the impacts of different policy options, it should be emphasized that this study will try to provide the final answer to Thai society (by claiming the best solution for the society). Oppositely, the impact analysis should be viewed as an attempt to facilitate an enrichment of further public deliberation on related policy issues, with the clearer idea of the possible alternatives and their consequences to society.

Table 4.7 The Comparison of Four Policy Discourses in the Thai Power Sector

Item	State Monopoly	Power Pool	Private Monopoly	Decentralization
Main Languages or Policy framing	- National security - Public services - Economic growth	- Efficiency - Competition	- Competitiveness of the nation - National Champion - Regional energy hub	- Fairness for all stakeholders - Sustainability - Good governance
Main Rationale for policy/planning	- Power system reliability - Economy of Scale	- Competition-led improvement	- Power system reliability - Expansion into regional market	- Democratic and integrated planning - Sustainable development
Actors	- EGAT executives (before 2003) - EGAT Labor Union	- NEPO - Chuan Government	- Thaksin government - PTT - EGAT Executive (from 2003)	- Civic Groups (NESAC, FFC, CCO, SENT, HSRI, Palangthai
Proposals for Market Structure	Centralized system & state monopoly	Centralized market mechanism	Centralized system & private monopoly	Decentralized power system
Proposal on EGAT privatization	No Privatization	Privatized and broken down EGAT	Privatized but no separation of EGAT	No privatization but separation b/w Generation and Transmission
Proposals for planning process	Centralized planning, like PDP	Market mechanism	Centralized planning, like PDP	Integrated and participatory planning
Proposals for future investment	Pre-emptive expansion	Expansion through market signals	Pre-emptive expansion	Moderate strategy
Preferable future fuel source	Shifting to Imported Coal	Shifting to Imported Coal	Stay with Natural Gas	Switching to Renewables
Environmental and Health Issues	Focus on project level	Focus on project level	Focus on project level	Focus on policy and planning level
Renewable energy development	Limited	Depend on market and reasonable subsidies	High potential and need of target and policy mechanism.	High potential and need of fair institution and policy mechanism.
Domination period	1957-1991	1992-2000	2001-2005	Not yet dominate the policy direction

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Chapter 5
Analytical Framework for Strategic Impact Assessment

The policy analysis in the previous chapter provides an insight into how different groups in Thai society interpret the concept of power development policy differently, and how these interpretations contest and interact with each other to construct social realities in the Thai power sector. Certainly, different policy interpretations will lead to different policy recommendations and actions, which, consequently, will result in different impacts on Thai society.

Therefore, an understanding of different policy discourses is still not enough to develop a healthy public policy in the Thai power sector. According to the concept of healthy public policy, the systematic assessment of health impacts of different policy proposals is needed to ensure that the health aspect and healthier options will be taken into account in the policy process. At the same time, since healthy public policy also aims to make a healthier option an easy option to make for decision-makers, this systematic impact assessment cannot be focused only on the health aspects, but also on other dimensions of policy formulations, including contestable aspects of policy discourses, as learned from the previous chapter.

Although, like other policies, power sector policy is a multi-facet process, the formulation of a power development plan (or PDP) can be recognized as one of the most concrete or practical-oriented aspects of the policy process, which is of particular interest to strategic impact assessment. This is mainly because, as a strategic investment plan, the power development plan determines the types of power plants, technologies, and power producers (including IPPs and SPPs) in which the plan will invest on specific scales and at determined times. Therefore, from a broad policy direction perspective, the PDP provides a concrete step towards future realities in the competing public policy process.

Within the four policy discourses described in the previous chapter, three discourses have paid serious attention to the formulation of a “power development plan”, which will strategically shape the realities of the Thai power sector. However, the three policy discourses represent notably different views on all important aspects of the power development plan, including demand forecasting, renewable energy potentials, and power market structure, as shown in Table 5.1. Certainly, these three policy directions will end up with different types of impacts on Thai society, including health impacts. Therefore, it is a good idea to analyze and compare the impacts of these three policy strategies.

In this study, the power development plan will be used as a focal point for further policy analysis with the attempt to understand the different impacts of these three policy strategies and search for the healthiest policy direction. However, since the impact assessment process is, in various cases, highly contestable and can (explicitly or implicitly) link to specific policy assumptions and consequently specific policy recommendations, it is necessary to determine how the impact will be assessed and under which policy and scientific assumptions. This chapter will provide an analytical framework for strategic impact assessment by applying the concept of strategic environmental assessment (SEA), as explained in Chapter 3. Specific focus will be placed on the power development plan and health impact analysis.

Table 5.1 The Different Views and Directions of the Four Main Policy Discourses in the PDP Formulation Process.

Aspects in PDP Formulation	**State Monopoly**	**Power pool**	**Private Monopoly**	**Decentralized power**
Importance of PDP in system planning	Very important	Not so important, market can decide.	Very important	Very important
Investment Strategy	Expansionists	Expansionists	Expansionists	Moderate
View on the appropriateness of the present demand forecasting	OK	OK but not necessary, since market can decide	OK	Systematic over-estimation lead to over-investment
Power Market Structure	Centralized by EGAT	Centralized at power pool	Centralized by EGAT co, ltd.	Decentralized
Potentials of Renewable Energy	Limited	Depends on market and policy	High Potential	High Potential
Main Fuel Sources of power generation	Increasing of coal in the fuel mix.	Depend on market, support differentiation to coal	Natural Gas	Introducing renewables and distributed power
Consideration of Environmental and Health aspects	Should be considered at project level (not PDP level)	Should be considered at project level (not PDP level)	Should be considered at project level (not PDP level)	Should be considered at strategic level, such as in PDP.
PDP-Options for Impact Assessment in this study	PDP-Coal	-	PDP-Gas	PDP-Renewables

Source: Summarized from Chapter 4.

The chapter will begin with the introduction of the specific SEA applications in this study, which will be designed and explained. Then, the formulation process of a power development plan in Thailand will be presented. After that, three PDP options, which derive from these three policy discourses, will be described and discussed. Later, the detailed discussions on the analytical framework in each aspect will be explained, i.e. environmental, health, economic, resource, and social aspects, respectively. In the last section, the process of public communication as a main component of both SEA and deliberative policy processes will be described.

5.1 SEA Applications in This Study

Along with the conflicts over the power plant projects, Environmental Impact Assessment (or EIA), legalized by the National Environmental Quality Act in 1992, is always the issue of debate and criticism, as described in the previous chapter. In general, EIA in Thailand have been conducted with very limited public participation and transparency. Moreover, several EIA reports of power plant projects have contained obvious and serious mistakes leading to public mistrust of the EIA process and its outcome[1].

At the same time, since the power system needs a long-term investment plan with the clear schedule of each power plant project, EIA seems to be inadequate to facilitate public discussion at the policy level. A more proactive approach of impact assessment is thus needed in the strategic planning of the Thai power sector[2].

Since SEA is a tool for searching for opportunities rather than just impacts, it is certainly useful for facilitating sustainable energy policy and planning in Thailand. The Thai government has established a clear vision for sustainable development from the National development plan to the ministerial level, as already pointed out. The critical task remaining is the bridging of this sustainable development vision and a sustainable energy strategy. One of the best ways to fulfill this task is to assess long-term societal impacts in all aspects, thus aiming to promote the policy options which support a sustainable future.

5.1.1 National Vision and Goals

For Thailand, the good starting point for SEA is the national vision of development. The 9th National Development Plan (2002-2006) clearly defined the king's philosophy of "Sufficient economy" as the country's development vision. According to this sufficient economy philosophy, moderation and due consideration in all modes of conduct of the populace should be promoted. Concurrently, the development process should incorporate the need for sufficient protection from internal and external shocks, and lead to the development of self-support and self-reliance. It should also establish development objectives and targets, which are closely related to the development of sustainable energy. For example, the development target of (a) 1-2% surplus in the annual current account, (b) new employment of more than 230,000 jobs annually, and (c) the access to resources to achieve good health and education, are highly relevant to the aims and benefits of sustainable energy investment[3].

Apart from the National Development Plan, the Thai government has stated that renewable energy development is one of the three national energy strategies. The main rationales for increasing renewable energy shares are (a) to reduce the import dependence and burden; (b) to reduce environmental and social impacts of existing energy technologies; and (c) to make the best use of national resources. The Thai government also established clear targets for renewable energy, aiming to increase renewable energy shares from 0.5% to 6% in the power sector within the next 10 years. In general, the national energy strategy also aims to reduce the increase in total energy consumption from 1.4:1 to 1:1 of national income growth[4].

Both the National Development Plan and government targets are basically the creation of conducive environment for better health, therefore, they are following the same line of concepts in healthy public policy. Moreover, relating sustainable energy policy, as a healthy policy option, to well-stated national visions and goals is one of the best way to make a healthier choice an easier one to make for decision-makers.

5.1.2 Strategic Options

This study will focus on the Power Development Plan (PDP). PDP is the long-term investment plan of the Thai power sector. The PDP determines the construction of all new power plants according to the long-term power demand forecast. The decisions on energy options are made in the planning process and these include fuel and power plant technology, the power-generating capacity of each project, and the potential area for construction. Accordingly, other related energy projects, such as lignite mining, gas pipeline, as well as the expansion of the power transmission system are developed[5].

Therefore, the PDP will set forth the development direction of the electricity as well as the energy sector. Hence, the plan will determine the impacts and consequences for society, not only the emissions and other externalities but also the investment, import burden, fuel price risks, employment, technological development, etc. This is the main reason to focus on PDP as the main policy mechanism in the Thai power sector in this study.

Three PDP options have been identified in this study based on on-going policy discourses in Thailand. The first option is the existing PDP, which relies mostly on natural gas and its combined-cycle power plants. The second option reflects the attempt to promote more coal in Thailand's fuel mix, mainly proposed by EGAT. Last, the people's proposal on more renewable and decentralized power generation has been developed further to be one of the PDP options. The details of these PDP options will be presented in the next section.

5.1.3 Strategic Impacts

Since healthy public policy aims to create supportive environments for healthy living and, at the same time, to make a healthier choice an easier choice to make in decision-making, the promotion of healthy public policy needs to look beyond physical health outcomes and to emphasize more on the changes in its wider determinants of health.

Concurrently, as defined by the World Energy Assessment[6], sustainable energy means "energy produced and used in the ways that support human development over the long term in all its social, economic and environmental dimensions". Therefore, the promotion of a sustainable energy policy also requires a strategic impact assessment, which can provide the whole picture of social, economic, environmental, and health consequences.

Hvelplund and Lund also suggest that the societal objectives/goals should always be at a center of every energy planning analysis, in order to ensure that energy planning will ultimately lead to desirable outcomes, as defined by society[7].

Thus, as a strategic environmental assessment and healthy public policy advocacy, this study aims to cover the wider range of impacts. Based on the concept of ecosystem health (or holistic health) presented in Chapter 2, Figure 5.3 shows the area of impact indicators, which will be analyzed in this study. In short, these impact indicators can be categorized into 6 main areas, as follow.

- **Environmental impact indicators** are six main air pollutants, which cause climate change, acidification, air pollution and, consequently, health problems. The detailed discussion on environmental health impacts will be presented in section 5.5.

- **Health impact indicators** include mortality, morbidity and the loss of healthy life years (or disability-adjusted life years – DALYs), which in this study focus mainly on the physical health impacts of air pollution, climate change and accident. The health impact analysis will be described in section 5.6.
- **Economic impact indicators** always constitute one of the most influential dimensions in Thai energy policy-making, thus the analysis of economic impact is required in making a strategic decision. From the healthy public policy perspective, it is also essential for making a healthier choice an easier one to make. There are five economic indicators in this study; namely investment requirement, generation costs, balance of payment effect, GDP contribution, and external costs. In section 5.7, the method and assumption of impact analysis will be explained.
- **Resource impact indicators** focus on a) domestic resource share as a reflection of national self-sufficiency in power generation, b) impacts on national natural gas reserves and c) renewable energy share, both as a long-term sustainable perspective.
- **Social impact indicators** include the impact on job creation, the impact on decentralization and the impact on social conflicts. Although they are called social impacts, all of these indicators are, in reality, highly related to the health status of the population. However, due to limits of information and its high context-dependency, the related health outcomes of these social impacts cannot be quantified in this study.
- **Government Target Achievement** is the set of indicators that can analyze the possibility of each PDP option in reaching the government target of 6% renewable energy share and 1:1 energy elasticity with economic growth.

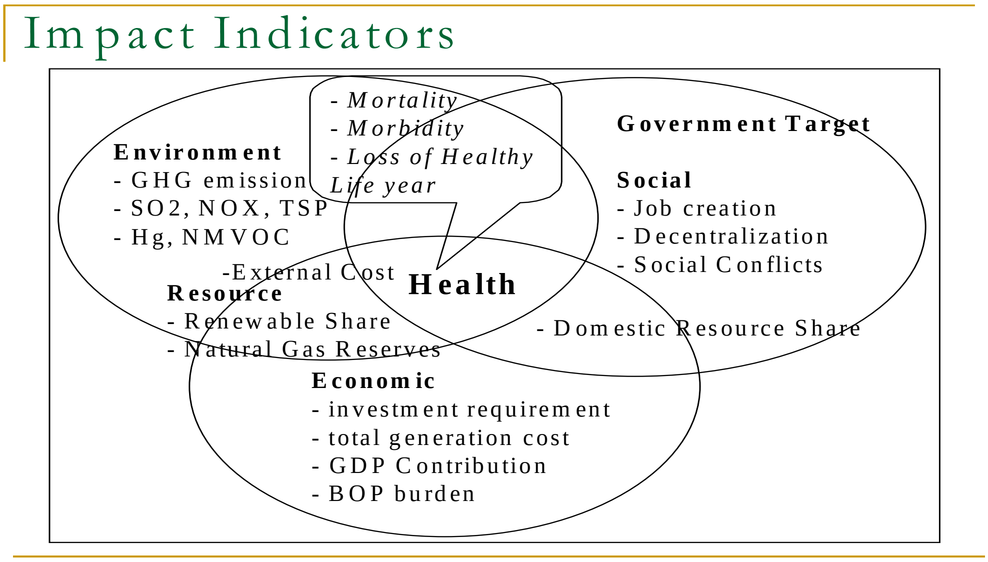


Figure 5.1 Impact Indicators in This Study

5.1.4) Strategic Position and Communication

Since this study is neither a part of the SEA legal requirement nor the formal PDP planning processes, the most appropriate position of this study is as a communicative policy learning process outside the formal decision-making process. In other words, this study has applied the decision-centered model of SEA, as explained in Chapter 3. This standing point allows the study to discuss more freely deliberative policy in Thai society, in terms of policy options, policy impacts and policy institutions and mechanisms.

As a decision-centered SEA model, two import elements must be in focus in its applications. Firstly, insightful decision-making analysis is required in order to design an effective SEA process. During the SEA process, the communication strategy is essential to the deliberative policy discussion. Since various perspectives and preferences exist in Thai society, the most important consideration is to keep the SEA process open, transparent, and communicative, in order for it to become a real dialogue (which refers to "between-reasons") and, hopefully, a continuous learning process in society. The detailed discussion on policy communication and policy action was explained in the first chapter.

5.1.5) Overall Process

In summary, the SEA process applied in this case has been conducted in seven main steps as follow;

1) **Analyzing Development Visions and Goals**. The National Development Plan and national energy strategy have been analyzed to find an appropriate indicator for strategic impact assessment as earlier described.
2) **Developing Policy Options**. In this step, three policy options of four policy discourses are defined as the main directions and priorities of power development planning.
3) **Identifying PDP Options**. Then, all these three policy options have to be readjusted to match the power planning criteria both in terms of a 15% reserve margin and sufficient energy generation to ensure system reliability. After the re-adjustment, these policy options will be presented in the form of three PDP options with investment and generation details, as explained in this chapter.
4) **Calculating Strategic Impacts.** The strategic impacts of all three PDP options will be calculated on the basis of their investment and generation plans and the coefficients of the impact indicators. The coefficients of each power technology, which will be utilized in each PDP option, are shown in the later parts of this chapter.
5) **Preparing a policy document.** After the calculation, all impact indicators of the three PDP options will be presented and compared with each other. The comparison will lead to the identification of the most suitable options in terms of health and sustainable perspective, as will be discussed in Chapter 6.
6) **Policy communication.** The result of this calculation, combined with relevant information on local sustainable energy potentials of sustainable energy trips and fairs, has been used for stimulating public discussion on the energy policy direction in each public forum in order to gain more insightful recommendations from different perspectives.
7) **Policy Recommendations and Actions.** At the end, the policy recommendation will be presented to related authorities and the Thai public through a series of policy workshops combined with some policy actions, including mass media communication to stimulate further discussion and policy changes.

5.2 Power Development Plan

As mentioned earlier, the Power Development Plan (PDP) is the long-term investment plan of the Thai power sector (normally of a 10-15-year period), which determines all new power plant projects according to the long-term demand forecasting. It also determines fuel, technology and generating capacity of each project. In other words, it represents the gatekeeper which determines the future of the Thai power sector. Therefore, it has great impacts on environmental quality, resource management, economic growth and burden, social consequences and technological development.

Since the PDP is the strategic focus of this study, this section will provide the background information about the PDP, its planning processes, its critiques and the demand for an alternative PDP in Thai society.

5.2.1 PDP Planning Process

The PDP planning process can be divided into three main steps[8], as shown below.

- **Demand Forecasting**. The first step of the PDP planning process is the forecast of the future electricity demand, which is the responsibility of the Sub-committee for Load Forecasting, appointed by the Ministry of Energy. In this step, the sub-committee also considers an expected demand side management as a part of demand forecasting, in stead of allowing DSM to be one choice of power development plan, as is usually done in Integrated Resource Planning.
- **Planning Process**. Then, the Electricity Generation Authority of Thailand (EGAT) will plan the PDP in response to the forecast with the concrete rules of a 15% reserve margin (above annual peak demand) of system reliability. EGAT will begin with its consideration of the existing power plants and the progress of the under-construction projects, which will constitute the fixed choices of the PDP. Then, different options of fuel and power plant technologies will be analyzed according to technical factors and financial viability. The data from the analysis will be entered in the least-cost programming and EGAT’s least-cost option will be selected and presented as EGAT’s PDP in the decision-making process.
- **Decision-making Process**. The political decision-making process has four main steps. First, it begins with the Board of EGAT, of which a senior governmental staff or senior academic is the chair. Then, it has to be considered by The Energy Policy Executive Committee, before going to the National Energy Policy Council, which is led by the Deputy Prime Minister. The final decision is made by the Cabinet.

5.2.2 Problems of the existing PDP process

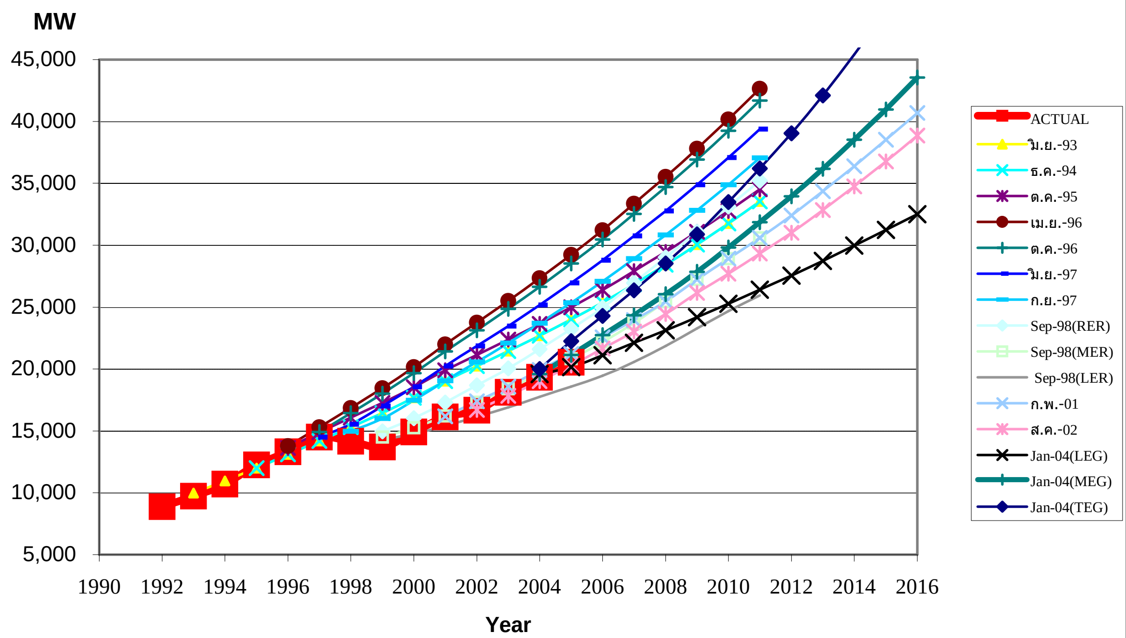
At present, the existing PDP process has faced six main criticisms, which lead to the problem of making an actual strategic decision.

First, although the electricity development has vast impacts on society, the goals of the PDP planning are still limited to only the energy security and the utilities' least-cost solution. The other important societal goals, like self-sufficient economy, balance of payments (BOP), employment, environment, and health have never been included[9].

Second, although for many years, the local people and many civil society organizations have been advocating for their participation in energy planning[10] and several cases of social conflict over the deadlock situation at the project level have taken place, there has been no public participation at all throughout the PDP process. Not only the civil society has been excluded from participation, but the parliament, senate, academics, consumer groups, and mass media, have not had any role to play in the process, either[11 12].

Third, the forecast of power demand has been too high for more than a decade, leading to excess power plant projects, over-generating capacity and also over-investment, as shown in Figure 5.2. Recently, in 2005, the difference between actual peak demand and the PDP forecast was 600 MW. Probably, the main cause of the problem is the fact that all overrun costs can be passed on to Thai customers. In other words, there is no means of public accountability in the PDP Process[13].

Figure 5.2 Previous Demand Forecasting and Actual Peak Demand



Source: Witoon Perpongsacharoen, 2005[14]

Fourth, the PDP process in Thailand is fully controlled by authorities, especially EGAT and MoEn. The PDP process never begins without the approval of these authorities or a strong political signal from the government. Although it was quite clear in mid-2005 that the demand forecasting was overestimated and that several assumptions do not match real economic conditions, EGAT still denies reconsidering and revising its own PDP[15]. In other words, there is no clear corrective mechanism within the PDP process.

Fifth, since renewable energy technologies are perceived by EGAT as being neither economically nor technically viable, the fuel and technology options are always limited to large-scale conventional energy projects, i.e. fossil fuel power plants and large hydroelectric dams. In other words, there has been no real comprehensive consideration of other energy alternatives.

Last, in the PDP of 2004, no actual least-cost option analysis was presented since several government energy policies predetermined the choices in the planning process. For example, the EGAT privatization policy with the Enhance Single Buyer model locked 50% of new installed capacity to EGAT without any least-cost analyses. Renewable energy was also locked into the 5% Renewable Portfolio Standard mechanism without considering the possibilities of moving beyond 5% of energy contribution and of being independent options rather than fixed with the new fossil fuel-based power plant projects.

5.2.3 The Need for an Alternative PDP

The concept of alternative PDP was developed in Thailand in 1999, when the Sustainable Energy Network for Thailand (SENT) proposed that Thai government should invest in sustainable energy technologies instead of investing in a controversial coal-fired power plant project. This was based on the arguments that the sustainable energy choice would lead to a higher GDP contribution to the national economy, reduce the BOP burden, create more jobs, and lower the GHG emission compared to the coal-fired power plant[16]. Concurrently, critiques of overestimated demand forecasting and the high reserve margin of the power sector were also echoed, leading to the final decision to postpone the project[17].

However, SENT’s study is still at the project level. The actual alternative PDP was suggested by the National Economic and Social Advisory Council in 2004, during the public debate on a government privatization policy for the Thai power sector. Since one of the main forces of privatization is to release public investment and debt burden, the aim of this alternative PDP was to point out how alternative PDP could reduce the investment requirement and, thus, release the pressure for privatization[18]. Unfortunately, this alternative PDP did not link to other development goals or impacts.

Concurrently, in August 2003, the Thai government launched the National Energy Strategy, which set up quite ambitious targets for energy-efficient and renewable energy development. The strategy also provided new information on the potential of renewable energy and energy efficiency as main alternatives for the power development in Thailand[19]. However, the strategy did not show the direct link between the proposal and its environmental social and health consequences.

This study resumes the idea of an alternative PDP and the National Energy Strategy by showing that an alternative way is possible and perhaps even better. At the same time, the study will include another possible alternative to the PDP 2004 suggested by EGAT, as well.

5.3 Three Power Development Plan Options

Three main PDP options are discussed and analyzed in this study; namely the existing PDP (or PDP-Gas), EGAT's alternative PDP (or PDP-Coal), and the renewable alternative PDP (or PDP-Renewables). These three policy options will be described in this section and will be analyzed and compared according to their strategic consequences in Chapter 6.

5.3.1 The Existing PDP (PDP-Gas)

The present Power Development Plan (PDP2004) was approved by the Cabinet in September 2004. It was based on the power demand forecast in the beginning of 2004, which assumed a constant annual economic growth rate of averagely 6.5 percent through out the planning period (2004-2015)[20].

Consequently, 23 new power plant projects were planned in addition to the seven projects, which were already 'under construction'. These new projects can be divided into two groups by the period of construction. During 2004-2010, five new projects were decided with gas as the fuel. For 2011-2015, 18 new projects were planned with gas as the fuel. The planned installed capacity and expected peak demand of the PDP-Gas is shown in Figure 5.3 and the fuel-mix of PDP-Gas is presented in Figure 5.4.

It is clear from Figure 5.6 that the future of the Thai power sector will rely mostly on natural gas, which will account for 81 percent of the power generation in 2015. This is why, in this study, it will be referred to as "PDP-Gas". The PDP-Gas also includes the investments in renewable energy under the renewable portfolio standard (or RPS) scheme, which means that every new IPP project based on fossil fuels has to invest or buy renewable energy equal to 5% of its capacity.

Moreover, it is important to emphasize that, during the negotiation process of privatizing EGAT, the government has agreed that EGAT will be responsible for half of the new projects in 2011-2015, equal to nine projects. In the case of the other half, the government will open the bidding process. However, EGAT subsidiaries may enter the bidding and compete with other IPPs, as discussed in the previous Chapter.

Up to September 2006, PDP-Gas still received strong support from the Thai government. There is no clear sign that the Thai government will change its policy direction away from natural gas. With its monopoly in gas suppliers, PTT also implicitly supports this PDP option by highlighting the availability of natural gas supplies (including the investment proposal of a liquid natural gas system) and its cleaner environmental effects.

5.3.2 EGAT's alternative PDP (PDP-Coal)

Since the PDP of 2004 mostly relied on gas, EGAT expressed their concern for the energy security. Therefore, EGAT proposed that the new projects should utilize more coal to diversify the fuel mix.

This initiative was obvious when EGAT organized the Coal-Trans International Conference in Lampang in January 2005 and promoted the use of coal in Thai newspapers during and after the conferences. Later, in January 2006, an EGAT subsidiary, EGGO, also announced its plan for coal-fired power plant investment, mainly because the developed natural gas reserves were too limited and the coal technology was now more environmentally friendly than before.

However, the discussion is still going on and, thus, the proposed capacity of coal-fired technology in the PDP has not been defined yet. As a result, to provide an insight into the effect of coal initiatives, this study has assumed that half of the new projects, or nine 700 MW power plants, will switch from gas to coal. In this study, it will be referred to as the "PDP-Coal".

By this way, the planned installed capacity and expected peak demand of PDP-Coal is totally similar to that of PDP-Gas (already shown in Figure 5.3), but it has a large difference in the fuel mix as shown in Figure 5.5. From this figure, the increased share of coal in energy can be seen clearly. At the end of the period, the proportion of coal and lignite in the Thai fuel mix is expected to reach 27% (compared to 11% in PDP-Gas).

Figure 5.3 Total Installed Capacity and Peak Demand in PDP-Gas and PDP-Coal

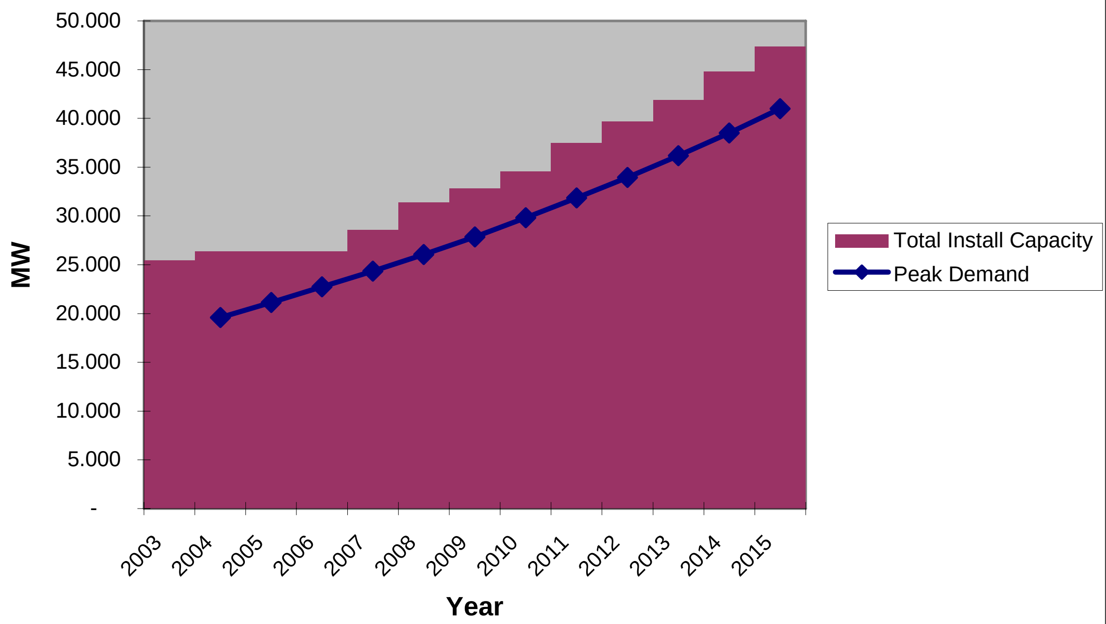
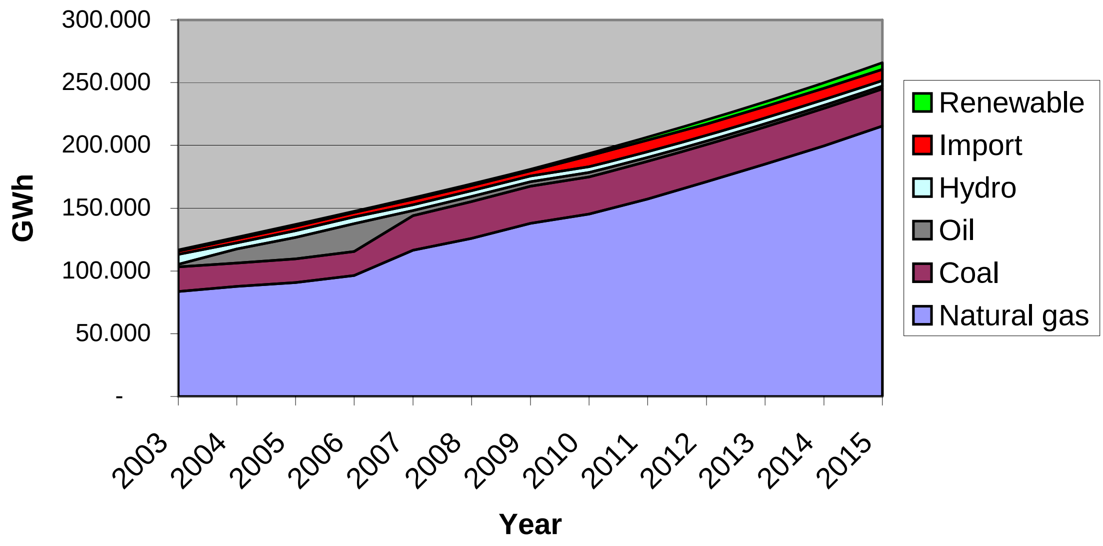
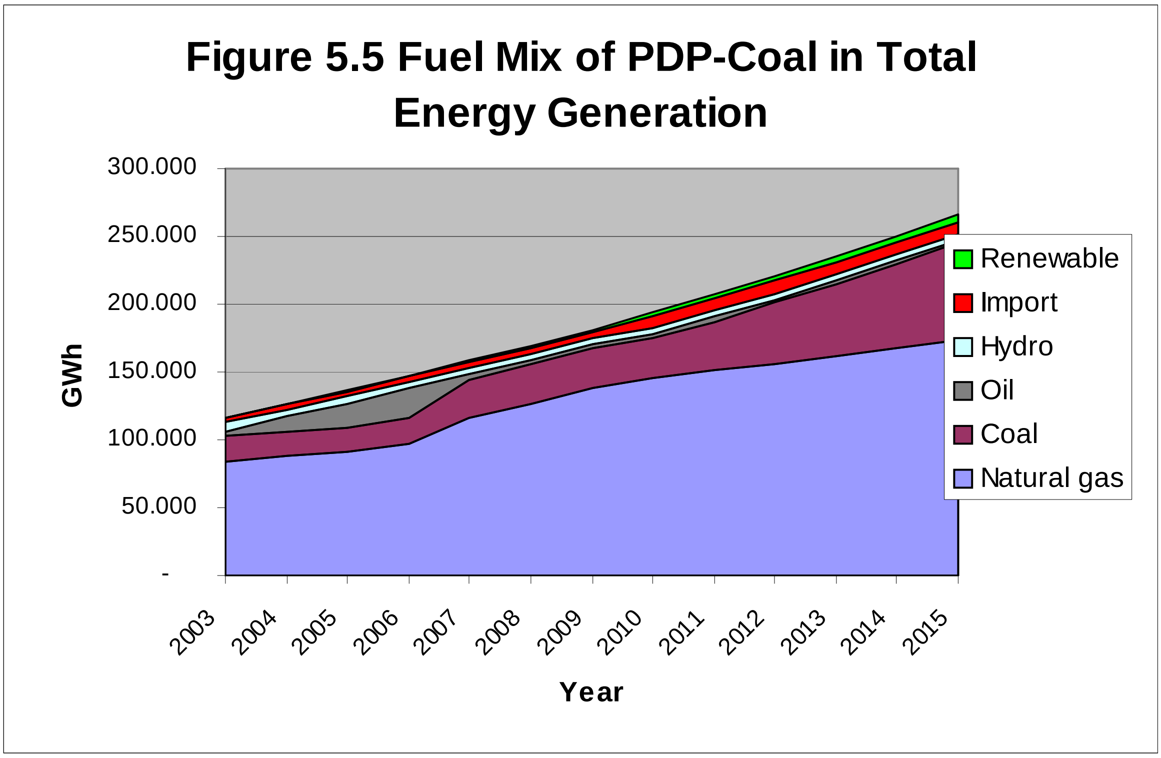


Figure 5.4 Fuel Mix of PDP-Gas in Total Energy Generation





5.3.3 The Alternative PDP

a) Principle

The development of an alternative PDP has followed six planning and operational principles, which are important in Thai society.

- The first principle is the Ninth National Development Plan, which follow the king's Sufficient Economy Philosophy. Thus, the Plan will emphasize on more balanced economic growth and self-reliance.
- The second fundamental principle is the National Energy Strategy which aims to improve energy efficiency and promote renewable energy in the country, as explained earlier.
- Third, the renewable alternative PDP should be based on the present potential of domestic energy resources and the present energy technology, which means that this alternative PDP will be pragmatic and feasible under the present resources and technology.
- Fourth, more realistic assumptions of the power demand forecast are crucial to prevent over-investment in the power system expansion.
- Fifth, this renewable alternative PDP requires the maintenance of the system reliability of the Thai power system. Operationally, its reserve margin needs to be above 15% and the annual power generation needs to cover the annual energy demand for the whole planning period.
- Lastly, to make this renewable alternative an easier choice for decision-makers to make, especially in terms of the financial perspective, this PDP-

option will try to combine a) cheaper solutions (compared to conventional power plants), such as revising the demand forecast and DSM, with b) competitive solutions, like Industrial CHP, biomass and biogas, and c) more expensive solutions, like wind and solar energy.

Since this alternative PDP has the clear aim and strategy to promote renewable technology, it will be referred to as "PDP-Renewables", in this study.

b) Measures

Based on the six principles, seven measures have been employed to develop this PDP-Renewables.

Firstly, according to the suggestion of NESAC[21], the power demand forecast has been adjusted to the more realistic annual economic growth rate, since in the twenty-years record, the long-term economic growth rate of the country was just around 5.2%, and not 6.5% as assumed in the existing PDP (or PDP-Gas). At the same time, the forecasted demand in 2004 should be adjusted to the actual peak demand, which is almost 300 MW lower than in the forecast. This measure is very important in preventing the Thai power sector from over-investing due to over-forecasting, as it has usually happened. The revised version of the demand forecast for PDP-Renewables is presented in Table 5.2.

Second, Demand Side Management (DSM) and energy saving are top priorities because of their low investment costs with low negative impacts. From the overall DSM potential of around 2,000-3,000 MW (discussed in Chapter 3), 2,400 MW of DSM in 2015 is applied to this PDP-Renewables.

Third, the high potential of various renewable energies will be exploited. The promising renewable energy in Thailand includes biomass and biogas, solar, mini-hydro, and wind. Table 5.3 presents the huge differences between the power potential and the existing installed capacity and the government target to promote renewable energy. From the same table, it is clear that PDP-Renewables is following the same line as the government's own target, with a small modification. Among different renewable technologies, PDP-Renewables will focus more on biomass and biogas technology, because of their economic and investment advantages, as previously discussed in Chapter 3. It is also important to notice that, in 2015, PDP-Renewables will only employ less than half of the overall potential.

Table 5.2 Existing Demand Forecast and Its Revised Version for PDP-Renewables

Year	Jan 04 Forecast		Adjustments to Jan 04 forecast (MW)				Forecast (adjusted)
	Assumed per annum GDP growth rate	Peak demand (MW)	Use actual 2004 peak as base (19,326)	GDP growth = 5.2% (average past 15 yrs)	Peak Cut (according to EGAT's PDP 2004)	Total (MW)	Revised peak demand (MW)
2004	6.5%	**19,600**	-274	0	0	-274	**19,326**
2005	6.5%	**21,143**	-296	-304	0	-600	**20,543**
2006	6.5%	**22,738**	-318	-637	-500	-1455	**21,283**
2007	6.5%	**24,344**	-340	-990	-500	-1830	**22,514**
2008	6.4%	**26,048**	-364	-1361	-500	-2225	**23,823**
2009	6.4%	**27,852**	-389	-1771	-500	-2661	**25,191**
2010	6.6%	**29,808**	-417	-2278	-500	-3195	**26,613**
2011	6.5%	**31,844**	-445	-2804	-500	-3750	**28,094**
2012	6.5%	**33,945**	-475	-3367	-500	-4341	**29,604**
2013	6.5%	**36,173**	-506	-3983	-500	-4989	**31,184**
2014	6.4%	**38,515**	-538	-4626	-500	-5664	**32,851**
2015	6.5%	**40,978**	-573	-5348	-500	**-6421**	**34,557**

Source: Witoon Permponsacharoen, 2005[22].

Table 5.3 Renewable Energy Potential, Installed Capacity in 2004, Government Target and The Planned Capacity in PDP-Renewables

Resources	Power Gen. Potential (MW)	Present Installed Capacity (MW)	Government Target (MW)		Planned in PDP-Renewables (MW)	
			2006	2011	2011	2015
Biomass	7,000	609.5	703	1,600	1,500	2,700
Biogas	900	4.6	12	100	270	470
Solar	5,000	5.5	21	250	270	470
Wind	1,600	0.2	26	350	100	260
Micro-hydro	700	2.0	26	350	180	300
Geothermal	N/A	0.5	6	10	-	-
Total	15,200	622.3	774	2,410	2,320	4,200

Source Decharut Sukkumnoed, 2003[23]

Fourth, after the DSM and renewable energy technology, PDP-Renewables also employs a co-generation system with natural gas as the main fuel, because of the high efficiency achieved through the combined production of heat and power in one system. This system can be based on several industrial estates around the country (especially in the East, Central and South where they have a natural gas pipeline). From the overall potential of 3,000 MW of the new installed system, PDP-Renewables plans to invest around 2,500 MW during this planning period.

The fifth energy measure is the re-powering of the existing power plants of EGAT, which means the construction of new power plants to replace the existing ones. The benefits of this measure are to improve the energy efficiency of the old plants and to avoid the potential conflicts in new project sites. In PDP-Renewables, an additional 2,800 MW of re-powering projects will be employed apart from the existing plan of 2,800 MW in PDP-Gas, while the total potential of re-powering projects is around 7,700 MW[24].

Sixth, after employing all five measures, it is firmly possible to cancel the new conventional projects. These include the two controversial projects, Nam Theun 2 Dam in Laos and the Jana Gas Power Plant, as well as the other 19 new power plant projects (both NGCC in the PDP-Gas and Coal-fired power plants in PDP-Coal). Moreover, three IPP projects can be postponed from 2009 to 2010 and 2011. In addition, the consumption of fuel oil and diesel for power generation in 2004-2006 has been reduced.

Lastly, the Mae-Moh lignite power plant, which is the most well-known power plant in terms of the negative health impacts of its pollutant emissions and mining process, will reduce its production to only half of its total installed capacity and its normal power generation in order to alleviate negative health impacts.

Based on these seven measures, PDP-Renewables will be able to meet the 15% reserve margin, as required (Figure 5.6). In fact, because of lower load hours in several renewable technologies, to meet annual energy demand, the PDP-Renewables' reserve margin is much higher than 15%. The lowest reserve margin in PDP-Renewables for the whole period is 23.9% in 2006.

Unlike the first two PDP options, Figure 5.7 clearly shows an increasing trend in renewable power generation and the decrease in coal contribution to the Thai fuel mix. By the end of the period, the renewable share is expected to be almost 10%.

Figure 5.6 Total Installed Capacity and Peak Demand in PDP-Renewables

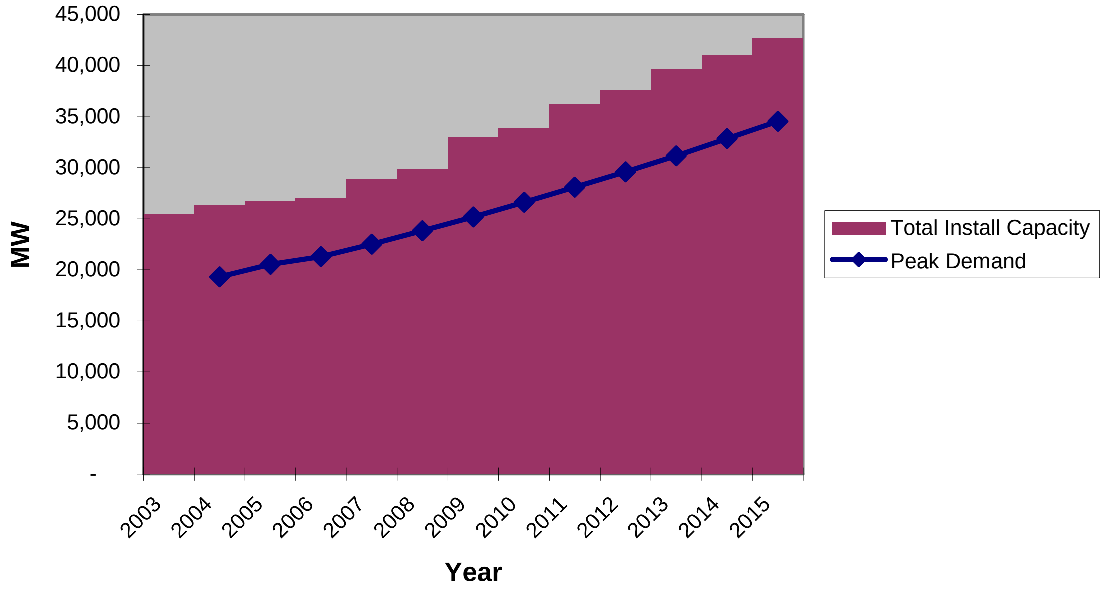
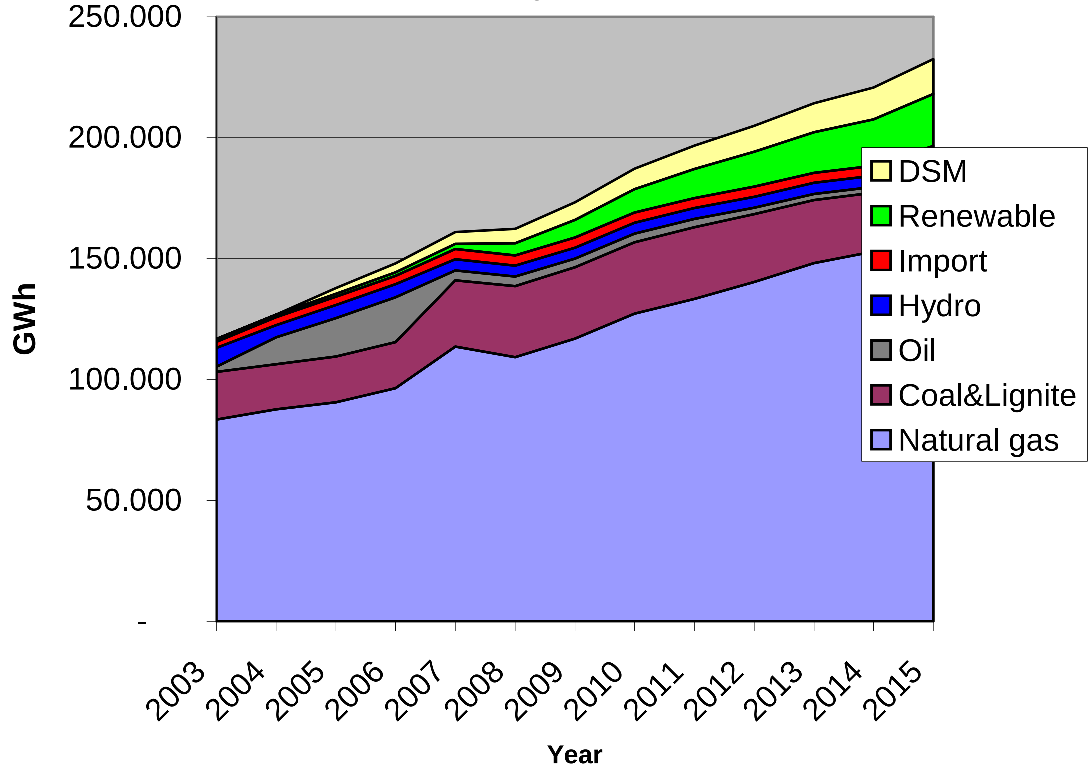


Figure 5.7 Fuel Mix of PDP-Renewables in Total Energy Generation



5.3.4 Main Differences between the Three PDP Options

Table 5.4 presents the main differences between the three PDP options. Obviously, the revising of demand forecast and DSM can lower the power demand and, consequently, the installed capacity and energy generation in PDP-Renewables.

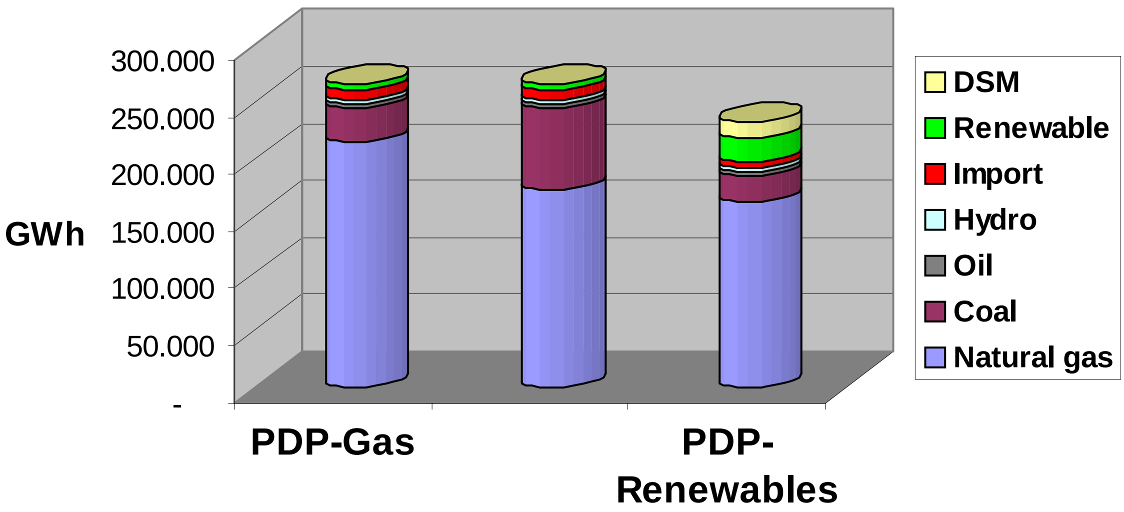
It is also clear that the proportions of energy generation in these three PDP options differ significantly, as shown in both Table 5.5 and Figure 5.8. Obviously, PDP-Gas will push for the Thai power system to be based on natural gas up to 81%. PDP-Coal tries to avoid this situation by increasing the fuel share of coal from 11% to 27% and reducing natural gas share to 65%. Oppositely, PDP-Renewables maintains the natural gas share at 70% and reduces the coal share to 10%, while increasing the renewable energy share from 2% to almost 10% in 2015.

Table 5.4 Main Differences between the Three PDP Options

Items	PDP-Gas	PDP-Coal	PDP-Renewables
1. Assumed Economic Growth Rate (%)	6.5	6.5	5.2
2. Power Demand in 2015 (MW)	40,978	40,978	34,557
3. Installed Capacity in 2015 (MW)	47,334	47,334	41,485
4. Energy Generation in 2015 (GWh)	265,786	265,786	232,534 (218,134)
5. Proportion of Energy Generation in 2015 (%)			
- Gas	81	65	70 (75)
- Lignite & Coal	11	27	10 (10)
- Oil	1	1	1 (1)
- Renewable energy	2	2	9 (10)
- Large hydro	2	2	2 (2)
- Import	3	3	2 (2)
- DSM	-	-	6 (0)

Note: The Figures in Parenthesis are the energy generation and the proportion of energy generation excluding DSM.

Figure 5.8 Energy Generation and the Fuel Mix in 2015 by Three PDP Options



5.4 Environmental Impact Analysis

The environmental impact analysis is one of the key analyses in this study, because the environmental aspect has always been on the agenda of energy policy debates. At the same time, environmental impacts are also the main sources of physical health consequences of power generation, as discussed in Chapter 2.

At the strategic planning level (i.e. PDP level), where the specific plant locations and pollution control technologies have not been identified, the environmental impact analysis has to be at an overview level. In this study, the focus will be on the atmospheric pollutant emissions from power generation both due to their major impacts on human health and to the availability of information about these emissions.

The emissions of six pollutants will be analyzed in this study. First, the study will look at the climate change problem by analyzing future greenhouse gas emissions from power generation in each PDP option. Then, the study will analyze the emissions of each PDP option of five main pollutants that cause local and regional air pollution problems, including SO_2, NO_X, TSP, mercury and Non-methane Volatile Organic Compounds (NMVOC) emissions.

The calculation of these six atmospheric pollutant emissions will be done through the multiplication of annual energy generation (as shown in Appendix 1) and an assumed emission factor for each power technology (and also for each pollutant emission). By this way, the selection of emission factors is crucial to the results of the analysis. Therefore, it is quite important to discuss the nature of these emission factors, based on the review of previous life cycle assessments, as presented below.

a) Greenhouse Gas Emission

Due to its impact on climate change, greenhouse gas emission has always been the focus of life cycle assessment studies in the energy sector. Normally, these studies provide the emission results in "ton (or kg.) of CO_2 equivalent", which means that CO_2 and other greenhouse gases have been included in the assessment through the conversion of "global warming potential", in relation to CO_2. [25].

In terms of power generation, the most important greenhouse gas is CO_2. Any combustion will produce CO_2. The differences in the CO_2 emissions of different combustion power technologies is mainly determined by the carbon content in each fuel source and the energy efficiency of power plants. Although Table 5.5 presents some variation in assessing life cycle greenhouse gas emissions of each power generation technology, the variation is rather small compared to other pollutants emission, discussed later. This is mainly because there is no commercial scrubbing of CO_2 available on the market[26].

Table 5.5 Ranges of Estimated Greenhouse Gas-intensity of Selected Fuels.
(Unit: gram CO_2 per kWh).

Fuels	Holdren and Smith, 2000.	Rowlands, 2005.
Conventional Coal	960-1300	Coal = 790-1182
Advanced Coal	800-850	
Oil	690-870	733-935
Natural Gas	460-1230	362-653
Nuclear	9-100	2-59
Large Hydro power	2-410	2-48
Biomass	37-166	15-101
Solar PV	30-150	13-731
Wind	11-75	6-124
Geothermal	-	15-97

Source: Complied from Holdren and Smith, 2000[27] and Rowlands, 2005[28].

Certainly, non-combustion power technologies, like wind energy, PV, or micro hydro power, provide very low greenhouse gas emission in their whole life cycles. Their greenhouse gas emissions are normally related to the construction process, not the generation process. Although biomass and biogas power-generating technologies also require a combustion process, their life cycle of regenerating biomass will absorb the same amount of CO_2 from the atmosphere, leading to very low greenhouse gas emissions in their life cycles. In cases of biogas technology, since it reduces CH_4 emission, compared to the natural decomposition process of animal manures, it even has a negative greenhouse gas emission in its life cycle[29]. In practice, the greenhouse gas emission of biomass and biogas power generation depends very much on the transportation distance between fuel sources and power plants[30].

b) Sulfur Dioxide Emission

The main problems of SO_2 emission are the acidification and negative health impacts, as described in Chapter 2. From the life cycle analysis by Gagnon et al, it is clear that the SO_2 emission of each power generation technology can vary significantly (Figure 5.11) due to various factors, especially fuel sources, technologies and regulations[31].

For example, the sulfur content of coal can vary from 0.5% to 5% and in the case of oil, it can vary from 0.2% to 2%[32]. In coal-fired power plants, there are a number of technologies that can reduce the SO_2 emission[33]. The commercial scrubbing technologies can remove up to 90% of emissions, but these technologies have not been widely implemented. Therefore, generally, coal, oil, and diesel are still the main polluters in terms of acidification[34].

Natural gas has virtually no sulfur, because it is removed in processing plants after extraction. Depending on the sulfur concentration and regulation, this process can also lead to low or high SO_2 emission[35]. A study of Korea shows that, unlike the case of other fossil fuels, more than 99% of SO_2 emission in the natural gas life cycle comes from the upstream process, and is not a direct emission from the power plant[36].

Compared to fossil fuels, biomass and other renewable energy technologies have a low SO_2 emission factor[37], thus, they can contribute to the alleviation of the acidification problem.

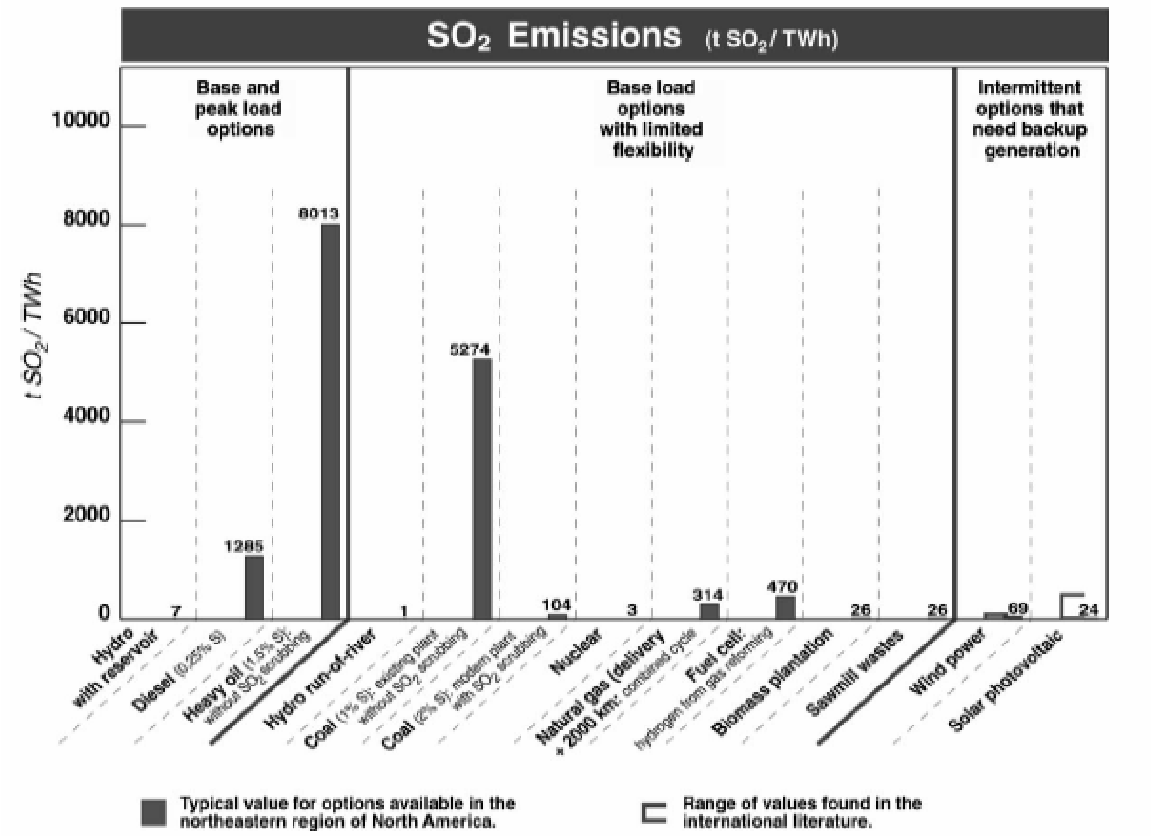


Figure 5.9 SO_2 Emissions from Different Power Technologies Based on Life Cycle Assessments. Source: Gagnon et al. 2002. p. 1272.

c) Nitrogen Oxides Emission

NO_X Emission can also vary widely (Figure 5.10). However, unlike SO_2, the variation of NO_X basically depends on combustion technologies and conditions rather than fuel sources, because NO_X formation can occur when the temperature is higher than 1370° C[38]. Normally technologies that involve air compression, like the diesel engine, will produce a high level of NO_X emission.

Certainly, non-combustion renewable technologies, like wind and solar energy, have very low NO_X emissions in their whole life cycle. Unlike SO_2 emission, due to their combustion condition, biomass and biogas technologies still have quite high NO_X emissions[39] [40]. Therefore, better combustion technologies and higher efficiency are required to reduce NO_X emissions[41].

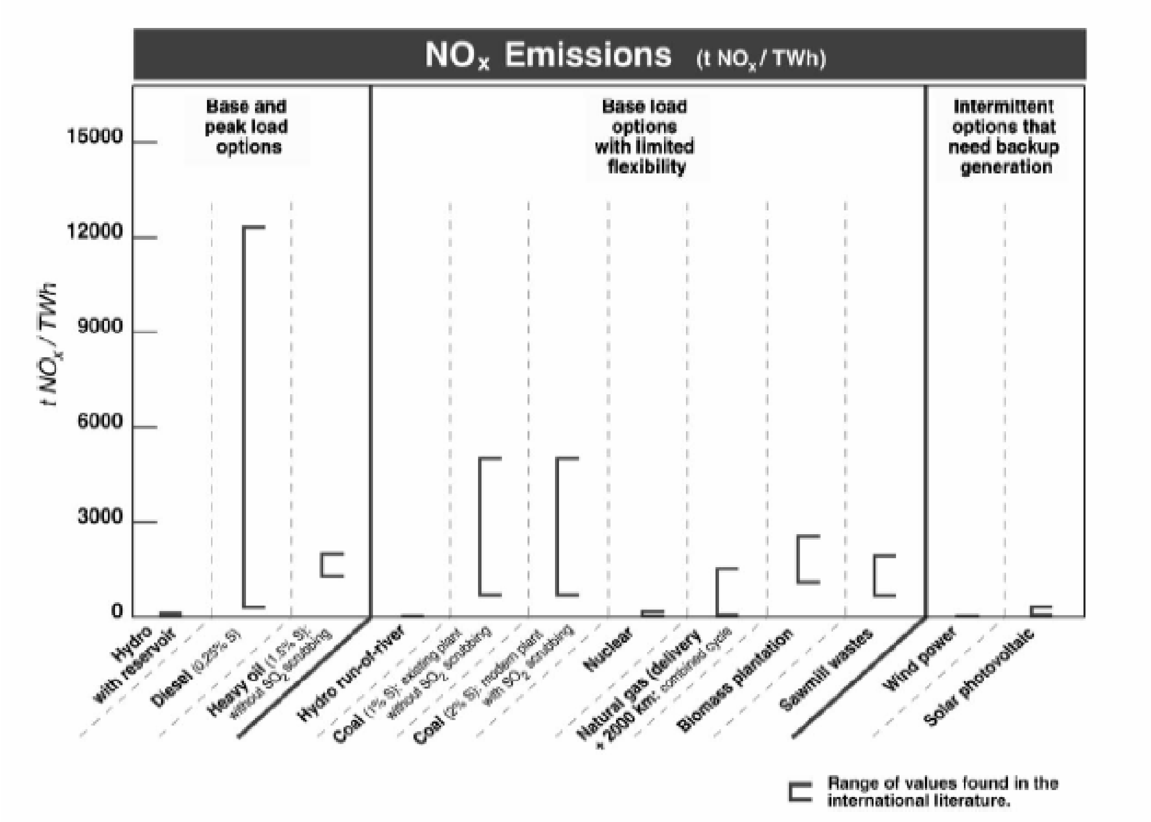


Figure 5.10 NO_X Emissions of Different Power Technologies Based on Life Cycle Assessments

Source: Gagnon et al. 2002. p. 1273

d) Other Pollutants

Apart from three main pollutant emissions, Gagnon et al also provide emission factors of three other pollutants, which also have direct and more local effects on health; namely total suspended particles (TSP), mercury, and non-methane volatile organic compounds (NMVOC) emissions, as shown in Table 5.6.

Table 5.6 Other Atmospheric Emissions of Energy Options
(Note: Some data is not life cycle assessment).

Generation options (classified by level of service)	NMVOC emissions (t/TWh)	Particulate matter emissions (t/TWh)	Mercury emissions (kg Hg/TWh)
Options capable of meeting base load and peak load			
Hydropower with reservoir		5	
Diesel	1570	122–213	
Base load options with limited flexibility			
Natural gas c.c. turbines	72–164	1–10	0.3–1
Bituminous coal: modern	18–29	30–663	1–360
Lignite: old plant		100–618	2–42
Heavy oil: no scrubbing	22		2–13
Hydropower run-of-river		1–5	
Biomass combustion	89	190–320	0.5–2
Nuclear		2	
Intermittent options that need a backup production			
Wind power		5–35	
Solar photovoltaic	70	12–190	

Source: Gagnon et al. 2002. p. 1277.

However, as cautioned by the authors, much of the data in the Table are only direct emissions from power plants, not the results of life cycle assessment[42]. Like the SO2 and NO_X emissions, the figures in the Table show a variation of emission factors of each technology. Normally, non-combustion technologies provide much less emission. Natural gas also has quite low emissions compared to other combustion technologies, except in terms of NMVOC emissions.

With all the variations in these emission factors, identifying an emission factor of each technology, as an assumption for the impact analysis of each PDP option, is not an easy task. Although Chuangsanguansit et al present a comparison of direct emission of some power plants in Thailand, as shown in Table 5.7. These figures do not include the whole life cycle emission and the recent improvement in dust control technologies for biomass power plants[43]. Therefore, the selection of appropriate assumed emission factors needs to compare the emission factors of each technology from several sources. The results of this selection are summarized and presented in Table 5.8.

In the case of high variations in these emission factors, a sensitivity analysis is needed to ensure the range of validity of this impact analysis. The details of the sensitivity analysis will be presented in section 5.9.

Last but not least, it is also important to note that all these environmental impacts do not include solid waste. In fact, different power technologies can lead to completely different impacts in terms of solid waste, both in terms of quantity and toxicity. Especially, when coal-fired and nuclear power plants have been considered as options, the analysis of solid waste impacts is very important and can lead to different policy results. Therefore, based on this fact, the absence of assessment of solid waste impacts is one of the major limitations of this study.

Table 5.7 Direct Pollutant Emissions from Biomass and Other Fossil fuel Power Plants

Item	Emission (kg/MWh)				
	Roi Et Green (Biomass)	Coal	Oil	Gas	Combined Coal, Oil, Gas
CO_2	**Nearly Zero**	**1260**	**810**	**570**	**730**
SO_2	**0.32**	**2.8**	**1.3**	**0.0003**	**0.65**
NO_X	**2.5**	**5.8**	**2.9**	**1.4**	**2.4**
CO	**0.71**	**0.20**	**0.27**	**0.20**	**0.20**
TSP (dust)	**0.080**	**0.0037**	**0.097**	**0.0036**	**0.036**

Source: Chuangsanguansit et al[44].

Table 5.8 The Assumed Emission Factors of Each Technology Applied in This Study

Technology	GHG	NO_X	SO_2	TSP	Hg	NMVOC
	g./kWh	g./kWh	g./kWh	g./kWh	mg./kWh	g./kWh
Lignite	1,200	5.800	5.270	0.618	0.042	0.029
Coal	960	3.790	3.760	0.329	0.360	0.029
Oil	770	2.900	4.900	0.247	0.013	0.022
Diesel	650	2.900	1.285	0.247	0.013	1.570
Natural Gas	512	1.250	0.314	0.010	0.001	0.164
Biomass	46	2.500	0.302	0.200	0.002	0.089
Biogas	-33	1.944	0.068	0.100	0.002	0.164
Solar PV	30	0.008	0.023	0.017	0.000	0.070
Large Hydro	15	0.020	0.007	0.005	0.000	0.000
Micro hydro	2	0.010	0.001	0.001	0.000	0.000
Wind	10	0.000	0.069	0.005	0.000	0.000
Cogeneration	343	0.838	0.210	0.007	0.001	0.110
Import Laos	15	-	-	-	-	-
Im. Malaysia	443	-	-	-	-	-

5.5 Health Impact Analysis

5.5.1 DPSEEA Model

The health impact analysis in this study follows the World Health Organization's DPSEEA model, as previously discussed in Chapter 2. Normally, the DPSEEA model of power generation takes its point of departure in the expansion of economy as the main driving force, which encourages to the investment in fossil fuel-based power generation. This pressure, then, leads to changes in environmental qualities, ecosystems and local livelihoods, and, in the case of Thailand, a higher economic burden (both for import fuels and investment). These changes raise peoples' exposure to poor physical environment (both from local air pollution and climate change) and present more difficulties to the maintenance of socio-economic conditions (due to more social conflicts and insecurity, and negative impacts on local and national economy). Last, due to the exposure, health effects can occur in forms of physical impacts of poor environment (like respiratory system disorders and diseases or expansion of communicable diseases) or psychological and social related health impacts of the negative changes in the social determinants of health, as previously mentioned. This normal version of the DPSEEA model is presented in Figure 5.11

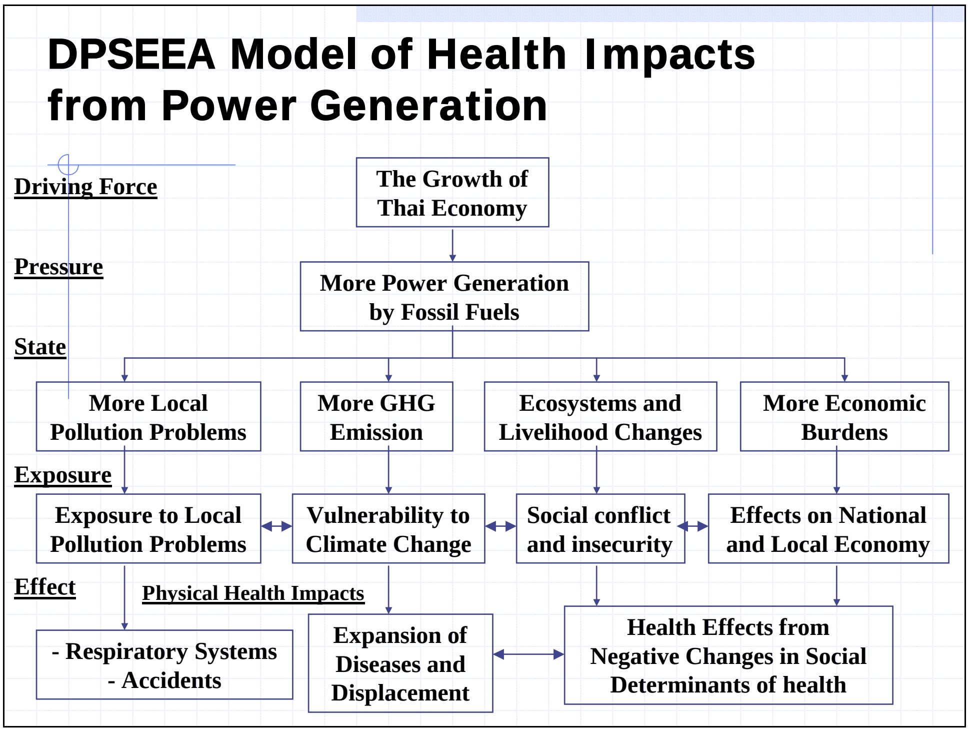


Figure 5.11 DPSEEA Model of Health Impacts of Power Generation

However, with the direct relationship between the expansion of economy and power demand as a main presupposition, this normal DPSEEA model seems to disregard the fact that the Thai power sector always over-forecasts its expansion for a decade, as previously shown in this chapter. In other words, the expansion of power demand is not only the effect of economic growth, but partly it becomes a strategy (or so-called expansionist strategy) of the Thai power sector itself. Concurrently, the pressure of generating more fossil fuel-based electricity should not be another precondition of the model. With a variety of potential sustainable energy options, as shown in Chapter 3, Thai power can simply reduce this pressure by investing more in energy efficiency and renewable energy technologies. Therefore, instead of ending up with end-of-pipe technologies, as usually done, this study aims to provide more "upstream actions", as suggested in the concept of healthy public policy.

Hence, in the analytical model of health impact analysis, as presented in Figure 5.12, two upstream actions are now taken into account. The first attempt is to review the demand forecasting. The second action is to increase the share of renewable energy and DSM and, consequently, to reduce the share of fossil fuel-based power generation in the Thai fuel mix. Certainly, as already explained, both attempts are now included in PDP-Renewables. Therefore, the main task of the health impact analysis is to compare the health impact of PDP-Renewables with two other PDP options based on the DPSEEA model.

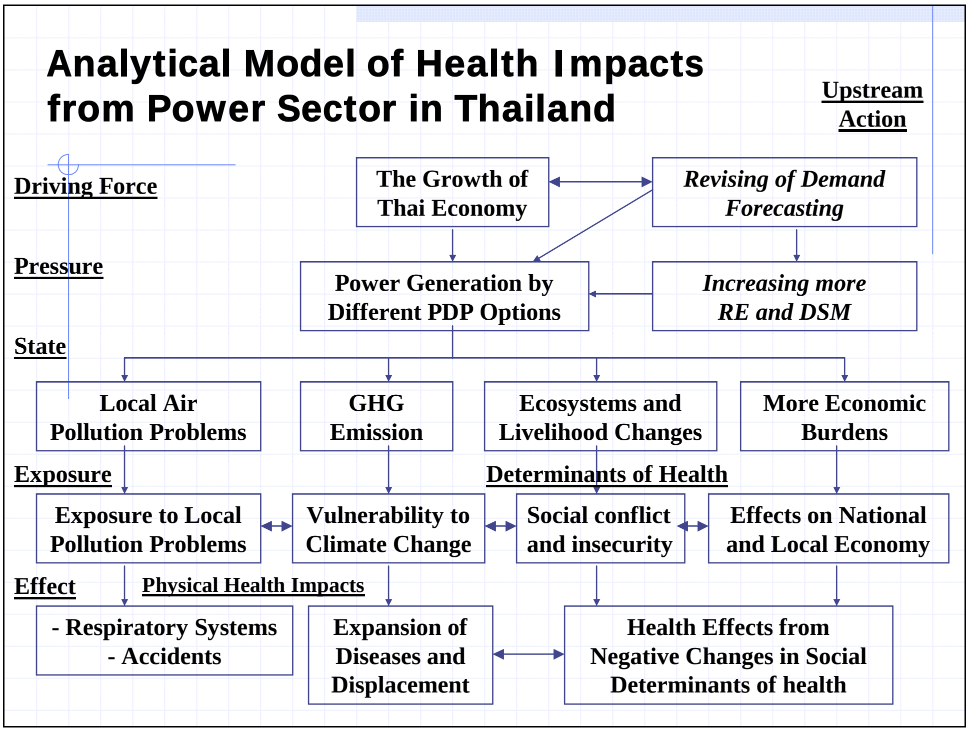


Figure 5.12 Analytical Model of the Health Impacts of Power Generation in Thailand

Due to the limitation of information, not all aspects of this DPSEEA model can be quantified into physical health units. For the effect of poor environmental quality, the study will calculate the health impacts in terms of mortality, morbidity, and disability-adjusted life years, described later in this section. However, for socio-economic changes, it is very difficult to quantify these effects into specific physical units. Therefore, these effects will be reported in terms of the changes in determinants of health, like more job creation, less import burden, lower generation cost, etc.

5.5.2 Impact Analysis on Mortality and Morbidity (The Extern-E Approach)

The analysis of health impacts in this study is based on the report of the World Health Organization for European Region[45], which refers to the analytical results of the Extern-E project. The Extern-E project is the first comprehensive attempt in Europe to evaluate the external costs associated with different fuel cycles. The Extern-E project represents the growing interest in developing an approach to the quantification of environmental and health impacts of energy uses and also their external costs[46].

The Extern-E project applies an impact pathway analysis, by starting from the specific, site-dependent activity (in this case, power plant emissions and their fuel processes) that gives rise to health effects. In the case of air pollution, the emission is then modeled by use of atmospheric transport modeling techniques, before mapping it to human receptors in different locations, based on regional and national population statistical databases. Later, the integrated model called ECOSENSE generates the estimation of the physical health impacts of energy-related activities. Finally, the model converts these impacts into monetary terms by multiplying the physical health impacts by monetary unit values that are estimated for each impact. In the case of the accident-related health impacts, the results are estimated by use of probabilistic analysis based on historical data[47].

In this approach, the types of health impacts are disaggregated into different effects, for example, premature death, chronic bronchitis, etc. and their units (e.g. number of cases, years of life loss). In order to compare alternative energy technologies, the health impacts are expressed in terms of the physical unit per TWh of electricity generated by each power technology. In the Extern-E project and also in this study, "comparability is essential in order for research exercise to be able to inform policy decision relating to the internalization of these external impacts"[48]. The example of health impact results (of coal) is presented in Table 5.9.

In this table, it is very important to note that the physical health impacts of air pollution (both acute and chronic impacts) is the sum of those from individual pollutants; namely SO_2, NO_X and TSP.

Based on the fact that the impacts of power generation can vary greatly due to the differences in fuel sources, combustion technologies, and regulations, in general, the results shown in the WHO-Europe report and also applied in this study are based on the UK context, which has impact rates that are close to the average of the EU. For coal technology, the results in Table 5.9 are based on the use of a conventional pulverized fuel generation technology with flue gas desulphurization (FGD) abatement technology. For lignite, the results are based on those for Germany. The air pollution health impacts from lignite are approximately 30% higher than those of coal. From the Extern-E results, wind energy is considered to have the lowest level of negative health impacts, which are around 10% of those from coal for the same amount of electricity generation[49].

Table 5.9 Main Health Impacts of the Generation of Electricity by Coal in Europe

Fuel cycle stage & source of impact	Media (e.g. air, water, soil)	Health Outcome	Unit of measurement	Magnitude of impact – units per TWh	Comments
All stages	Occupational accidents	Death	Cases	0.1008	Accident cases are the sum of those estimated for the mining, transport, extraction, generation and dismantling stages.
		Severe injuries	Cases	2.517	
		Minor injuries	Cases	21.773	
All stages	Public accidents	Death	Cases	0.0155	
		Severe injuries	Cases	0.1532	
		Minor injuries	Cases	0.6949	
Power Generation	Public health - acute effects: air pollution	'acute' mortality	[deaths] per TWh	2.786	The health impacts are the sum of those from individual pollutants SO2, Particulates and Nitrogen Oxide.
		'acute' Years Of Life Lost (YOLL)	[years] per TWh	2.089	
		respiratory. hosp. admissions	[case] per TWh	1.8929	
		Cerebro-vascular hosp. admissions	[case] per TWh	2.664	
		congestive heart failure	[case] per TWh	1.2714	
		Restricted. activity days	[days] per TWh	7511.8	
		Bronchodilator usage (in asthmatic adults & children)	[case] per TWh	2060.92	
		Cough (in asthmatic adults & children)	[day] per TWh	2358.45	
		Lower resp. symptoms (in asthmatic adults & children)	[days] per TWh	1095.31	
	Public health - chronic effects: air pollution	'chronic' mortality	[deaths] per TWh	21.69	Sum, as for acute impacts.
		'chronic' YOLL	[years] per TWh	216.86	
		Chronic bronchitis (adults)	[cases] per TWh	14.546	
		Chronic bronchitis (children)	[cases] per TWh	204.3	
		chronic cough	[episodes] per TWh	261.58	

Source: Hunt, A. 2004.

Certainly, the Extern-E approach has faced a number of limitations and uncertainties. In terms of limitations, the Extern-E approach fails to include the health impacts of climate changes and secondary air pollution problems (e.g. very fine particles from the chemical reaction of SO_2, NO_X and other pollutants), which are now the growing concerns of health experts, as shown in Chapter 3. In terms of uncertainties, its results can be varied on the basis of the uncertainty of parameters of the model (e.g. an exposure-response function, etc.), the uncertainty of future technology development (both in power generation and in medical treatments), and the uncertainty of incomplete or ambiguous information[50].

Although the results of the Extern-E project face some limitations and uncertainties, especially as they are applied to Thailand, which has considerably differences in atmospheric and settlement conditions, they provide very good basic information for analyzing health impacts at the strategic level. To a certain extent, the application of this Extern-E project can provide Thai society with insightful information on potential future health impacts of power generation and its development plan. Following the Extern-E approach, the health impact assumption, which will be used for the health impact analysis in this study, is presented in Table 5.10.

5.5.3 Impact Analysis on Disability-adjusted Life Years (The Eco-indicator Approach)

Another approach to health impact analysis is the calculation of disability-adjusted life years (or DALYs), which is developed by the Eco-indicator 99 project funded by the Dutch Ministry of Housing, Spatial Planning, and the Environment (VROM). The aim of the project is to develop indicator scores for life cycle assessment, which can be widely used by many designers. To reach this aim, the calculation of more aggregated impact information is needed. In this project, three types of environmental damages; namely human health, ecosystem quality, and resource, are calculated, weighted, and finally integrated into the single eco-indicator[51]. However, since the focus of this analysis is on the health aspect, only the indicator on human heath damage will be applied to this study.

a) Disability-adjusted Life Years

To identify human health damage, the concept of disability-adjusted life years (or DALYs), developed in collaboration between the World Bank and the World Health Organization, is used as an aggregated unit for various physical health impacts[52]. This is due to the fact that DALYs measure the total amount of ill health of the population (or the loss of healthy life years) by summing the time (or years) lost due to premature death (or years of life lost: YLL) and the years lost due to disability (years lived disability: YLD). Basically, the YLL “correspond to the number of deaths multiplied by the standard life expectancy at the age at which the death occurs”. At the same time, “to estimate YLD for a particular cause (or disease) in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead)”[53].

The main advantage of the DALYs approach is that it is able to include several important factors in life cycle assessment, like “the number of individuals effected by the problem, the time humans suffer from disabilities and the lifetime lost by premature death, as well as the severity of the health problem, ranging from premature death to irritation”, in one indicator and “can be quantified theoretically”[54].

Table 5.10 The Assumed Health Impact Factors of Each Technology from the Extern-E Project Applied to This Study

Co-efficient Item	Unit	Lignite	Coal	Oil	Diesel	Gas	Biomass	Biogas	PV	Hydro	Micro-hydro	Wind	DSM	Cogeneration
Death from accident	Cases/TWh	0.116	0.116	0.033	0.033	0.021	0.000	0.036	0.000	0.002	0.001	0.000	0.000	0.014
Severe Injuries	Cases/TWh	2.670	2.670	0.234	0.234	0.263	0.000	1.102	0.000	0.167	0.083	0.000	0.000	0.176
Minor injuries	Cases/TWh	22.468	22.468	2.471	2.471	1.555	0.000	5.810	0.000	2.176	1.088	0.000	0.000	1.042
Acute Mortality	cases/TWh	3.710	2.786	2.658	2.658	0.039	0.130	0.127	0.000	0.000	0.000	0.000	0.000	0.026
Acute Year of Life Loss	Years/TWh	2.780	2.089	1.994	1.994	0.029	0.100	0.095	0.000	0.000	0.000	0.000	0.000	0.020
Acute Hospital admissions	cases/TWh	6.060	4.557	3.076	3.076	1.757	0.818	3.076	0.000	0.000	0.000	0.000	0.000	1.177
Acute Congestive heart failure	cases/TWh	1.690	1.271	0.913	0.913	0.165	0.250	0.373	0.000	0.000	0.000	0.000	0.000	0.110
Acute Restricted Activity Days	Days/TWh	9991.000	7511.800	5402.000	5402.000	959.000	1134.000	2167.000	0.000	0.000	0.000	0.000	0.000	642.530
Chronic Mortality	cases/TWh	28.870	21.690	15.570	15.570	2.770	4.500	9.050	13.040	0.000	0.000	2.100	0.000	1.856
Chonic YOLL	Years/TWh	288.420	216.860	155.700	155.700	27.700	45.300	90.600	130.400	0.000	0.000	21.000	0.000	18.559
Chronic Bronchitis (adult)	cases/TWh	19.340	14.546	10.377	10.377	1.890	3.080	4.270	1.300	0.000	0.000	0.200	0.000	1.266
Chronic Bronchitis (Children)	cases/TWh	271.720	204.300	147.000	147.000	26.090	42.000	58.960	0.000	0.000	0.000	0.000	0.000	17.480
Chronic cough	episodes/TWh	350.000	261.580	189.000	189.000	33.500	54.780	75.710	0.000	0.000	0.000	0.000	0.000	22.445

b) Model Calculation

For the power generation, the eco-indicator approach initiates its calculation with the fate analysis linking the emissions of several air pollutants, including SO_2, NO_X, TSP, NMVOC, and CO_2, to a temporary change in their concentrations. Then, it makes an exposure analysis linking this temporary concentration to a dose. Later, in the effect analysis, it links the dose to a number of health effects, like the number and types of respiratory system disorders. Finally, the damage analysis links the specific health effects to DALYs[55]. Figure 5.13 presents the overall methodological approach of the eco-indicator project.

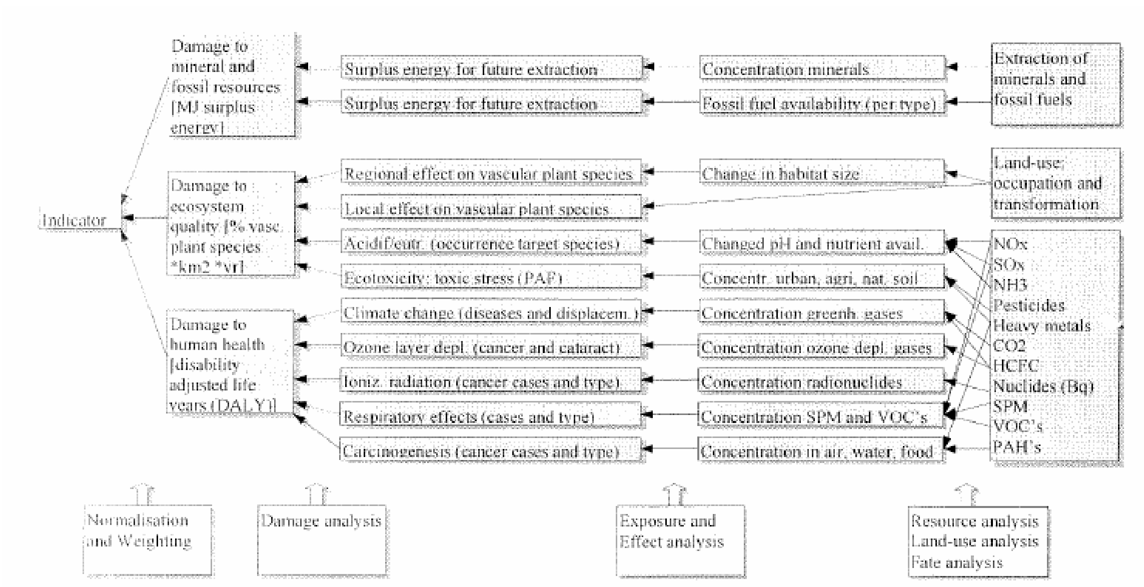


Figure 5.13 Overall Methodological Approach of the Eco-indicator Project

Source: Goedkoop, M. and R. Spriensma. 2001.

By this way, the units of the end results in the eco-indicator project, which will be used in this study, are the DALYs per Kg of each pollutant emission (not physical unit per kWh as applied in the Extern-E approach). Therefore, to calculate the health impact in this study, the calculation of environmental impacts (in terms of each pollutant emission) is required, as planned and described in the previous section. Finally, to summarize the overall health impacts of all pollutants derived from power generation, the summation of health impacts of each pollutant will be done, with the identification of two important types of health effects; namely climate change and respiratory effects of air pollution.

It is very important to note that, based on the results of the eco-indicator, that the so-called health impacts of air pollution in this study are only the respiratory effects. In other words, the growing concerns of lung cancer caused by air pollution and children neurobehavioral impairment related to mercury exposure[56], as discussed in Chapter 3, do not form part of this analysis.

Concurrently, due to the available information, health impacts of climate change in the eco-indicator include the increasing of diseases as a result of higher average temperature (such as malaria, schistosomiasis, dengue fever, cardiovascular and respiratory disorder) and the number of people that have to be displaced due to the rising sea level[57]. The following are excluded from the eco-indicator, a) other diseases than vascular diseases due to heat waves, b) other vector-borne diseases than malaria, schistosomiasis, dengue fever, c) effects on malnutrition and hunger, d) increased impact of pollutant at higher temperatures, and e) the effects of extreme weather events[58].

Moreover, to better represent the situation in the real world decision-making, three sets of health damage factors are identified in the eco-indicator project. Based on cultural theory, “Egalitarian” refers to a long-term perspective and a more pre-cautionary approach, which means that even a minimum of scientific proof justifies inclusion into the damage model. Oppositely, “Individualist” refers to a short-term perspective and only proven effects are included in the model. Last, “Hierarchist” represents a balanced time perspective and uses consensus among scientists to determine the inclusion of effects[59]. In general, the Hierarchist version is suggested by the authors, since it represents a consensus-building process and a balanced view of long and short-term perspectives[60].

Table 5.11 presents the results of the eco-indicator, which will be used as an assumption of this study. Apart from health impacts of NO_X, the table shows only slight differences between the three perspectives of decision-making. As suggested by the authors, this study will mainly use the hierarchist version as a standard for further analysis.

Table 5.11 The Eco-indicator’s Health Damage Factor of Selected Pollutants in Three Decision-making Perspectives (Unit: DALYs per kg of emission).

Pollutants	Hierarchist	Egalitarian	Individualist
CO_2	2.10E-07	2.10E-07	2.00E-07
SO_2	5.46E-05	5.46E-05	3.90E-05
NO_X	8.87E-05	8.91E-05	1.19E-06
TSP	1.10E-04	1.10E-04	8.03E-05
NMVOC	1.28E-06	1.28E-06	1.19E-06

Source : Compiled from Goedkoop and Spriensma, 2001.

Like the Extern-E approach, the limitations and uncertainties of the eco-indicator approach lie under the scope of available information and model development. In specific, health damage factors of the eco-indicator are still based on existing European experiences, except from those of climate change (which are based on the global scale). These factors do not cover the full range of health impacts of power generation, as mentioned earlier either. At the same time, they are based on the present knowledge of health impacts and relied on present technologies for health protection and treatment.

5.5.4 Comparison of the Two Approaches

Based on the above description, the differences between the Extern-E and the Eco-indicator approaches are summarized in Table 5.12.

Table 5.12 The Comparison between the Extern-E and the Eco-indicator approaches

Items	Extern-E Approach	Eco-indicator Approach
Nature of health impact factors	Disaggregation into different physical units (e.g. no. of mortality cases or chronic bronchitis cases)	Aggregation into DALYs
Units of health impact factors	Different physical units per kWh of each power technology	DALYs per kg of each pollutant emission from power generation
Identification of different impacts	Yes, mainly divided into acute and chronic health impacts	No. All impacts included into DALYs
Calculation procedure in this study	Directly from energy generation of each technology determined in each PDP option	Indirectly from amount of pollutant emissions, calculated in environmental impact analysis
Main types of health impacts	Impacts of air pollution and accidents	Impacts of air pollution and climate change
Inclusion of air pollutants (excluding climate change)	SO_2, NO_X, and PM	SO_2, NO_X, TSP, and NMVOC
Main source of information	European experiences	Mainly European experiences (except climate change)
Differentiation for different decision-making schemes	No differentiation	Three sets of factors applied to different decision-making schemes

Obviously, the differences in the nature of health impact factors between these two approaches lead to the different applications in this study. For the Extern-E approach, the different types of health impacts can be identified, but an overall health impact indicator cannot be obtained. Oppositely, the aggregation into DALYs allows the eco-indicator to present a picture of the overall health impact of power generation, while it fails to present different types of health impacts.

In terms of calculation, since the Extern-E approach provides factors based on kWh of each technology, the calculation of health impacts can be easily performed directly from power generation in each PDP option. However, because the health damage factors in the eco-indicator approach are based on the amount of each pollutant emission, the calculation of health impacts requires the results of pollutant emission from the environmental impact analysis.

Last, in terms of scope of health impacts, these two approaches do not cover the same aspects, although both rely on the existing experiences of the European region. Both approaches cover health impacts of air pollution with small differences in terms of pollutant inclusion. While the Extern-E approach fails to include climate change effects, the eco-indicator misses the accident-related health impacts in its analysis.

Based on this comparison, it is useful to apply both approaches to this study. Applying both approaches will allow us to know both overall and specific health impacts from the analyses. It also provides useful insights into all health impacts of accidents, air pollution, and also climate change. It can also provide some comparability between the results of these two approaches, at least in terms of health impacts of air pollution. Since the eco-indicator approach covers both YLL and YLD (while the Extern-E approach calculates only YLL) and more pollutant emissions, the DALYs results of health impacts (of air pollution) from the eco-indicator approach should principally exceed the years of life loss presented in the Extern-E.

5.5.5 Limitations and Uncertainties

Like other strategic impact analyses, the limitations and uncertainties of the study depend mainly on the availability of information and the appropriateness of the applied model. Based on these two approaches, the health impact analysis in this study faces five limitations and uncertainties, as discussed below;

- Not all health impacts can be included in the analysis. Mainly the physical health impacts of air pollution, climate change, and accident are quantified in the analysis. All socio-economic consequences cannot be translated into physical units, but they are part of the great concerns in Thai society, as shown in Chapter 1 and Chapter 4.
- Since both approaches rely on European epidemiological studies and models, they can lead to important uncertainties when applied to Thailand. Among all differences between Europe and Thailand, four main different conditions must be considered; namely, weather conditions, demographical conditions, coping capacities of health sector and society, and environmental regulations. For example, the warmer weather can lead to greater negative impacts of air pollution[61]. Higher population density and a higher proportion of children in the total population can lead to greater negative health impacts as well. Poorer coping capacities and environmental regulation can certainly lead to poorer environmental conditions, higher risk exposures, and consequently much worse impacts on health.
- Because Thailand's PDP does not specify the locations of new power plants, an actual exposure analysis of Thailand cannot be obtained in this study. In other words, this study uses direct calculations from amounts of power generation and pollutant emissions without considering the importance of location in its impact analysis.
- In practice, each power plant can lead to different environmental and health impacts. Therefore, to use one impact co-efficient for each technology (assuming that all power plants using the same technology) is associated with some uncertainty.
- The impacts of future technologies, both in the power sector (including in pollution controls) and in medical treatment (to reduce the health impacts or preventing premature death), and future knowledge about health impacts (more scientific proofs and consensus on health impacts from power generation), cannot be included in this study.

Although they face these limitations and uncertainties, it is still useful and worthwhile to apply these two approaches to analyze the health impacts of Thailand's PDP. This is mainly because they can provide an overview picture of what may happen (i.e. potential health impacts) in each PDP option, based on previous international experiences and knowledge. Since no systematic health impact analysis of power generation in Thailand has previously be conducted , the future health impacts of different development options with different power technologies cannot be systematically compared and deliberatively discussed in Thai society without these calculations. Moreover, both approaches form part of state-of-the-art in this research field and have been widely adopted across the world. Therefore, while facing limitations and uncertainties, this quantified health impact analysis is still expected to contribute with a valuable insight to healthy public policy discussions in Thai society.

5.6 Economic Impact Analysis

Economic impacts are very important aspects in overall impact analysis. This is not only because the economic aspect forms part of the social determinants of health, as shown in the DPSEEA model, but also because it is considered to be the most important factor in policy-making within Thai power policy. Therefore, regarding the concept of healthy public policy, the implementation of an economic impact analysis can be seen as an attempt to make the healthier choice an easier one for decision-makers.

a) Economic Impact Indicator

Although, in theory, we can identify the final endpoint or the ultimate indicator for economic analysis, like the maximization of net present value or the minimization of societal costs, in reality, there is always more than one aspect of economic impacts which needs to be discussed in policy-making processes. The balancing between economic growth and stability is one of the obvious examples. Another example that can be identified is the balancing between short-term and long-term benefits.

Therefore, to represent the reality of policy-making, the economic impact analysis in this study will provide five main indicators, which are relevant to policy discussion in the Thai power sector and Thai society.

- **Investment requirement**. Although investment requirement should not be a big concern for a relatively high stable and profitable electricity market like Thailand, it becomes a part of the main policy argument for EGAT privatization (discussed in Chapter 4). In short, its analysis can show which PDP options are financially viable in this present context.
- **Generation costs**. Generation costs are always on the top of the agenda of policy debates and politics in the Thai power sector (see Chapter 4). It becomes a political indicator in itself. Thus, it is essential to this analysis to show the impacts of different PDP options on generation costs.
- **GDP Contribution**. At the national level, GDP growth is always a top development indicator for the Thai government. Recently, the Thai government has also considered the power generation project as a part of the mega-projects which can boost national economy. Considering the fact that investment in different power technologies can lead to great differences in their GDP contributions to national economy (mainly due

to the differences in local contents), it is very useful to identify the most valuable PDP option in terms of GDP contribution.

- **Balance of Payment Effect**. After the economic crisis in 1997, economic stability has certainly become a great concern in Thai society even though, unlike GDP growth, it is not yet a politically sensitive indicator. The 9th National Development Plan has stated clearly the target of national balance of payment as a part of the development of the sufficiency economy. Thus, in this study, the different import burdens arisen from different PDP options will be calculated and compared in order to provide an insight into how power generation investment plans can affect national economic stability.
- **External Cost**. In economic theory, calculating external cost is the way to integrate external impacts into the decision-making equation (or consideration). Therefore, to many economists, it can be the bridge to sustainable development planning; though, in practice, it cannot easily work and reach the public decision-making process, as assumed in theory. However, according to its theoretical intention, it is a good idea to analyze the effect of internalized future impacts of power generation on the PDP decision-making process.

b) Data Assumption and Calculation

To calculate all economic impact indicators, the information on cost structure in the Thai context is required. From the several sources of information found through the review of literature, three main sources of information have been applied to the study, as described below;

- The study of IEA (2005)[62] on Projected Costs of Generating Electricity (a summary of results is shown in Table 5.13) can be used as a recent international reference.
- The EGAT's PDP report provides EGAT's own assumptions on investment costs in several conventional power technologies, including natural gas (combined-cycle and re-powering plants), coal, fuel oil, etc.[63]
- The Report of E for E Foundation[64] for Thailand's Energy Policy and Planning Office presents a comparative cost structure of different power technologies in the Thai context, as shown in Table 5.14.

Based on these main sources of information with some modifications, the investment costs, O&M costs, and fuel costs of each technology have been identified as assumptions of this study (later shown in Table 5.17). The investment costs will be based basically on EGAT's own assumption and, in other cases, on the E for E report. The O&M and fuel costs will be based on the E for E report. Modification is required to represent the actual cost changes in 2003 (mainly fuel cost changes) and load factors as planned in EGAT's PDP. For Biogas technology and DSM, of which no information is available in these documents, the assumption will be based on the OVE handbook for Thailand's Ministry of Energy's local energy planning project[65].

Table 5.13 The Projected Costs of Different Types of Power Plants in OECD Countries

Type	Construction Cost (USD/kWe)	5% Discount (US cent/KWh)				10% Discount (US cent/KWh)			
		Invest.	O&M	Fuel	Total	Invest.	O&M	Fuel	Total
Coal	1000-1500	10-12	4-9	12-30	25-50	18-23	4-12	10-29	35-60
Gas	400-800	4-10	2-5	32-44	37-60	18-36	6-10	4-8	40-63
Nuclear	1000-2000	10-18	6-10	4-8	21-31	18-36	6-10	4-8	30-50
Wind	1000-2000	27-60	6-20	-	33-76	46-90	5-15	-	45-120
Solar	2500-6000	115-480	5-50	-	120-480	205-740	5-50	-	210-740
Hydro	1300-3000	31-50	2-13	-	40-60	55-90	2-13	-	65-100
CHP	500-1500	6-35	1-23	21-50	25-65	10-50	1-23	21-50	30-70
Biomass	1700-2200	15-19	10-13	13-53	37-85	28-34	10-13	13-53	50-100

Source: Summarized from IEA (2005).
Note: CHP data includes heat credit.

Table 5.14 The Generation Costs of Different Power Technologies in the Thai context

Item	Unit	Coal	Gas	Fuel Oil	Biomass rice husk	Micro-hydro	Wind	Solar PV
Capacity	MW	300	729	735	18	0.06	1	0.003
Load factor	%	80	80	25	80	50	16.6	13.7
Lifetime	Year	25	20	25	25	25	20	20
Fuel Price		569.7 THB/ton	148 THB/m.btu	7.01 THB/l.	350 THB/ton	-	-	-
Investment cost	THB/kW	54,920	18,800	27,000	54,639	61,833	56,640	190,429
O& M Cost	THB/kWh	0.1470	0.0493	0.1382	0.3817	0.6123	0.6492	0.0292
Fuel Cost	THB/kWh	0.6197	1.0738	1.5710	0.4734	-	-	-
Total Cost	THB/kWh	1.4469	1.3570	2.0170	1.5697	1.7564	3.9764	9.0665

Source: Summarized from E for E (2003), pp 2-86 to 2-89.

From these assumptions, the annualized capital costs have been calculated for each power technology in order to compare annual generation costs with different project lifetimes (in different technologies) and different time frames of investment of each PDP option. In this calculation, the interest rate of 5% is assumed to represent a less risky market situation in the Thai power sector. For the conventional power technologies, a project lifetime of 25 years is assumed, while, to represent higher chances of new technological development, a 20-year project lifetime is assumed for renewable technologies.

In analyzing the GDP contribution and the BOP effect, information is needed on the domestic and import characteristics of each technology. Unfortunately, this information is not complete in the Thai context. However, from the work of Songkrot Kalnpongwarn[66] and the analysis of the latest 2000 Input-Output table, Table 5.15 provides some initial idea which can be used for identification in this study. In the study, the assumptions (as also later shown in Table 5.17) of import content will be separately identified for capital costs (or construction costs), O&M costs, and fuel costs, to reflect the different natures in cost distribution in these cost activities.

Table 5.15 Share of Import Costs in Power Generation and Related Activities

From Songkrot kalnpongwarn, 2001		Own Analysis from 2000 I-O Table	
Biogas to power	8.82%	Coal and Lignite	34.52%
Biomass power	18.2%	Petroleum and gas	70.98%
LPG	57.18%	Electricity	28.13%
Electricity	26.66%	Power Plant Construction	26.65%

Source: Summarized from Songkrot Kalnpongwarn (2001) and own analysis

In terms of external costs, this study is based on the recommendation of the E for E Foundation[67] (to Thailand's Energy Policy and Planning Office), which now becomes a formal proposal for internalizing the benefits of renewable energy in the Thai context (namely in government subsidies and pricing). The E for E recommendation is basically referring to the result of the Extern-E project, adjusted by the purchasing power difference between Thailand and the EU according to the method of benefit transfer. In this recommendation, two types of externality costs are identified; namely, the minimum level of external costs for government subsidies and the average level of external costs for real economic pricing, as shown in Table 5.16. In this study, the average level of external costs is applied to represent the idea of real economic pricing.

Table 5.16 Suggested Externality Costs of Power Generation in the Thai Context (Unit: THB/kWh).

Approach	Coal	Fuel Oil	Gas	Biomass	Hydro	Wind	Solar PV
Minimum Level (for gov. subsidy)	2.09	2.02	0.60	0.48	0.30	0.04	0.11
Average Level (for real econ. Pricing)	2.76	2.67	0.79	0.63	0.39	0.14	0.05

Source: Summarized from E for E (2003), pp. 2-106 to 2-107.

Through all these assumptions and calculation, the final set of economic assumptions used in this study is identified and presented in Table 5.17.

It should be noted that, since the fuel costs of each technology are based on the fuel price in 2003, when the recent world oil price rise had not yet occurred, the sensitivity analysis of higher fuel costs is thus essential. This sensitivity analysis will be explained in section 5.9.

Table 5.17 The Economic Assumption for Each Power Technology in This Study

Co-efficient Item	Unit	Lignite	Coal	Oil	Diesel	Gas	Biomass	Biogas	PV	Hydro	Micro-hydro	Wind	DSM	Laos	Malay.	Co-gen
Investment Costs	M.THB /MW	45.000	42.000	27.000	55.000	25.000	55.502	80.750	190.429	23.150	61.833	56.640	7.500	-	-	36.000
Annualized Capital Costs (5%)	M. THB /MW	3.20	2.98	1.92	3.91	1.78	4.44	6.46	15.23	1.64	4.95	4.53	-	-	-	2.56
Import Content	%	50	70	70	60	70	50	30	50	60	30	60	50	0	0	70
Operation & Maintenance	THB /kwh	0.11	0.18	0.14	1.86	0.10	0.51	1.20	0.03	0.13	0.62	0.65	0.50	0.00	0.00	0.12
Import Content	%	10	15	15	15	15	10	15	15	10	10	15	15	0	0	15
Fuel costs	THB /kWh	0.570	0.670	1.571	3.023	1.125	0.786	0.000	0.000	0.000	0.000	0.000	0.000	1.650	1.600	1.182
Import Content	%	20	90	90	90	70	20	0	0	0	0	0	0	100	100	70
External Costs	THB /kwh	4.04	2.76	2.67	2.67	0.79	0.63	-	0.05	0.39	0.13	0.14	-	0.39	0.79	0.47

5.7 Resource Impact Analysis

Power generation, especially in conventional technologies, is a resource-consuming activity and Thailand is certainly not a rich country in terms of fossil-based resources. Therefore, according to the concept of sustainable development and sufficiency economy, better strategic energy resource management is highly required. The analysis in this study aims to provide information on how different PDP options with different power generation technologies will lead to different patterns of resource utilization, self-sufficiency and conservation.

There are three indicators in this resource impact analysis;

- **Share of domestic resource**. The share of domestic resource in power generation represents the idea of self-sufficiency in the Thai power sector. However, it should be used with caution, since the present high domestic resource share, especially in terms of finite resources, may lead to a higher rate of resource depletion and, therefore, a lower rate of resource self-sufficiency in the longer term.
- **Effect on Natural Gas Reserve**. Natural gas is the most important fuel for power generation in Thailand, but Thailand has only a limited existing natural gas reserve. The imported natural gas from neighboring countries becomes more and more important in the near future, as presented in Chapter 3. Therefore, the relevant strategic impact assessment should include the different effects of PDP options on natural gas consumption, natural gas reserve, and resource lifetime.
- **Renewable Energy Share**. Renewable energy share can be a very good indicator for moving towards a sustainable future. Apart from lower negative environmental and health impacts, renewable energy means less reliance on risky energy markets. Recently, the Thai government also announces the clear target of 6% renewable energy share of the total power generation by 2011.

Since most of these indicators can be calculated directly from the PDP and its energy generation table (in appendix 1), it is less complicated compared to previous health and economic analyses. The natural gas reserve information in this study is based on the 2003 annual report of the Department of Mineral Fuels[68] and the internal document of the National Energy Policy Office (NEPO)[69]. The information on natural gas consumption outside the power sector and the natural gas mix (between different sources in Thailand and neighboring countries) is also based on the NEPO internal document[70].

5.8 Social Impact Analysis

Normally, the social impacts of power projects and generation depend very much on contexts, implementation and interaction between actors, which are quite difficult to assess at the strategic level. However, due to the differences in technologies, fuels, types of projects and ownership structures in the three PDP options, four sets of social impact indicators can be identified in this study, including;

- **Employment Effect**. Although the unemployment in Thailand is considerably low, job creation is still very important to the poverty alleviation strategy. The 9th National Development Plan also set up a specific target of job creation. This impact analysis will provide an estimation of job creation in each PDP option.
- **Decentralization Effect**. Thailand's constitution presents a clear direction of decentralization in Thai society, as discussed in Chapter 2. However, in practice, decentralization is hardly taking place in a highly centralized power system, like Thailand[71]. This study will foresee the impact of each PDP option on the share of decentralized power generation and on the overall power market structure.
- **Potential Conflicts in Society**. As earlier mentioned, social conflicts are highly context and process-dependent. At the strategic level, this study in itself cannot provide a finite answer to future conflict assessment. However, since each PDP option leads to big differences in types of power plant investment as well as the scales of environmental and health impacts, which certainly link to different potentials in terms of social conflicts, this study will provide a discussion on this point.
- **Government target Achievement.** In 2003, the Thai government set up two main targets for sustainable energy development, as mentioned earlier; namely the 1:1 energy intensity (as compared to GDP growth) and the 6% renewable energy share by 2011. This study will analyze how the three PDP options will lead to the achievement of these government targets.

The decentralization effect, potential conflicts, and government target achievement can be calculated, compared and discussed directly from power investment and generation plan in each PDP option. For employment effect, there are two ways of calculation. The first approach is the calculation of employment share (or wage or salary share) in cost structure[72] and the second one is the calculation of the direct employment coefficients of each power technology. This study applies the latter approach, using the coefficients from the study of Goldemberg [73]with some modification, as noted in Table 5.18.

However, it is important to note that the main assumption of this direct job calculation is that all power generation, fuel supply, construction, and equipment processes are done domestically. The problem is that no information exists on the expected number of jobs created in Thailand through different power technologies. Therefore, with this limitation, the study decides to use the lower number within the range of suggested coefficients. Especially, for coal-fired power plants, which rely on imported coal, the assumption is made that only half of the jobs will be created in Thailand.

Table 5.18 Direct Jobs in Power Generation and Fuel Supply

Power Technologies	Summarized by Goldemberg (2004)	Assumption for this study
	(Job-Year/TWh)	(Job-Year/TWh)
Lignite	-	370
Coal	370	185 (1)
Natural Gas	250	250
Nuclear	75	-
Wood Energy	733-1,067	733
Hydro	250	250
Mini-hydro	120	120
Wind	918-2,400	1,200
Solar PV	29,589-107,000	35,500
Biogas	-	733 (2)
DSM	-	1,000 (2)

Source: Goldemberg (2004).

Note: (1) Due to the import of coal (2) Own Assumption

5.9 Sensitivity Analysis

A strategic impact analysis is normally based on several assumptions, as described in this chapter, which, in many cases, are highly uncertain and also contestable. In some cases, like fuel costs, the current prices are even unforeseeable. To confirm reliability and to understand the validity of the results, sensitivity analysis is quite useful and essential. In this study, four sensitivity analyses are conducted, relating to the variation of environmental and health impact factors, fuel prices, the high demand growth situation, and the low demand growth situation.

a) Sensitivity Analysis I : Environmental and Health Sensitivity

Since environmental and health impacts constitute the main focus of this study, the first sensitivity analysis is dealing with the uncertainties in emission factors and health impact factors, which, as explained earlier, vary greatly due to different conditions. The main objective of this sensitivity analysis is to test how the variability of these environmental and health coefficients will lead to different results in environmental and health impact analyses.

In terms of environmental analysis, the sensitivity analysis will focus on the changes in the emission factors of six pollutants. For CO_2, this sensitivity analysis applies the lowest international references for greenhouse gas emissions from coal, natural gas, and lignite power generation technologies (both for old and new power plants). For the other five pollutants, of which the emission can vary greatly as explained above, different percentage reductions of emission factors in coal, natural gas, and lignite power generation technologies (in both old and new power plants) are tested in order to identify the level that will change the results of the environmental and health analyses.

For the health impact analysis, since the analysis in the eco-indicator approach is calculated from the pollutant emission levels of three PDP options, the sensitivity analysis in this approach is closely related to the previous environmental sensitivity analysis. As a result, the earlier changes in emission factors are also applied to the sensitivity test in the eco-indicator approach to health impact analysis.

Unlike the eco-indicator approach, the analysis of health impacts in the Extern-E approach is not calculated from various pollutant emissions; therefore, an additional sensitivity analysis is needed. Using the same logic, health impact coefficients of all coal, natural gas, and lignite power technologies are assumed to be reduced in equal percentages and the health impact results will be recalculated.

b) Sensitivity Analysis II: Fuel Price Sensitivity

The variation of fuel price is certainly crucial to every strategic impact assessment in energy planning. However, it is an unpredictable factor, regarding today's world energy market situation. Therefore, the sensitivity analysis of different fuel price situations is useful, both to find the least-cost solution in different situations as well as to search for the most secure options for an uncertain future.

Three different price situations are applied to the fuel price sensitivity analysis in this study. The base case scenario refers to the assumptions used in the existing PDP, i.e. the 2003 normal price situation (or the price of natural gas at 155 THB/btu). The second scenario (the so-called situation II) is the scenario of an increasing natural gas price in Thailand, up to the highest level of 2005 (and also in the beginning of 2006), at 190 THB/btu. The last scenario (the so-called situation III) is the situation in which the prices of both imported coal and biomass are also increasing proportionally to the natural gas price, because of their substitution effect. The comparison of fuel costs in the three situations can be seen in Table 5.19.

Table 5.19 Fuel Cost Assumptions for Fuel Price Sensitivity Analysis (Unit: THB/kWh)

Price Situations	Natural Gas	Coal	Biomass
Situation I (Base case)	1.125	0.670	0.786
Situation II	1.379	0.670	0.786
Situation III	1.379	0.791	0.904

Source: Own Assumption.

c) Sensitivity Analysis III: High Demand Growth Sensitivity

There are two main differences between PDP-Renewables and the other two PDP options. These two main differences are their different fuel mixes and the demand forecasting. Regarding the demand growth expectation, though the figures of peak demand in 2004 and 2005 are much closer to what is predicted in PDP-Renewables than those of the other two options, as shown in Table 5.20, several planners will continuously take into consideration an unexpected high economic growth and, consequently, a high electricity demand growth. These expansionist planners prefer to keep over-estimating in order to ensure system reliability and business expansion and are, therefore, reluctant to accept PDP-Renewables, due to its lower demand growth assumption.

Table 5.20 The Differences between the Actual Peak Demand, Existing Demand Forecasting, and the Adjusted Forecast in PDP-Renewables (unit: MW).

Year	Existing Demand Forecasting (as in PDP-Gas & PDP-Coal)	Adjusted Demand Forecasting (as in PDP-Renewables)	Actual Peak Demand
2004	19,600	19,326	19,325
2005	21,143	20,543	20,538
2006	22,738	21,283	21,064

This sensitivity analysis will deal with this concern by analyzing the flexibility of PDP-Renewables in maintaining system reliability as well as its environmental, health, social, and economic advantages if the high demand growth is assumed (or the high demand growth become an obvious situation in the Thai power sector in a few years time).

The analysis will begin by changing PDP-Renewables' assumption of the power demand growth rate after 2006 to the same growth rate as the other PDP options (i.e., from 5.2% GDP growth assumption to 6.5% GDP growth assumption). Then, the adjustment of PDP-Renewables is needed in order to meet the new peak demand and maintain system reliability. In this study, the adjustment of PDP-Renewables will be done in the following way;

- Increase the installed capacity and energy generation of renewable technologies and DSM by 10% from the normal PDP-Renewables generation plan;
- Lower the reduction of the Mae Moh power plant from 50% reduction (or 1,200 MW reduction) in 2015 as previously planned in PDP-Renewables to a 37.5% reduction (or equal to 900 MW reduction);
- Install 700 MW new gas combined-cycle power plants in 2013, 2014 and 2015, respectively (all together 2,100 MW installed capacity in 2015).

By this generation plan adjustment, it is ensured that PDP-Renewables can secure the power system for the whole period with an adequate reserve margin (the lowest reserve margin will equal 19.3% in 2015). Last, the impact analysis of adjusted PDP-Renewables will be recalculated and compared to other PDP options.

d) Sensitivity Analysis IV: Low Demand Growth Situation

Oppositely, the last sensitivity analysis will analyze the low demand growth situation with the idea that, within a couple of years, the over-forecasting may become too obvious to ignore. Therefore, the existing PDP, or PDP-Gas, may decide to lower its installed capacity requirement to the same expectation as presented in PDP-Renewables

In other words, in this new situation of analysis, PDP-Gas is no longer employing the expansionist strategy (or no over-investment) but still prefers natural gas as a main source of power generation rather than renewable energy technologies. The PDP-Gas with lower demand expectation will be referred to as PDP-Gas (low), in this study. Because over-investment can have several negative environmental, health, and economic impacts, it is essential to recalculate the impacts of PDP-Gas (low), or PDP-Gas with no over-investment effects, and compare it to PDP-Renewables.

Following this logic, this sensitivity analysis also paves the way for a decomposition analysis of the benefits (or advantages) of PDP-Renewables. By comparing PDP-Gas and PDP-Gas (low) and PDP-Gas (low) and PDP-Renewables, respectively, the overall benefits of PDP-Renewables in each item will be classified into two categories; namely forecasting effect and renewable energy effect. The forecasting effect refers to the difference between PDP-Gas and PDP-Gas (low) and, with the same expectation of future electricity demand, the renewable energy effect refers to the difference between PDP-Gas (low) and PDP-Renewables. The summation of these two effects will equal the overall effect (between PDP-Gas and PDP-Renewables) in each item. Therefore, these two effects can be compared as percentages of the overall effect in this decomposition analysis.

Strategically, this decomposition analysis of the benefits of PDP-Renewables will provide an insightful answer on whether both revising demand forecasting and investing in renewable energy are needed in the PDP in order to make PDP-Renewables a more desirable choice in the policy-making process.

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72 Detail description can be seen in Hvelplund, F. and H. Lund. 1998. (Op. Cit.)

[73] Goldemberg, J. 2004. *The Case for Renewable Energies*. The Thematic Background Paper for International Conference for Renewable Energies, Bonn, 2004.

Chapter 6

Strategic Impact Assessment of Three PDP Options

This chapter presents the results of the impact analysis of three PDP options, namely PDP-Gas, PDP-Coal, and PDP-Renewables, based on the analytical framework discussed in Chapter 5. The aim of this chapter is to identify the best PDP options, in relation to health and other perspectives.

Since the physical health impacts of power generation are highly related to environmental quality changes, the chapter will begin by presenting environmental impact analysis. Then, physical health impacts will be analyzed. After that, the analysis of social impacts, including job creation and decentralization of the power sector will be discussed. However, investment policy in the power sector is highly economy-driven and resource-dependent, and therefore, the fourth and the fifth parts will concentrate on economic impact analysis and the impact on domestic resources, respectively. The last impact analysis will focus on how these three PDP options lead to the achievement of the governmental target of the present National Energy Strategy.

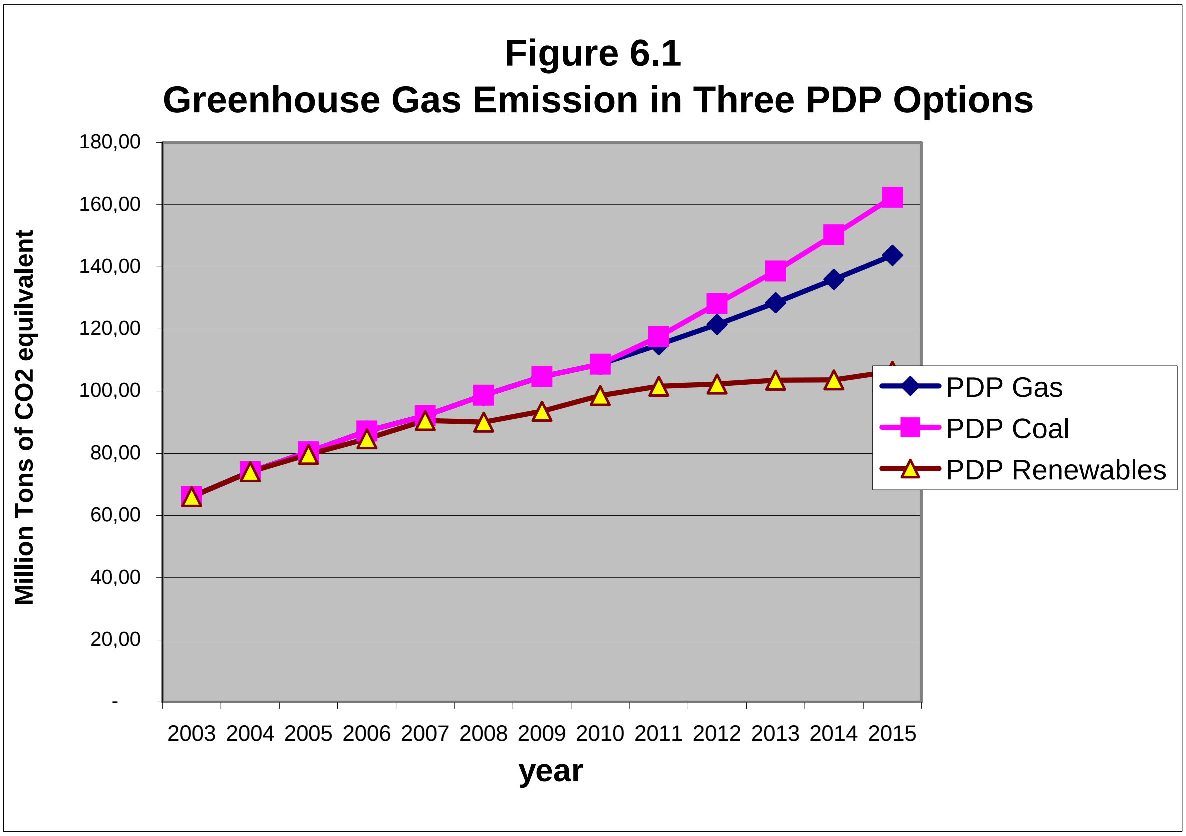
All impact analyses are based on a number of assumptions, including emission factors, health damage factors, fuel prices, and demand forecasting, and therefore, to ensure the reliability and validity of the analytical results, especially in terms of policy implications, the sensitivity analysis is certainly crucial. As told in Chapter 5, four sensitivity analyses will be presented and discussed in this chapter. The first sensitivity analysis will focus on the changes in the emission factors of the main fossil fuel technologies. Then, the changes in the fuel price situation will be discussed in the second sensitivity analysis. Later, the situation of high demand growth will be applied to PDP-Renewables in order to test its flexibility and advantages. Last, the low demand growth situation will be applied to the existing PDP (or PDP-Gas) in order to compare it with PDP-Renewables, which also assumed a low demand growth in its forecasting and investment plan.

6.1 Environmental Impacts

Power generation and its required investments can have several environmental impacts, both at the local and global levels. However, only two types of impacts are quantitatively assessed in this study; namely climate change impact and air pollution impact, which are among the most serious concerns in Thai society.

6.1.1 Climate Change Impact

Based on the existing Power Development Plan, i.e. PDP-Gas, the Thai power sector is estimated to increase its greenhouse gas emissions from 66.1 million tons CO_2 in 2003 to 143.6 million tons CO_2 in 2015. Adding more coal to Thailand's fuel mix, as planned in PDP-Coal, will lead to higher greenhouse gas emissions, up to 162.4 million tons CO_2 in 2015. Oppositely, improving energy efficiency, investing in renewable energy and revising demand forecasting, as mentioned in PDP-Renewables, will reduce greenhouse emissions to 106.4 million tons CO_2 in 2015, or 25.9% lower compared to PDP-Gas and 34.5% lower than PDP-Coal. More importantly, Figure 6.1 also shows that implementing PDP-Renewables can provide the strong hope for the Thai power sector that it will be able to stabilize its greenhouse gas emissions in the near future.



6.1.2 Air Pollution Impacts

As mentioned earlier, in Chapter 5, five main air pollutants have been assessed in this study as follows.

- **Nitrogen Oxides Emissions**

The pattern of the NO_X emissions in the three PDP options is quite similar to what is previously presented about the greenhouse gas emissions (Figure 6.2). PDP-Coal is the heaviest polluting PDP option with NO_X emissions of 530,310 tons, while PDP-Gas is expected to emit 423,684 tons in 2015. PDP-Renewables is still the best possible option with emissions of 352,439 tons in 2015, or 16.8% lower than PDP-gas and 33.5% lower than PDP-Coal.

- **Sulfur dioxide Emissions**

The SO_2 emissions in all PDP-options have increased during 2003-2006 as a result of the short-term switching to fuel oil in some power plants due to the shortage of the natural gas supply. After that, the level of SO_2 emissions in PDP-Gas will increase only gradually (as shown in Figure 6.3), because natural gas has quite low SO_2 emissions in its life cycle. In 2015, PDP-Gas is expected to emit 213,351 tons of SO_2. Switching half of the planned power plants to coal-fired technology will increase SO_2 emissions considerably after 2011 and end up with 358,011 tons of SO_2 in 2015. On the contrary, investing in renewable energy and reducing the power generation from the Mae Moh lignite power plant, as planned in PDP-Renewables, will reduce SO_2 emissions by 23.2% compared to PDP-Gas and 54.2% compared to PDP-Coal.

- **Total Suspended Particulates Emissions**

Like SO_2 emissions, based on power generation from natural gas, the existing PDP or PDP-Gas will lead to a small increase in TSP emissions, up to 17,875 tons in 2015. Unlike the other environmental indicators, PDP-Renewables will result in higher TSP emissions compared to PDP-Gas during the period of 2009-2012, before going down because of the scaling down of the power generation from the lignite-fired power plant from 2011 (Figure 6.4). In 2015, PDP-Renewables will emit 16,172 tons of TSP, or 9.5% lower than PDP-Gas. Obviously, PDP-Coal is still the most polluting option in terms of TSP with 31,263 tons of TSP emissions in 2015.

- **Mercury Emissions**

As mentioned earlier, Hg emissions are highly associated with power generation from coal. Therefore, with a smaller portion of coal in their fuel mixes, PDP-Gas and PDP-Renewables will almost stabilize their Hg emissions around 5.0-5.5 tons/year from 2008 till 2015 (Figure 6.5). In this case, PDP-Renewables can provide only little reduction in Hg emissions, around 5.7% compared to PDP-Gas. Oppositely, shifting to coal as intended in PDP-Coal will lead to a considerable increase in Hg emissions and end up with 20.5 tons of Hg emissions in 2015.

- **Non-methane Volatile Organic Compounds Emissions**

Unlike other environmental indicators, PDP-Gas becomes the main polluter in terms of NMVOC emissions with the level of 36,976 tons, while PDP-Coal is expected to emit 31,309 tons in 2015 (Figure 6.6). PDP-Renewables is still the best possible option with 28,834 tons of NMVOC emissions, which provides an emission reduction of 7.9% compared to PDP-Coal and 22.0% compared to PDP-Gas.

Based on these six environmental indicators (both climate change and air pollution impacts), it can be concluded that PDP-Coal is certainly not a good solution in an environmental perspective and PDP-Renewable is the most desirable option for Thai society, both in terms of climate change and air pollution mitigation. However, improving environmental management of renewable technologies is still highly recommended in order to lower its remaining negative impacts, especially in terms of TSP and NMVOC.

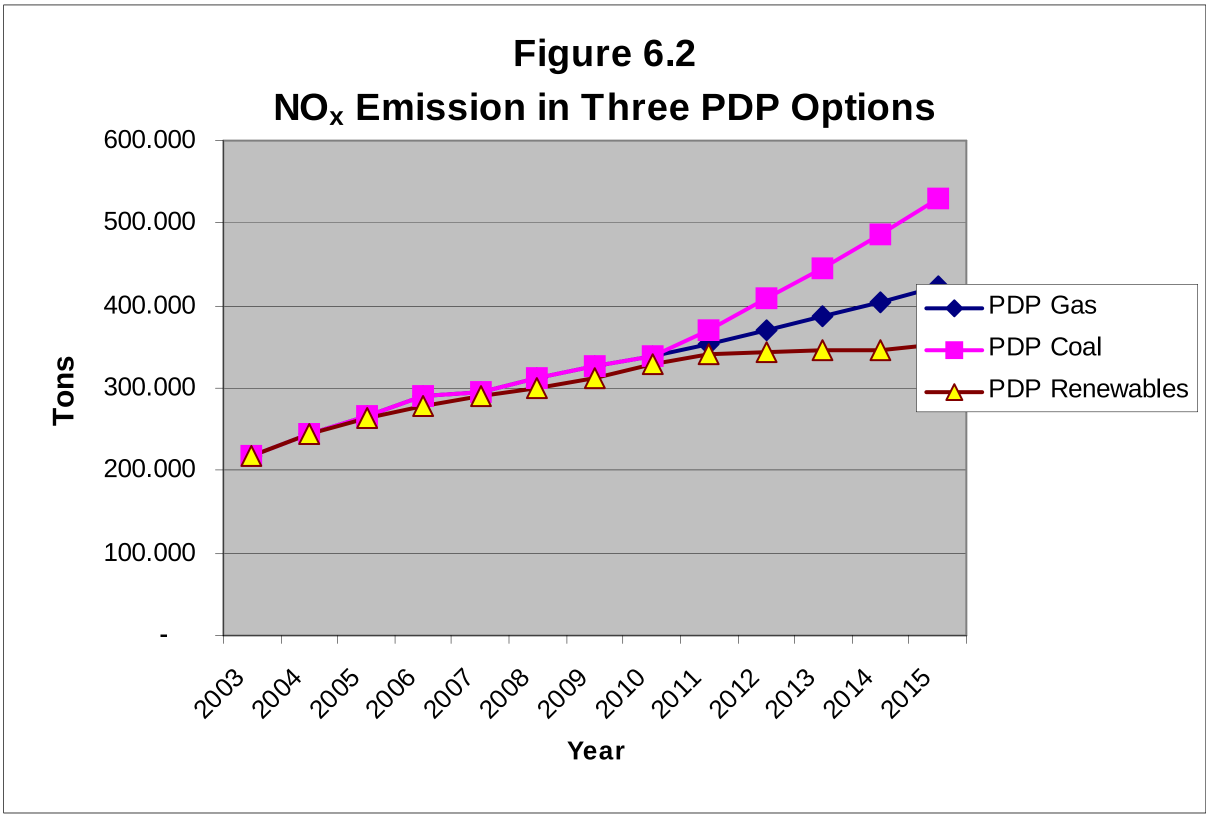


Figure 6.2
NOx Emission in Three PDP Options
600.000
500.000
400.000
300.000
200.000
100.000
-
Tons
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP Gas
PDP Coal
PDP Renewables

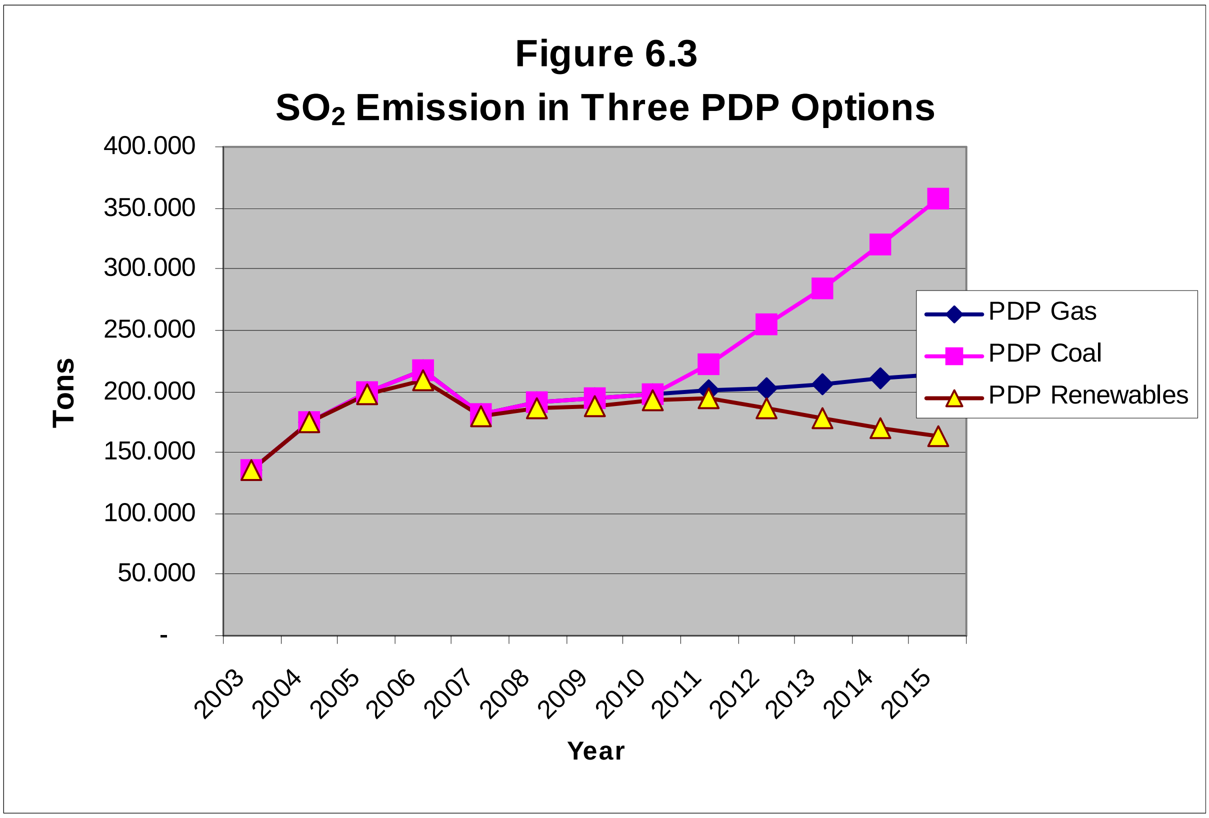


Figure 6.3
SO2 Emission in Three PDP Options
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
Tons
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP Gas
PDP Coal
PDP Renewables

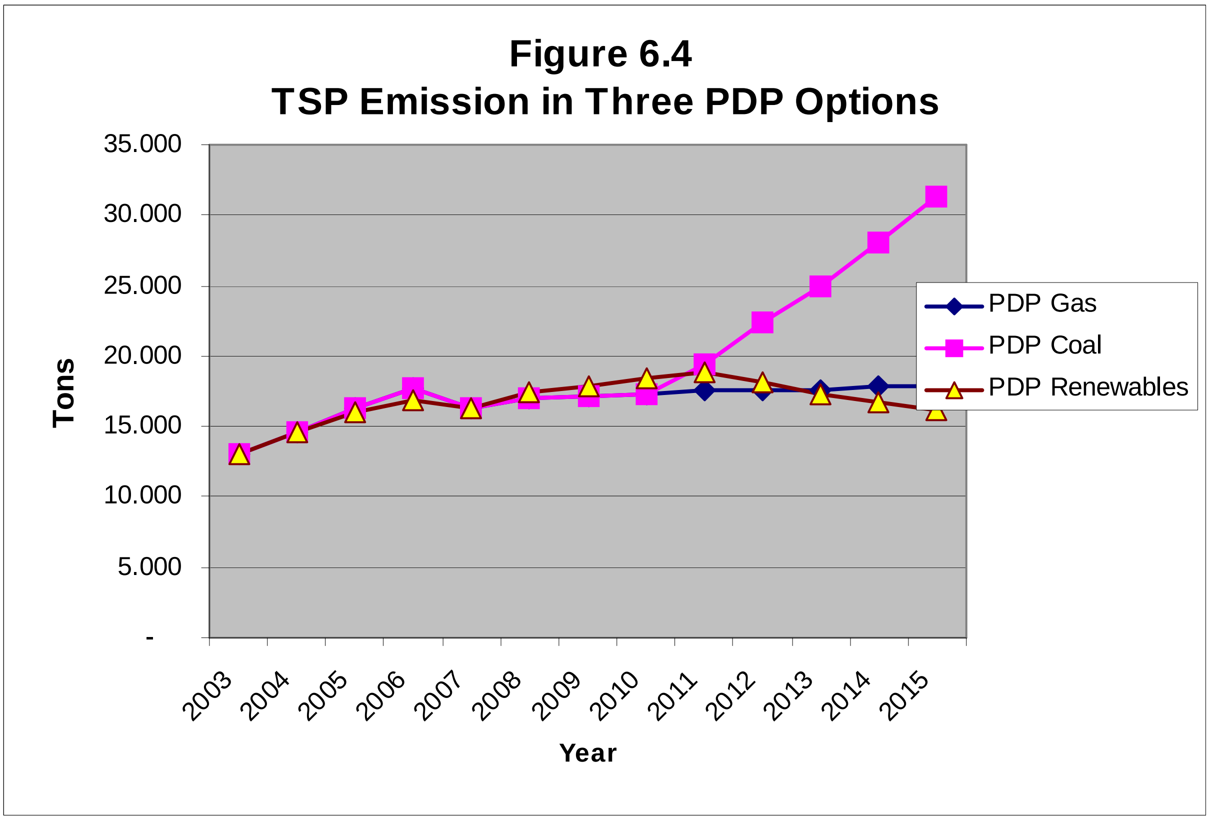


Figure 6.4
TSP Emission in Three PDP Options
Tons
35.000
30.000
25.000
20.000
15.000
10.000
5.000
-
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP Gas
PDP Coal
PDP Renewables

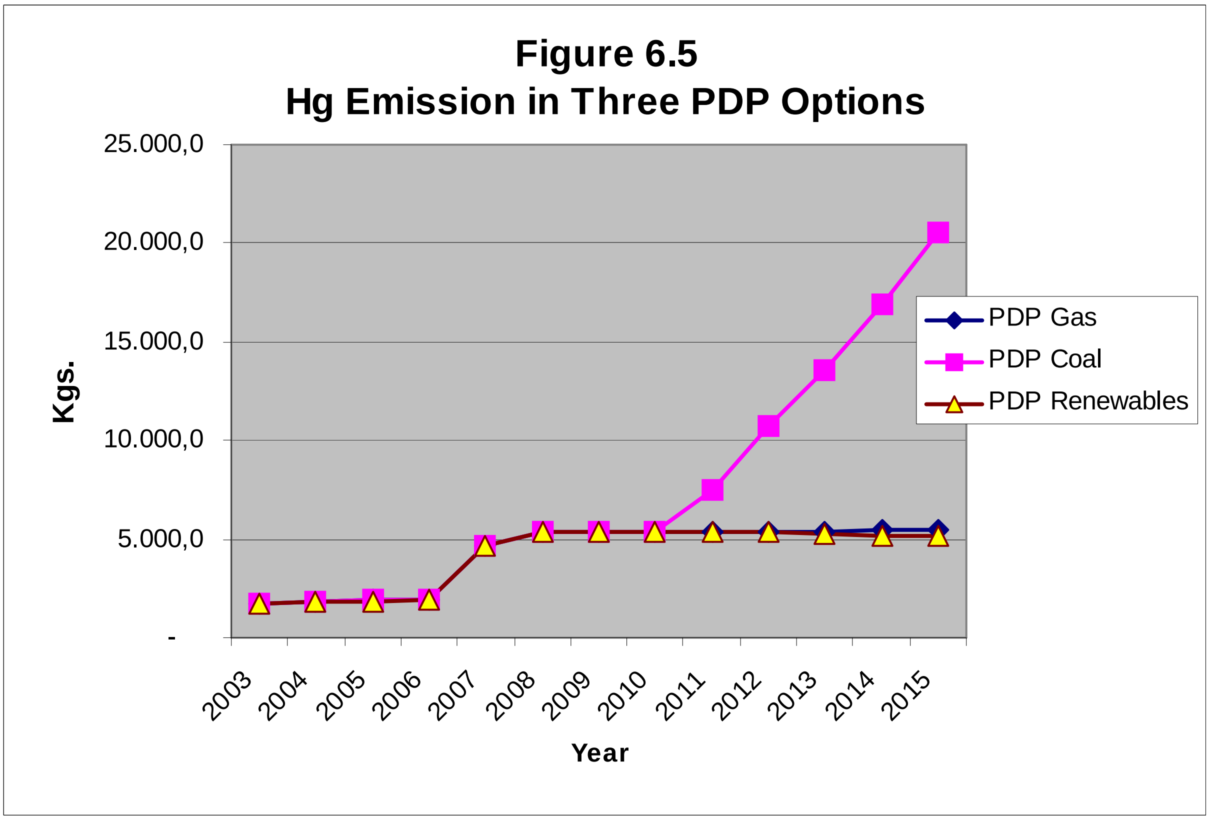
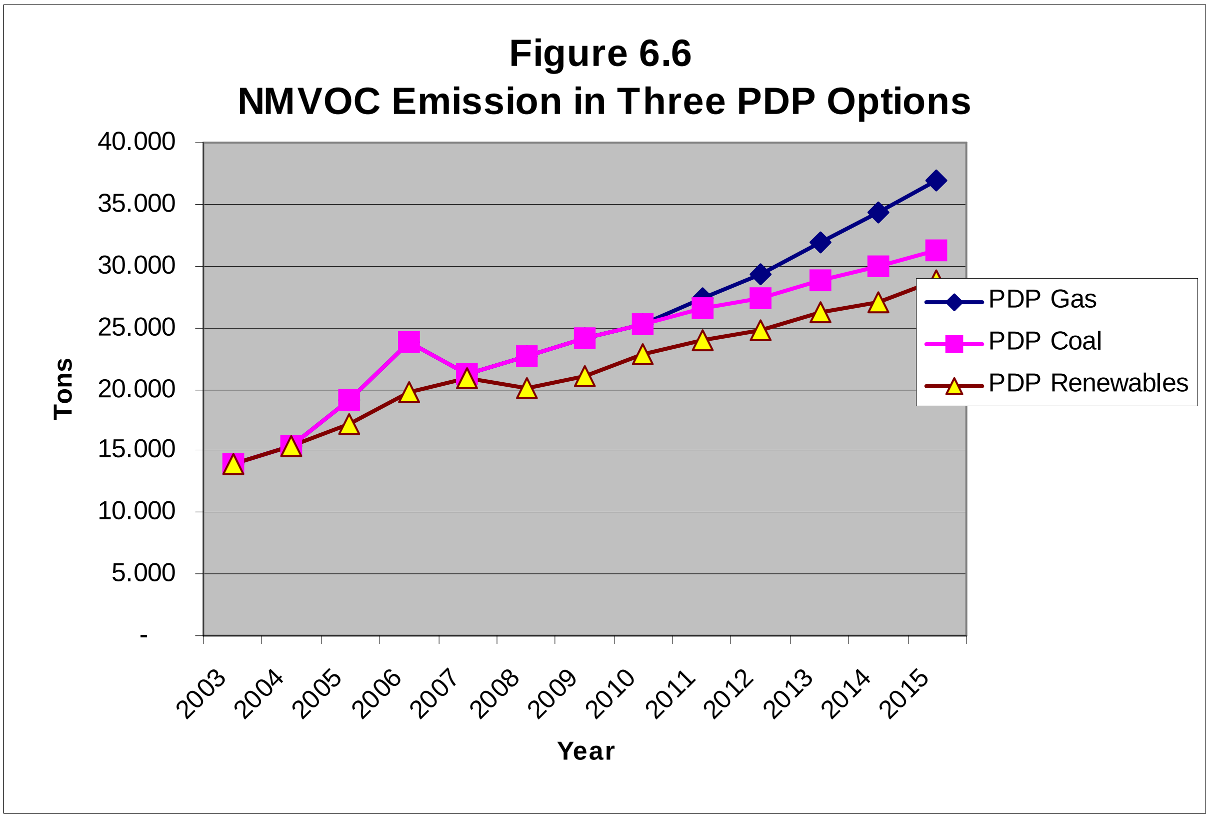


Figure 6.5
Hg Emission in Three PDP Options
Kgs.
25.000,0
20.000,0
15.000,0
10.000,0
5.000,0
-
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP Gas
PDP Coal
PDP Renewables



6.2 Physical Health Impacts

Two main ways of analyzing the physical health impacts of power generation are applied to this study, as described in detail in Chapter 5. The presentation of their results will begin with the mortality and morbidity assessment (or the ExternE approach) and continue with the disability-adjusted life year assessment (or the Eco-indicator approach).

6.2.1 Mortality and Morbidity Assessment (ExternE Approach)

Based on the health effect coefficients from the ExternE project, three kinds of health impacts can be quantified as presented below.

- **Injuries**

Table 6.1 shows that PDP-Coal, with the expected 12 cases of death, 239 cases of severe injuries and 1,907 cases of minor injuries in 2015, is the most serious PDP option in terms of injuries. Implementing PDP-Gas is expected to lead to 9.5 cases of death, 138 cases of severe injuries and 1,030 cases of minor injuries. With more reliance on renewable energy generation, PDP-Renewables is the best possible option with a 36.1% reduction in terms of death, a 22.9% reduction in severe injuries and a 23.2% reduction in minor injuries in 2015, compared to PDP-Gas. However, when compared in absolute reduction figures (a 3.4 cases reduction of death in 2015, for example), the improvement effect in injuries can be considered as a quite small advantage, especially compared to chronic health effects.

Table 6.1 Health Impacts from Air Pollution in Three PDP Options

Items	Unit	2015			2003-2015			Gas-Renewable				Coal-Renewable			
		Gas	Coal	Renew.	Gas	Coal	Renew.	2015	%	2003-2015	%	2015	%	2003-2015	%
Injuries															
Total Death from Injuries	Cases	9.5	12.0	6.1	83.9	90.9	72.2	3.4	36.1	11.7	14.0	5.9	49.4	18.7	20.6
Severe Injuries	Cases	137.9	239.0	106.3	1,416.2	1,699.0	1,305.8	31.6	22.9	110.3	7.8	132.7	55.5	393.1	23.1
Minor Injuries	Cases	1,029.5	1,907.4	791.1	10,883.1	13,340.1	10,072.1	238.4	23.2	811.0	7.5	1,116.3	58.5	3,268.0	24.5
Acute Health Effects															
Acute Mortality	Cases	113.0	228.3	87.7	1,439.4	1,762.1	1,361.1	25.2	22.4	78.3	5.4	140.6	61.6	401.1	22.8
Acute Years of Life Loss	Years	84.7	171.1	65.8	1,079.0	1,321.0	1,020.5	18.9	22.3	58.5	5.4	105.4	61.6	300.5	22.7
Acute Hospital Admission	Cases	542.9	660.4	418.6	5,259.6	5,588.6	4,750.7	124.3	22.9	509.0	9.7	241.8	36.6	837.9	15.0
Acute Congestive Heart Failure	Cases	82.4	128.9	65.8	895.4	1,025.5	837.6	16.6	20.1	57.9	6.5	63.0	48.9	187.9	18.3
Acute Restricted Activity Days	Thousand days	483.6	758.7	381.4	5,263.1	6,033.0	4,900.6	102.2	21.1	362.5	6.9	377.3	49.7	1,132.3	18.8
Chronic Health Effects															
Chronic Mortality	Cases	1,428.7	2,223.0	1,136.7	15,314.5	17,537.4	14,340.1	292.0	20.4	974.4	6.4	1,086.2	48.9	3,197.3	18.2
Chronic Year of Life Loss	Years	14,282.4	22,223.2	11,369.0	153,084.2	175,308.1	143,366.1	2,913.4	20.4	9,718.1	6.3	10,854.1	48.8	31,942.0	18.2
Chronic Bronchitis (Adult)	Cases	947.5	1,478.8	758.6	10,267.0	11,753.9	9,613.3	188.9	19.9	653.7	6.4	720.2	48.7	2,140.7	18.2
Chronic Bronchitis (Children)	Cases	13,173.7	20,654.8	10,554.5	143,372.0	164,309.5	134,273.0	2,619.2	19.9	9,099.0	6.3	10,100.3	48.9	30,036.4	18.3
Chronic Cough	Episodes	16,927.2	26,501.8	13,568.9	184,283.9	211,080.5	172,636.3	3,358.3	19.8	11,647.6	6.3	12,932.9	48.8	38,444.1	18.2

Source: Own Calculation

- **Acute Health Effects**

Obviously, PDP-Coal can cause serious acute health effects from air pollution. Installing more coal-fired power plants will lead to a considerable increase in the acute mortality effect of PDP-Coal after 2010 (Figure 6.7), while the acute effect of PDP-Gas is stable. In 2015, the acute mortality effect of PDP-Coal may be doubled compared to the effect of PDP Gas, and will also lead to the double effect in terms of years of life loss (Table 6.1). On average, the years of life loss of each case is lower than one year, which indicates that the acute mortality effects are more likely to affect the elderly people.

PDP-Coal will also lead to more incidences of acute hospital admission, acute congestive heart failure and acute restricted activity days, as shown in Table 6.1. However, the scales of the differences (compared to PDP-Gas and PDP-Renewables) are lower than the difference in acute mortality rate (see also figure 6.8 for the acute hospital admission effect).

PDP-Renewables can play a key role in reducing acute health effects since it provides the least negative impacts in all acute health indicators. PDP-Renewables can lower acute mortality by 22.4% compared to PDP-Gas (or 25.2 cases in 2015) and 61.6% compared to PDP-Coal (or 140.6 cases in 2015). It can also reduce acute hospital admission by 22.9% compared to PDP-Gas (or 124.3 cases in 2015) and 36.6% compared to PDP-Coal (or 241.8 cases in 2015). Moreover, PDP-Renewables will also reduce the number of cases of acute congestive heart failure by 20.1% and the acute restricted activity days by 21.1% compared to PDP-Gas. As shown in Figure 6.7, it is also important to note that, although power generation will continue to increase after 2010, PDP-Renewables can lower its acute mortality effect.

- **Chronic Health Effects**

Like acute health effects, PDP-Coal also has the most negative chronic health impacts. Implementing PDP-Coal will lead to 2,223 cases of chronic mortality in 2015. On average, the affected persons will lose around 10 years of their lives from chronic respiratory system-related diseases. PDP-Coal also leads to more than 22,000 cases of chronic bronchitis, of which 90% are children, and 26,500 episodes of chronic cough in 2015 (Table 6.1). In comparison, PDP-Gas will lead to 1,429 cases of chronic mortality, more than 14,000 cases of chronic bronchitis (also mostly children) and 16,927 episodes of chronic cough. Therefore, shifting from gas to coal, as suggested in PDP-Coal, is not a good policy direction in health perspective.

On the contrary, PDP-Renewables provides much better results in terms of chronic health impacts. In 2015, when compared to PDP Gas, PDP-Renewables can annually reduce the number of cases of chronic mortality by 292 (equal to 20.4% of the effect from PDP-Gas), the number of cases of chronic bronchitis by 2,808 (equal to 19.9%) and the number of episodes of chronic cough by 3,358 (equal to 19.8%). Compared to PDP-Coal, the reduction in health effects of PDP-Renewables in 2015 will be almost 50%. Furthermore, Figures 6.9 and 6.10 also show the declining trend in health effects of PDP-Renewables after 2011, compared to the increasing trend in both PDP-Gas and PDP-Coal.

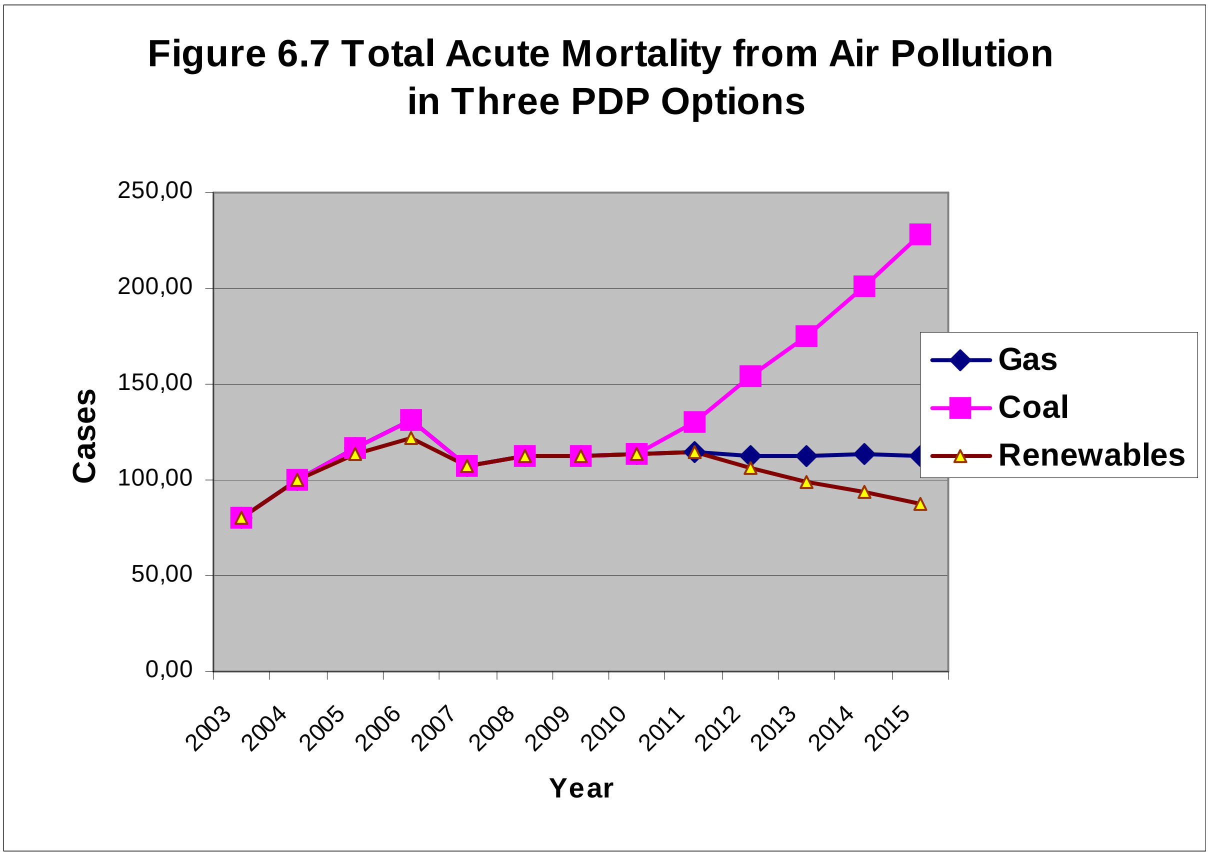


Figure 6.7 Total Acute Mortality from Air Pollution
in Three PDP Options
Cases
250,00
200,00
150,00
100,00
50,00
0,00
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Gas
Coal
Renewables

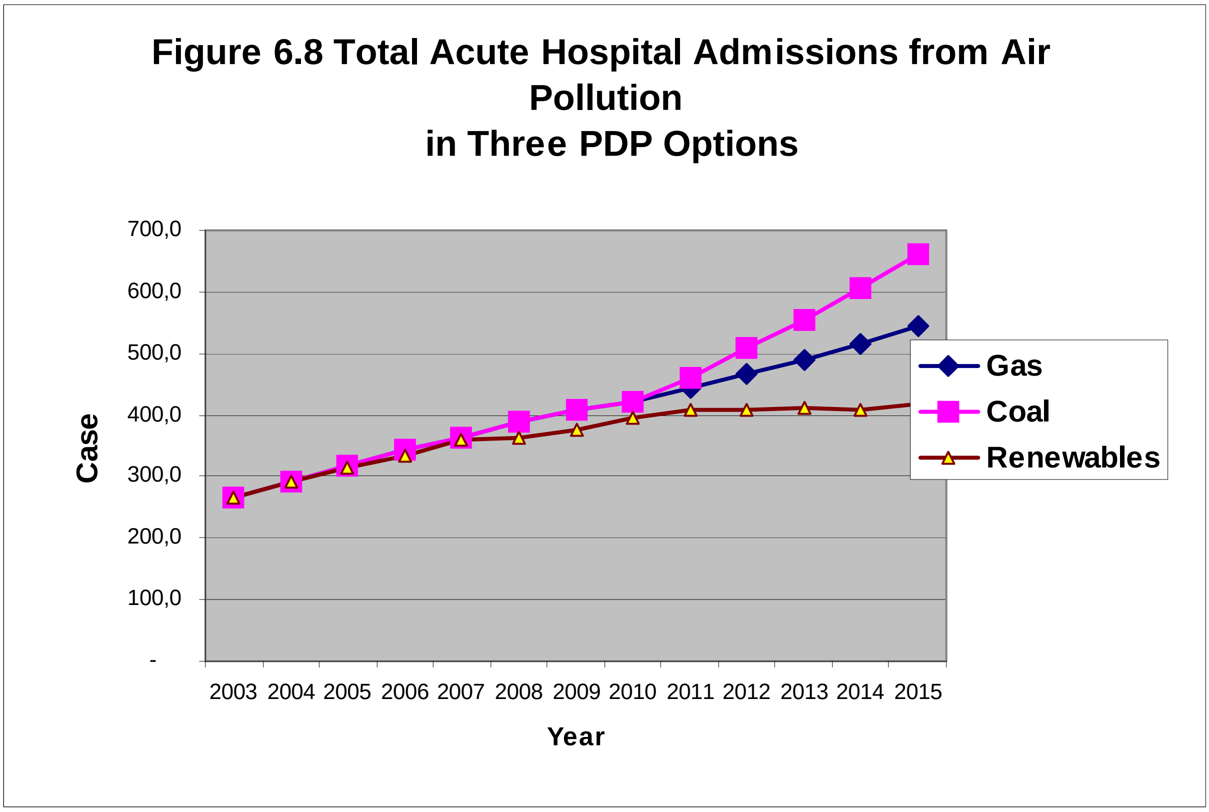


Figure 6.8 Total Acute Hospital Admissions from Air
Pollution
in Three PDP Options
Case
700,0
600,0
500,0
400,0
300,0
200,0
100,0
-
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Year
Gas
Coal
Renewables

Figure 6.9 Total Chronic Mortality from Air Pollution in Three PDP Options

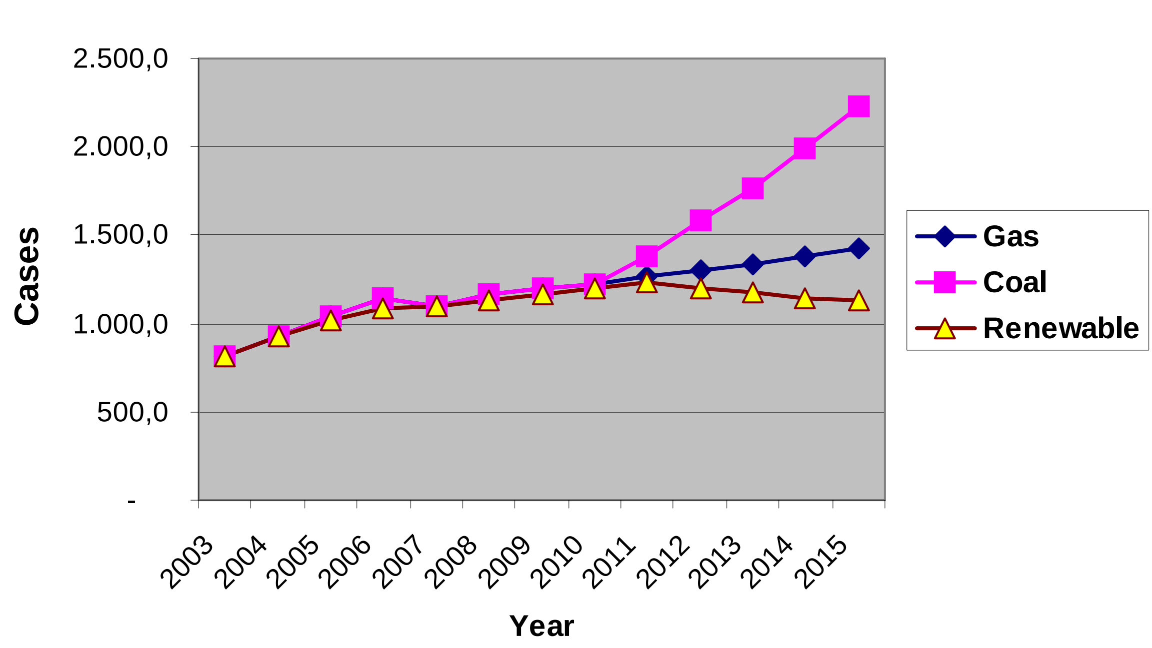
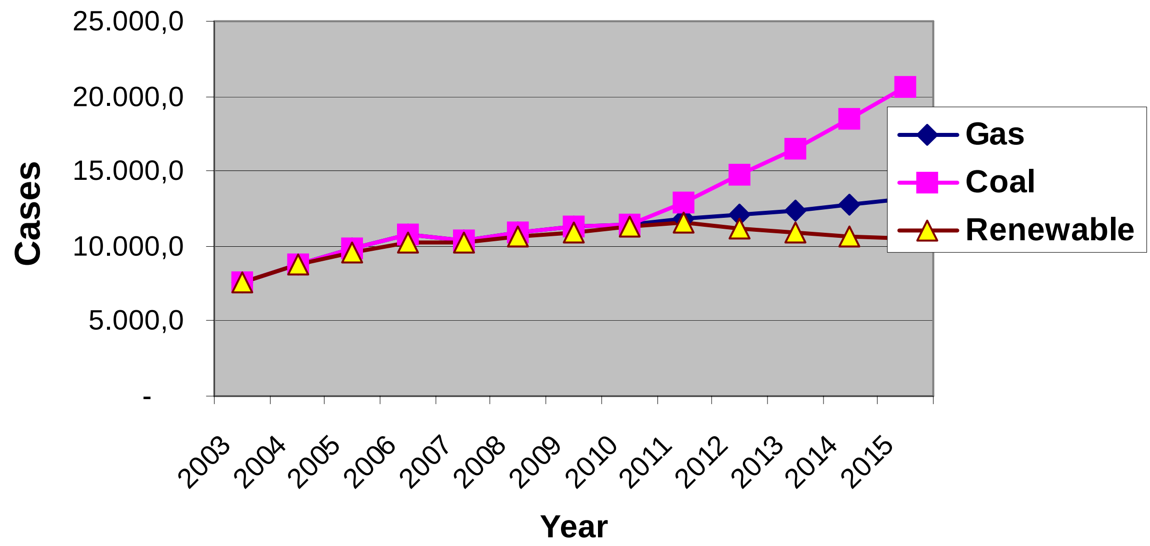


Figure 6.10 Total Chronic Bronchitis (Children) From Air Pollution in Three PDP Options



In conclusion, combining the three health impacts, it is obvious that PDP-Renewables is the best option in a health perspective. It can reduce negative health impacts by approximately 20% in 2015, which can save more than 300 lives and prevent 3,000 people a year from getting a chronic disease, compared to the existing PDP (or PDP-Gas). Moreover, with the declining trend in negative health impacts, PDP-Renewables provides a strong aspiration to de-link negative health impacts from the increase of power generation in the near future.

6.2.2 Disability-adjusted Life Year Assessment (Eco-indicator Approach)

An alternative approach to analyzing health impacts is to calculate the health impacts of the amount of selected pollutants together with the health damage factors provided by the Eco-indicator project (details will be discussed in Chapter 5). The result of this calculation is presented in terms of the disability-adjusted life year (or DALY), which combines both years of life loss (mortality cases) and the years lost due to disability (morbidity cases) in the population. Thus, applying DALY is an effort to represent the overall effect in terms of the years of “healthy life loss” (see also the discussion in Chapter 5).

Another advantage of this approach is the ability to take the health impact of climate change into account, which will provide a much better overview of the healthy public policy option in the Thai power sector.

This approach also presents its results in three different decision-making perspectives in dealing with uncertainties in scientific information. Although Table 6.2 presents the results from all three perspectives based on the suggestion of the project and the discussion in Chapter 5, this section will concentrate mainly on the results of the hierarchical perspective.

Table 6.2 shows that the existing PDP, or PDP-Gas, will lead to 81,405 years of healthy life loss of the total Thai population in 2015, which is composed of 30,162 years of healthy life loss from climate change effects and 51,243 years of healthy life loss from air pollution effects.

Similar to the previous approach, PDP-Coal is still the most negative option in terms of health impact. The years of healthy life loss from climate change effects in PDP-Coal will be 34,111 in 2015 and from air pollution effects 70,065 in the same year. In total, PDP-Coal will lead to 104,176 years of healthy life loss of the total Thai population.

Since PDP-Renewables is the best PDP option according to all environmental indicators, it is not surprising that PDP-Renewables is also the best possible option in terms of disability-adjusted life years (Figure 6.11). In 2015, PDP-Renewables is expected to cause 22,349 years of healthy life loss from climate change effects, which equals a 25.9% reduction compared to PDP-Gas and a 34.5% reduction compared to PDP-Coal. In terms of air pollution effect, PDP-Renewables will decrease the healthy years of life loss by 18.0% compared to PDP-Gas (or 9,214 years in reduction) and by 40.0% compared to PDP-Coal (or 28,036 years in reduction).

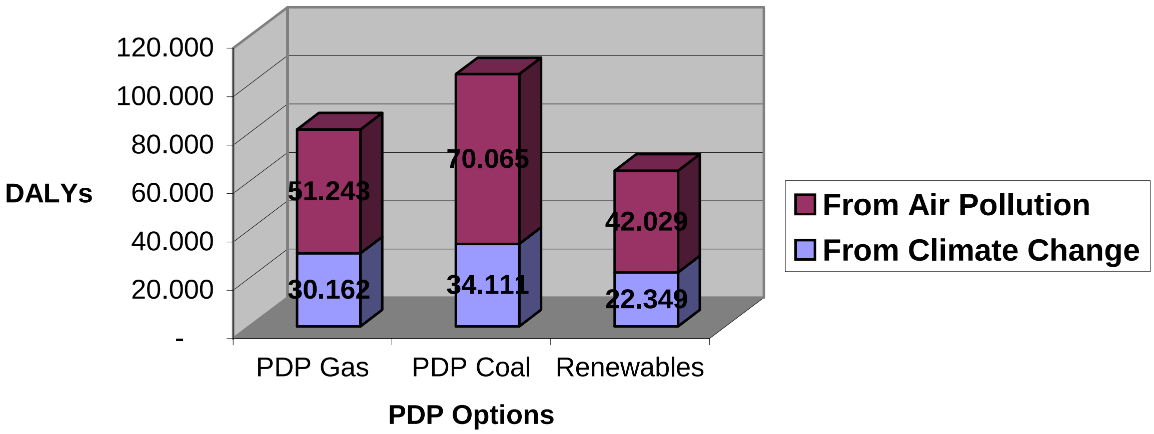
In total, PDP-Renewables can save the Thai population’s healthy life by 17,027 years compared to PDP-Gas (equals 20.9% of the PDP-Gas impact) and by 39,799 compared to PDP-Coal (or equal to 38.2% of the PDP-Coal impact).

Table 6.2 Health Impacts of Three PDP Options in Disability-adjusted Life Years **(Unit: DALYs)**

Impact Indicators	2015			2003-2015			Gas-Renewables				Coal-Renewables			
	PDP Gas	**PDP Coal**	**Renewables**	**PDP Gas**	**PDP Coal**	**Renewables**	**2015**	**%**	**2003-2015**	**%**	**2015**	**%**	**2003-2015**	**%**
Hierarchical Perspective														
From Climate Change	30,162	34,111	22,349	284,841	295,894	250,893	7,813	25.9	33,947	11.9	11,762	34.5	45,001	15.2
From Air Pollution	51,243	70,065	42,029	537,381	590,058	504,533	9,214	18.0	32,848	6.1	28,036	40.0	85,525	14.5
Total Health Impact	81,405	104,176	64,377	822,221	885,952	755,426	17,027	20.9	66,795	8.1	39,799	38.2	130,526	14.7
Egalitarian Perspective														
From Climate Change	30,162	34,111	22,349	284,841	295,894	250,893	7,813	25.9	33,947	11.9	11,762	34.5	45,001	15.2
From Air Pollution	51,412	70,277	42,170	539,073	591,870	506,119	9,243	18.0	32,954	6.1	28,107	40.0	85,751	14.5
Total Health Impact	81,574	104,388	64,518	823,914	887,764	757,012	17,056	20.9	66,902	8.1	39,870	38.2	130,752	14.7
Individualistic Perspective														
From Climate Change	28,725	32,487	21,285	271,277	281,804	238,946	7,441	25.9	32,331	11.9	11,202	34.5	42,858	15.2
From Air Pollution	10,304	17,141	8,146	121,265	140,400	114,357	2,158	20.9	6,908	5.7	8,995	52.5	26,044	18.5
Total Health Impact	39,029	49,628	29,431	392,542	422,204	353,302	9,599	24.6	39,239	10.0	20,197	40.7	68,901	16.3

Source: Own Calculation

Figure 6.11 Health Impacts of Three PDP Options in 2015



It is also worthwhile to notice that the differences in hierarchical and egalitarian perspectives are very small, as shown in Table 6.2. However, the differences are much larger when compared to the individualistic perspective. This is due to the perspective's very conservative view on the health impacts of NO_X, as described in Chapter 5. However, despite these huge differences, the results of the individualistic perspective confirm that PDP-Renewables is still the best possible option in relation to climate change effects, air pollution effects, and overall health impact.

In conclusion, both health impact analytical methods confirm that PDP-Renewables is the best PDP option to protect the health of the Thai population. In relative terms, in 2015, PDP-Renewables is expected to save 300 lives annually from acute and chronic mortality and prevent 3,000 people from getting a chronic disease (compared to PDP-Gas). At the same time, PDP-Renewables can save 17,000 healthy life years of the total Thai population. In general, the health benefits of PDP-Renewables will be approximately a 20% reduction in negative health impacts compared to PDP-Gas and a 40% reduction compared to PDP-Coal.

6.3 Social Impacts

In principle, the social impacts are highly process and context-specific, especially in terms of institutional frameworks and implementation processes, which are quite difficult to assess at the strategic planning level. However, based on this impact analysis, three consideration points should be addressed in this study; namely, employment impact, decentralization impact, and impact on social conflicts.

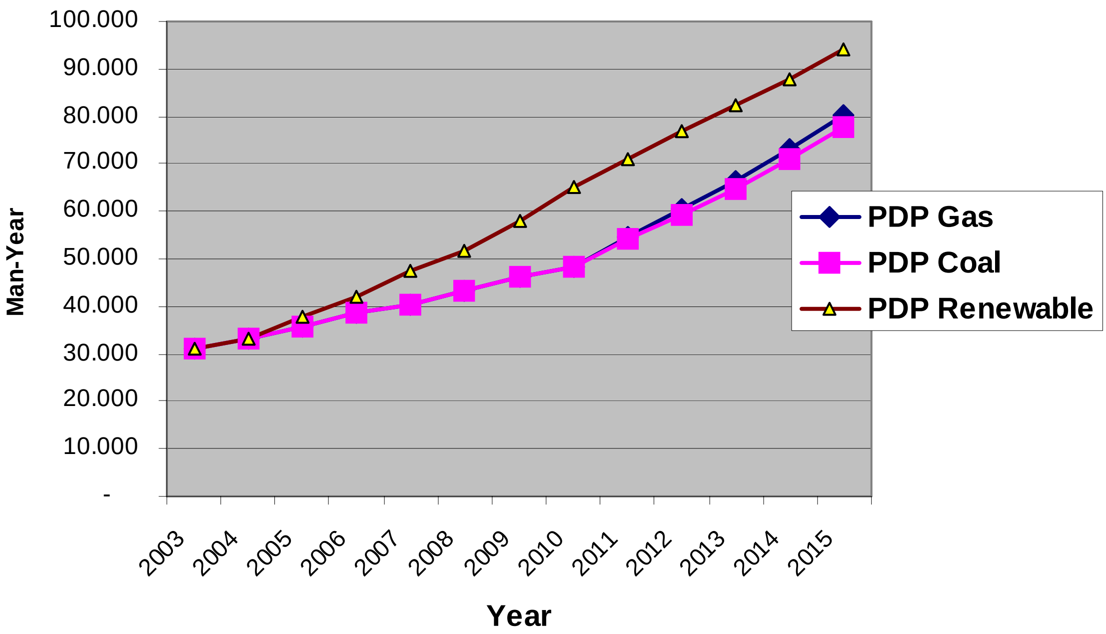
6.3.1 Employment Impact

One of the main advantages of renewable energy is that it creates jobs at the local level. Based on a life-cycle employment factor discussed in Chapter 5, the employment effect of the three PDP options is calculated as presented in Figure 6.12

The existing PDP, or PDP-Gas, with new installed power plants and more power generation will increase the total employment in power and fuel sectors from 31,785 in 2003 to 81,200 person-year in 2015. Since new coal-fired power plants will solely rely on imported coal, PDP-Coal will lead to a slightly lower employment effect (78,741 person-year in 2015) compared to PDP-Gas.

Since it is more dependent on domestic resources and small-scale technologies, the employment effect of PDP-Renewables, is much higher than the effects of PDP-Gas and PDP-Coal. In 2015, PDP-Renewables is estimated to employ 98,811 person-year, which is 17,611 person-year higher than PDP-Gas (or equal to an employment effect 21.7% higher than that of PDP-Gas).

Figure 6.12 Employment Effect from Three PDP Options



6.3.2 Decentralization Impact

In Thailand, the concept and the need for decentralization is clearly stated in the 1997 Constitution and the 8th and 9th National Development Plans. However, in the power sector, the decentralization process is much less systematically organized in practice. As described in chapter 4, there have been two important efforts to increase decentralized generation, firstly through the introduction of SPPs in 1995 and later through the introduction of VSPPs in 2001. However, the share of decentralized power generation is still lower than 10% of the total energy generation in the Thai power sector.

Table 6.3 indicates that relying on PDP-Gas and PDP-Coal will even lead to a lower proportion of decentralized power generation, both in terms of installed capacity and energy generation. In terms of energy generation, the share of decentralized power generation is expected to decrease from 9.9% in 2005 to 7.0% in 2015. This is because, according to PDP-Gas, most of the new installed capacity will be found at the centralized power plants with only a 5% share for renewable energy producers under the scheme of the renewable portfolio standard (RPS). Moreover, since 1998, the cabinet resolution has still blocked the new co-generation SPPs in entering into the power market.

With all these barriers to decentralized power generation, plus the government's agreement to allow EGAT to hold 50% of new installed power plants, as discussed in Chapter 4, EGAT can maintain its share above 50% of total installed capacity, at least up to 2015. At the same time, the concentration ration of the four largest power producers (or CR4) is still around 65-70% in terms of installed capacity and 55-57% in terms of energy generation.

Table 6.3 Comparison of the Market Structure in the Three PDP Options (%)

PDP Options	EGAT			CR4			Decentralized power generation		
	2005	2010	2015	2005	2010	2015	2005	2010	2015
By Install Capacity									
PDP-Gas	59.81	53.71	52.44	83.51	73.70	66.89	7.43	6.65	6.19
PDP-Coal	59.81	53.71	52.44	83.51	73.70	66.89	7.43	6.65	6.19
PDP-Renewables	60.73	50.67	52.19	84.80	72.88	70.24	7.54	15.00	22.43
By Energy Generation									
PDP-Gas	50.28	43.80	46.18	76.88	62.73	57.46	9.86	7.83	6.98
PDP-Coal	50.28	43.80	46.18	76.88	62.73	57.46	9.86	7.83	6.98
PDP-Renewables	50.76	37.17	42.14	77.26	57.67	55.88	9.96	15.96	23.32

Although PDP-Renewables cannot make a significant change in terms of EGAT's market share and concentration ratio of the four largest power producers, it can lead to a big improvement in the share of decentralized power generation. The share of decentralized power generation in PDP-Renewables will rise from 10% in 2005 to 23.3% in 2015, which is much higher compared to its share in PDP-Gas and PDP-Coal.

Certainly, several institutional and regulation arrangements need to be revised, improved and introduced in order to make this figure come true. All these regulations issues will be discussed in detail in the next chapter.

6.3.3 Impact on Social Conflicts

Evidently, Thailand has had great difficulties in dealing with conflicts arisen from large fossil-fuelled and hydro power plants for more than a decade, as described in Chapter 4. The nature of conflicts is closely related to the lack of public participation in the decision-making process and the unequal distribution of costs and benefits in Thai society. While the lack of public participation will be discussed in the next chapter, the issue of unequal distribution will be the point of discussion in this impact analysis.

PDP-Gas and PDP-Coal, with the concentration of large power plants, will worsen the problem of unequal distribution between those who are affected by the projects and those who consume electricity and get the profit from power investment. As usual, 20 new power plants can individually be a point of conflict in Thai society. Especially with the 9 new coal-fired power plants and much higher environmental and health impacts, as shown in previous sections, PDP-Coal can easily raise public concerns and, in various cases, create conflicts around these power plant projects. Although, in the existing PDP, the location of the plants is not mentioned at this point, but it is highly expected that new power plants in PDP-Gas and PDP-Coal will locate mainly in the provinces which already have the infrastructures required; namely, gas-pipeline for PDP-Gas and deep sea-port for PDP-Coal. This will certainly increase the concentration of impacts around these specific areas, which can easily create conflicts.

Alternatively, PDP-Renewables will considerably change the investment pattern of new power plant projects, as shown in Chapter 5 and in this chapter. With the revised demand forecast, demand side management and decentralized power generation, PDP-Renewables does not require any further investment in large gas-fired or coal-fired power plant projects, apart from EGAT's already committed projects. Most of the investment projects in PDP-Renewables will be smaller projects spread around the country with lower environmental and health impacts, as shown before. Moreover, to alleviate the existing impacts, PDP-Renewables also aims to reduce the power generation of the most well-known polluting power plant, the Mae Moh lignite power plant. Therefore, it is highly expected that PDP-Renewables can reduce the tensions and conflicts over the future power generation investment.

However, this is not a suggestion that renewable energy projects will not lead to any social conflict. In fact, in Thailand, there are a number of cases, especially biomass projects that have led to social conflicts in local communities. Nevertheless, with the smaller sizes of impacts and of the projects themselves, they are principally much easier to mitigate, to negotiate, and, more importantly, it is easer to control and to share the costs and profits of these smaller projects. The issue of local control over renewable projects will be discussed in more detail in the next chapter.

6.4 Economic Impacts

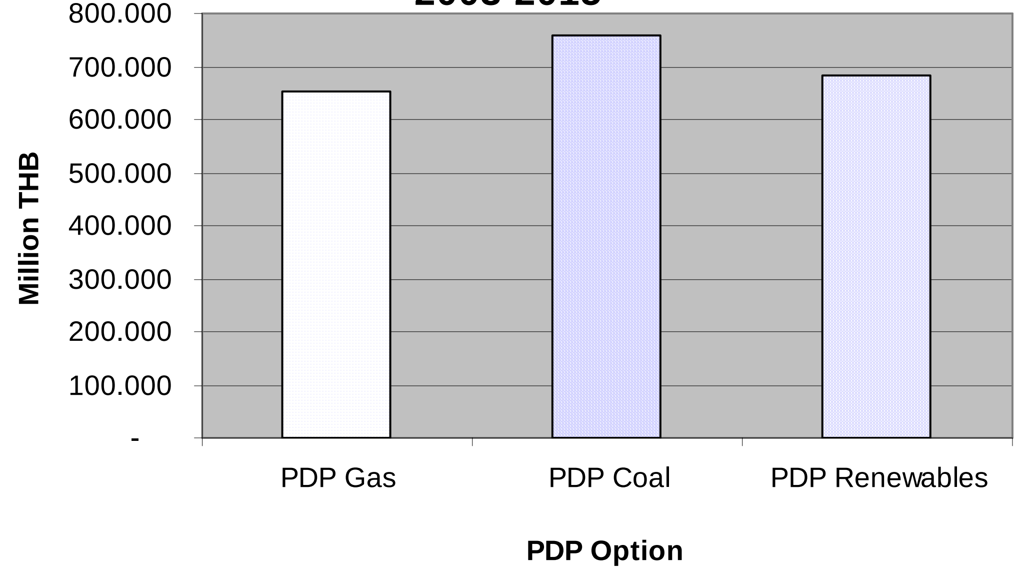
Although, from environmental, health, and social impact analyses' points of view, PDP-Renewables is clearly more desirable than PDP-Gas and PDP-Coal, the comparison of their economic impacts is much more crucial in the policy debate and policy-making in the Thai power sector, especially when "cheap electricity" becomes a main goal of power politics in Thailand, as described in Chapter 4. To facilitate a further discussion on healthy public policy in the Thai power sector, this chapter provides the comparison of four economic impact indicators in three sections as presented below.

6.4.1 Impact on Investment Requirement

Following the existing PDP, or PDP-Gas will require investment in an additional installed capacity around 651.6 billion THB (only in the generation sub-sector) during the period of 2003-2015. Moving to PDP-Coal will lead to a higher investment requirement, roughly 758.7 billion THB for the whole period (Figure 6.13). Investing more in renewable energy also pushes the investment requirement of PDP-Renewables slightly higher than PDP-Gas but still lower than PDP-Coal. For the whole period, PDP-Renewables requires 683.3 billion THB, which is 31.7 billion THB (or equal to 4.9%) more than PDP-Gas. The difference in investment requirement between PDP-Renewables and PDP-Gas is smaller than normally expected, because PDP-Renewables in this study tries to combine cheaper solutions, like DSM or demand forecasting reconsideration, and competitive solutions, like biomass power plants or co-generation, with the present expensive solutions, e.g. solar PV and wind energy.

With only a small difference in investment requirement, PDP-Renewables is certainly an affordable policy choice. However, the investment requirement is not the only aspect to consider. In the economic perspective, it is important to compare the total generation costs of the three PDP options, the distribution of the costs within and outside national economy and the external costs of these PDP options.

Figure 6.13
Investment Requirement in Three PDP Options 2003-2015



6.4.2 Impact on Generation Cost

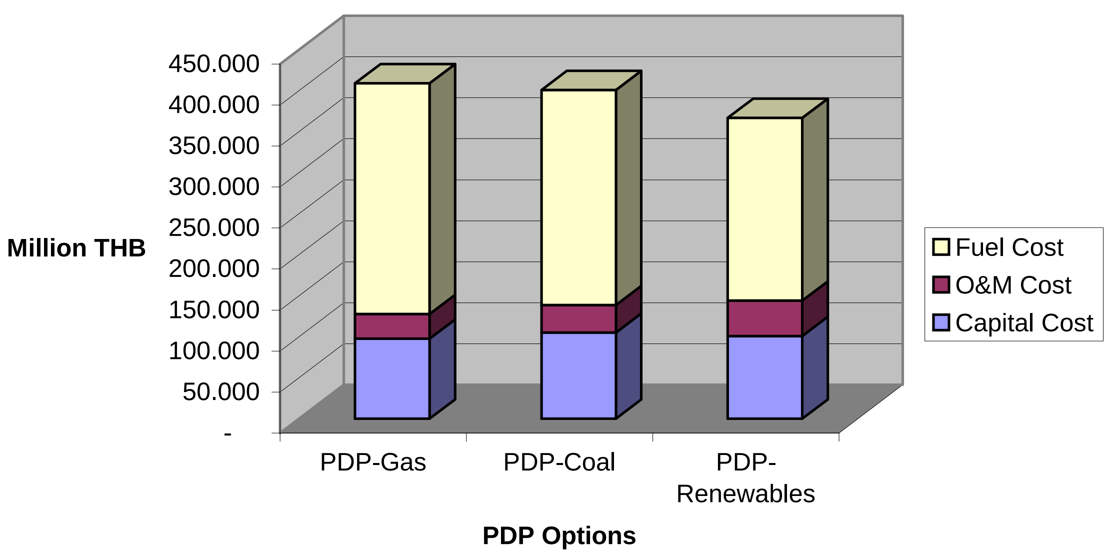
Although PDP-Gas requires the least additional investment, the higher price of natural gas as its main fuel source makes PDP-Gas the most expensive PDP option in terms of generation costs. Figure 6.14 shows the generation costs of the three PDP options in 2015. The total generation costs of PDP-Gas in 2015 is expected to be 408.7 billion

THB, while the costs of PDP-Coal and PDP-Renewables are expected to be 400.6 and 366.5 billion THB, respectively. In comparison, PDP-Renewables is 42.2 billion THB or around 5.2% cheaper than the existing PDP due to its lower fuel costs.

In terms of the net present value of the generation costs for the whole PDP period, the result also confirms that PDP-Gas will lead to the highest generation costs with 2.58 trillion THB. For the whole period, PDP-Coal will cost around 2.57 trillion THB in the net present value term. PDP-Renewables is the PDP option with the lowest generation costs at 2.46 trillion THB for the same period and the same present value term. In other words, compared to PDP-Gas, PDP-Renewables will lead to cost savings of 121.9 billion THB (around 4.7%) for the whole period.

With the lower fuel costs of renewable energy and better demand management, PDP-Renewables obviously becomes the cheapest solution, both at the final settlement and in the whole period comparison.

Figure 6.14
Generation Cost of Three PDP Options in 2015



6.4.3 Impact on GDP contribution and Balance of Payment

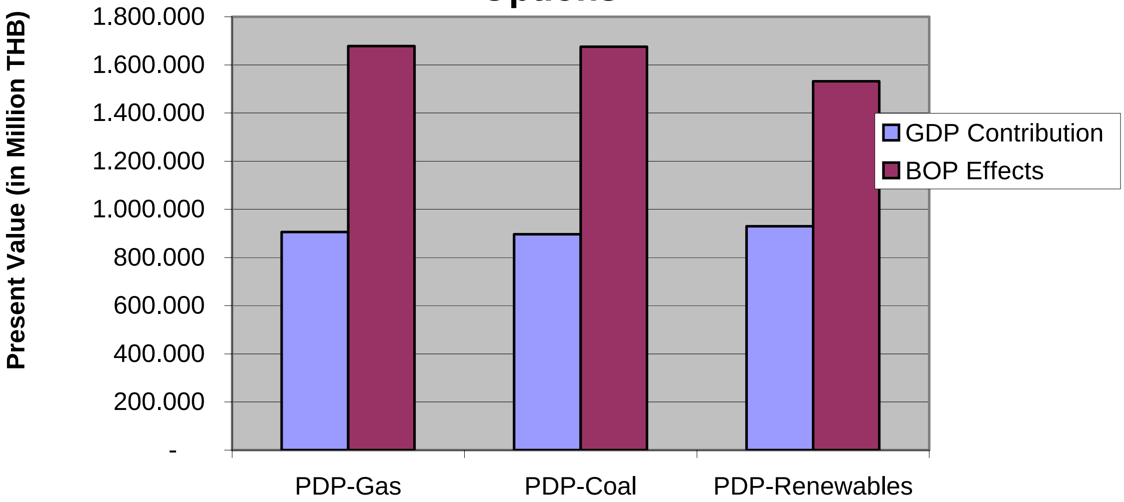
The analysis of cost distribution within and outside the country is quite essential to a small economy like Thailand, since higher costs of imported fuels and power technologies can also lead to the increase of the import burden, and the potential deficits in balance of trade and balance of payment (BOP). On the contrary, relying more on domestic resources and investments can directly contribute to the growth of the national economy and lower the import burden. Therefore, this study will provide an impact analysis on GDP contribution and balance of payment (or import burden).

For the whole PDP period (2003-2015), PDP-Gas will contribute with 905.7 billion THB to the national economy and, at the same time, raise the import burden by 1,677.9 billion THB in the present value term. The GDP contribution of PDP-Coal, with the higher share of imported coal in its fuel mix, will be 896.1 billion THB, which is slightly less than PDP-Gas. However, with the import cost of 1,675.3 billion THB, the import burden of PDP-Coal is also expected to be slightly smaller than that of PDP-Gas.

As shown in Figure 6.15, PDP-Renewables provides the best outcomes both in GDP contribution and balance of payment effects. In terms of GDP, PDP-Renewables is expected to contribute with 929.7 billion THB to the Thai economy for the same period, which equals 2.65% more than PDP-Gas. In terms of BOP, the import costs of PDP-Renewables are estimated to be 1,532.0 billion THB for the whole period, which is around 8.7% lower than PDP-Gas.

Based on this result, PDP-Renewables is much more suitable for Thai economy both in terms of accelerating economic growth through higher GDP contribution and in terms of stabilizing national economy through lower import burden.

Figure 6.15
GDP Contribution and BOP Effects of Three PDP Options

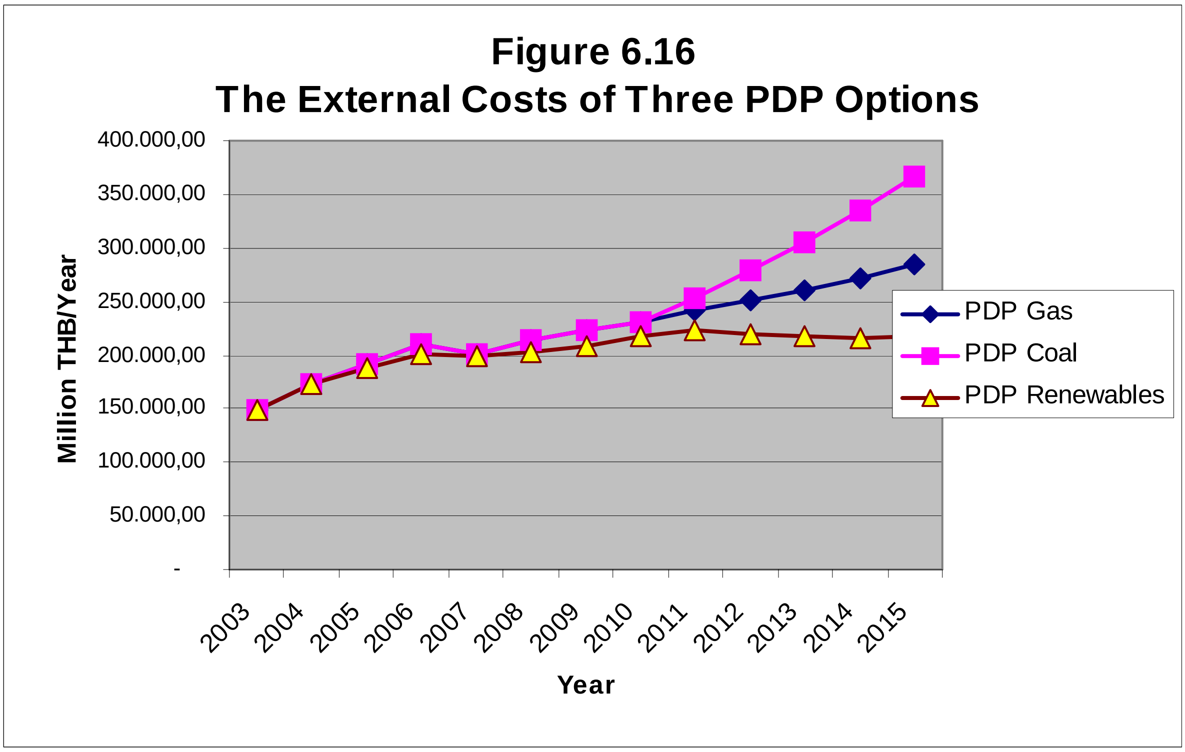


6.4.4 External Costs

The last important economic indicator is the comparison of external costs of the three PDP options. This indicator represents the idea that economic analysis should incorporate environmental, health and other societal consequences (both positive and negative) into its analysis by putting an external cost value on these consequences (or impacts). However, in practice, the valuation of impacts of power generation is very tricky and consequently highly debatable. This study follows the suggestion of the E for E foundation in valuing the external impacts in the Thai power sector as discussed in Chapter 5. The discussion about external cost calculation can be seen in Chapter 5, while the result is presented in Figure 6.16.

The result indicates that PDP-coal has the highest external costs, which is quite related to its higher negative environmental and health impacts, as discussed earlier in this chapter. In 2015, the external costs of power generation based on PDP-Coal are estimated to be 366.4 billion THB, which almost equals its own generation costs (400.6 billion THB in 2015). For PDP-Gas, its external costs will be 283.7 billion THB in 2015, which is much lower compared to PDP-Coal. Therefore, if the external impacts are internalized into an economic analysis for power development planning, as shown in Figure 6.17, PDP-Coal is now far from being a desirable choice for Thai society.

Related to its lowest negative impacts on environment and health, PDP-Renewables is again the most favorable PDP choice. The external costs of PDP-Renewables are expected to be around 217.2 billion THB in 2015, which is 66.5 billion THB/ year lower than PDP-Gas (or equal to 23.45% lower than PDP-Gas). When combined with its lower generation costs, as discussed in the previous section, the total economic savings of PDP-Renewables by 2015 will be 108.7 billion THB a year (see also Figure 6.17 for comparison). Therefore, this study suggests that PDP-Renewables has its own economic advantages, which can be used for stimulating economic growth, stabilizing national economy, and encouraging sustainable development within the country.



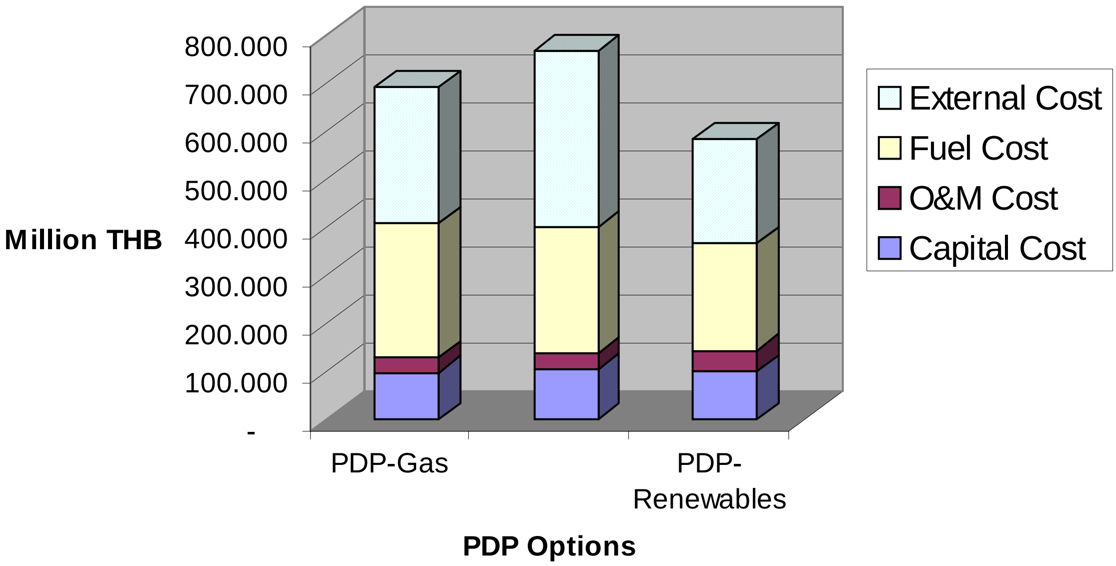
6.5 Domestic Resources Impacts

Thailand is an energy import country. Although Thailand has natural gas and lignite reserves, which are the most important fuel sources for power generation at present, the need for natural gas import from its neighboring countries has been, and will be, increasing. The effect of the PDP on domestic resources, therefore, becomes an issue of concern in Thai society, especially for those who follow the king's philosophy of sufficiency economy, as discussed in Chapter 5. From this point of view, two analyses will be presented here for further policy discussion.

6.5.1 Impact on Domestic Resources Share

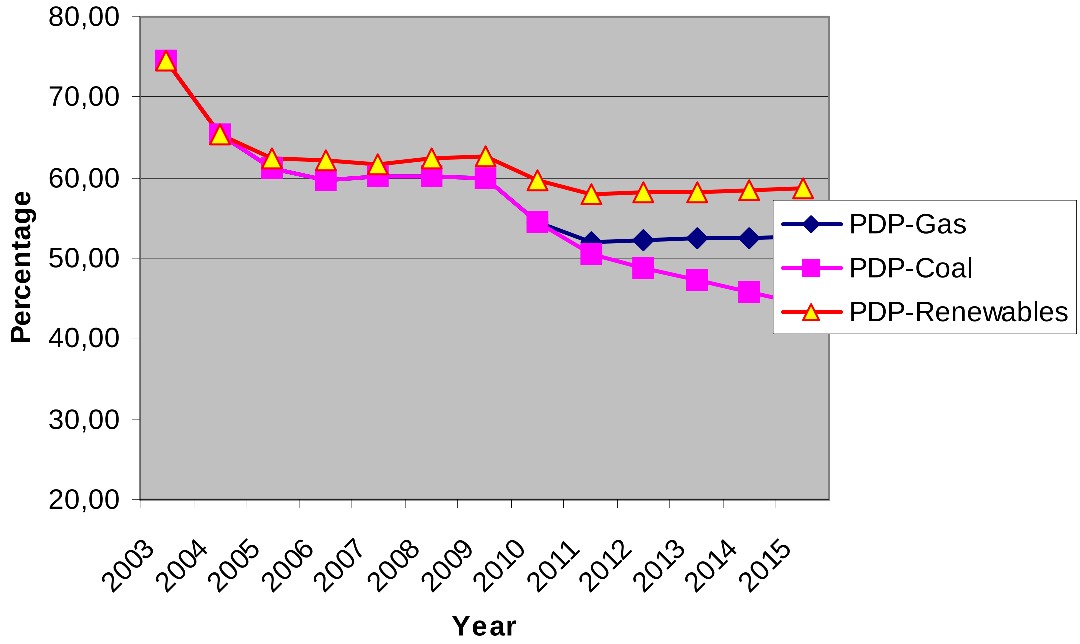
The first indicator is the domestic resources share, which intends to represent the levels of national self-reliance in power generation. Figure 6.18 indicates that Thailand's share of domestic resources in power generation is presently decreasing from nearly 75% in 2003 to around 60% in 2006, with the increased share of natural gas import from Myanmar and imported coal.

Figure 6.17
Generation and External Costs of Three PDP Options in 2015



The analysis shows that following the existing PDP, or PDP-Gas, will lead to a lower domestic resource share. In 2015, the domestic resource share in PDP-Gas will be around 52%. Moreover, shifting fuel sources from gas to imported coal for new power plants as planned in PDP-Coal will lead to a further decrease in domestic resource share down to 44% in 2015. From the self-reliance perspective, investing in renewable energy, as suggested in PDP-Renewables, is the best way to maintain the domestic resource share at around 58% during the period of 2010-2015.

Figure 6.18
Share of Domestic Resources in Power Generation From Three PDP Options



6.5.2 Impacts on Domestic National Gas Reserve

In dealing with exhaustible resources, like natural gas, a dynamic perspective is required in the self-reliance analysis. This is due to the fact that a higher domestic resource share may end up with a shorter resource lifetime, which implies less self-reliance in the long run. Certainly, natural gas reserves in Thailand and its neighboring countries are limited. Therefore, on one hand, increasing the share of natural gas in Thailand's fuel mix may maintain the domestic resource share at a certain point (especially compared to PDP-Coal). On the other hand, it can lead to a higher rate of resource depletion, i.e. a shorter resource lifetime, which is the concern of many Thais. The analysis in this part will discuss this concern.

Table 6.4 presents an overall picture of natural gas reserves in 2004 according to three definitions; natural gas consumption both in the power sector and other sectors from 2005 to 2015 and the impacts of these PDP options on gas reserve and resource lifetime.

With the 2P reserve definition (proven and probable gas reserve), as officially used in Thailand, Thailand only has 25.59 Tcf. domestically plus 13.95 Tcf from neighboring countries, or all together 39.54 Tcf. in its own account. Based on the existing plan, PDP-Gas which relies 81% on natural gas will consume 12.01 Tcf. during 2005-2015. During the same period, the consumption for other purposes will be around 3.31 Tcf. (equally assumed for all three PDP options). In summary, the total gas consumption for this period will be 15.31Tcf.

If there is no new reserve to be found, with this consumption level, the natural gas reserve in 2015 will be reduced to 16.88 in Thailand and 7.34 in the reserves of its neighboring countries. With the consumption rate of 2015, the domestic gas reserve will last only for another 16.8 years after 2015 (i.e. around 25 years from now) and the neighboring countries' reserve will last only for another 8.1 years (i.e around 17 years from now). On average, the gas reserve lifetime is expected to be only 12.7 years after 2015 (or around 22 years from now). With this reserve lifetime, based on PDP-Gas, other new natural gas power plants cannot be added into the system after 2015 if they are dependent on a reliable fuel resource. Even with the 3P definition (2P plus possible reserve), the reserve lifetime of PDP-Gas after 2015 is still expected to be lower than its projected 25 year-lifetime. Therefore, although it can maintain the domestic resources ratio beyond 50% in 2015, PDP-Gas cannot be considered a self-reliance option in the longer term.

PDP-Coal, which relies more on imported coal, can reduce the total natural gas consumption during 2005-2015 to 14.45 Tcf. (11.15 Tcf. for power generation). This will result in a slightly higher gas reserve after 2015 (24.22 for the total 2P gas reserve) and a longer reserve lifetime after 2015, 20.6 years for domestic gas-reserve and 10.2 years for neighboring countries' reserve. Totally, when compared to PDP-Gas, PDP-Coal can expand the gas reserve lifetime with around 3 years.

PDP-Renewables, which requires the least natural gas consumption of the three PDP options, will reduce the gas consumption to 13.92 Tcf for the period 2005-2015. Consequently, the level of gas reserve after 2015 will increase to 17.60 Tcf. for domestic gas and 8.02 Tcf. for neighboring countries' gas reserve. Therefore, in total, the reserve lifetime is expected to be 16.7 years after 2015, which is around 3 years longer than the lifetime achieved with PDP-Gas and 1 year longer than the one achieved with PDP-Coal.

Although PDP-Renewables provides the best result in prolonging the natural gas reserve with around 4 years, it does not make a big difference in the longer term (i.e, 25 years from now on). PDP-Renewables is clearly much less reliable on natural gas, which is not a reliable source anyway, in the long run. Therefore, strategically, PDP-Renewables takes a first step towards a less natural gas-dependent power system for the future. However, with these figures, the next step for the Thai power sector (after 2015) is even more challenging, especially when natural gas is not able to adequately supply the new power plants.

Table 6.4 Effects on Natural Gas Consumption and Reserve from Three PDP Options

Reserve and Consumption (Unit: Tcf)	Natural Gas Reserve 2004			Gas Consumption 2005-2015			Gas Consumption 2015		
	1P	2P	3P	PDP-Gas	PDP-Coal	PDP-Renew.	PDP-Gas	PDP-Coal	PDP-Renew.
Power Generation				12.01	11.15	10.61	1.57	1.27	1.19
Domestic				6.82	6.37	6.09	0.83	0.66	0.62
Neighboring countries				5.18	4.77	4.52	0.75	0.60	0.57
Other Consumption				3.31	3.31	3.31	0.34	0.34	0.34
Domestic				1.88	1.89	1.90	0.18	0.18	0.18
Neighboring countries				1.43	1.42	1.41	0.16	0.16	0.16
Total	28.27	39.54	58.91	15.31	14.45	13.92	1.91	1.61	1.53
Domestic	14.32	25.59	34.21	8.70	8.26	7.99	1.00	0.84	0.80
Neighboring countries	13.95	13.95	24.70	6.61	6.19	5.93	0.91	0.76	0.73
Gas Reserve in 2015	**PDP Gas**			**PDP Coal**			**PDP-Renewables**		
(Unit: Tcf)	1P	2P	3P	1P	2P	3P	1P	2P	3P
Domestic	5.62	16.88	25.51	6.06	17.32	25.95	6.33	17.60	26.22
Neighboring countries	7.34	7.34	18.09	7.76	7.76	18.51	8.02	8.02	18.77
Total	12.96	24.22	43.60	13.82	25.08	44.46	14.35	25.62	45.00
Reserve Lifetime after 2015	**PDP-Gas**			**PDP-Coal**			**PDP-Renewables**		
(Unit: years)	1P	2P	3P	1P	2P	3P	1P	2P	3P
Domestic	5.6	16.8	25.4	7.2	20.6	30.8	7.9	21.9	32.7
Neighboring countries	8.1	8.1	19.9	10.2	10.2	24.2	11.0	11.0	25.8
Average	6.8	12.7	22.8	8.6	15.6	27.7	9.4	16.7	29.4

Source: Own Calculation

Note 1P = Proven reserve

2P = Proven reserve and Probable reserve

3P = Proven reserve, Probable reserve and Possible reserve

6.6 Government Target Achievement

Another important aspect of the impact analysis is how these three PDP-options will help the Thai power sector to achieve the government target. As mentioned in Chapter 4, the two important targets of the power sector are a) to lower the energy intensity from 1.4:1 (energy generation expansion : GDP growth) to 1:1 and b) to increase the share of renewable energy generation from 0.8% to 6.0% by 2011.

Table 6.5 shows that neither PDP-Gas nor PDP-Coal can provide satisfactory results in reaching both of these targets. Both PDP options can lower the energy intensity to 1.1:1 (not 1:1 as planned by the Thai government) and increase the renewable energy proportion to 1.26% in 2011 (not 6% as declared). Even with the expansion period to 2015, the renewable share in these two PDP options will still be lower than 2%.

Therefore, it is quite clear that, within the three PDP options, only PDP-Renewables can successfully reach the government target, with 1.02:1 energy intensity (which is still slightly higher than the target) and 6.43% renewable energy in 2011. And, in 2015, the renewable share of PDP-Renewables will nearly reach 10%.

Table 6.5 Comparison of Three PDP Options in Achieving Government Targets

Items	Government Target	PDP-Gas	PDP-Coal	PDP-Renewables
Assumed GDP Growth (%)		6.5	6.5	5.20
Growth in energy generation (%)		7.1	7.1	5.35
Energy Intensity 2015	**1 : 1**	**1.09 : 1**	**1.09 : 1**	**1.02 : 1**
Renewable Energy Share 2011 (%)	**6.0**	**1.26**	**1.26**	**6.43**
Renewable Energy Share 2015 (%)	**>6.0**	**1.95**	**1.95**	**9.87**

Source: Own Calculation

6.7 Overall Impact Analysis

All these six aspects of impact analysis conclude that, within the three PDP options, PDP-Renewables is the most desirable option for Thai society. Table 6.6 presents the overall summary of the impact analysis, which can be concluded as followed;

- Environmentally, in 2015, PDP-Renewables can reduce greenhouse gas emissions from power generation by 26% compared to PDP-Gas and 34% compared to PDP-Coal, as well as other pollutant emissions by 6-23% compared to PDP-Gas and 8-54% compared to PDP-Coal.
- In a health perspective, PDP-Renewables can save more than 300 lives compared to PDP-Gas and more than 1,200 lives compared to PDP-Coal annually in 2015. The overall health benefits will be around a 20% reduction in negative health impacts of power generation compared to PDP-Gas and a 40-60% reduction compared to PDP-Coal.
- In the social aspect, PDP-Renewables will create more jobs (13,787 extra jobs compared to PDP-Gas and 16,515 extra jobs compared to PDP-Coal). It will also increase the share of decentralized power in 2015 from 7% in PDP-Gas to more than 23%.

Table 6.6 Overall Impacts of the Three PDP Options

Impact Indicators	2015			Difference			
	PDP-Gas	**PDP-Coal**	**Renew.**	**Gas-Renew.**	**%**	**Coal-Renew.**	**%**
Environmental Indicators							
CO_2 Emissions (million Ton)	143.63	162.43	106.42	37.20	25.90	56.01	34.48
NOX Emissions (ton)	423,684	530,310	352,439	71,245.13	16.82	177,871.79	33.54
SO_2 Emissions (ton)	213,351	358,011	163,949	49,402.11	23.16	194,061.75	54.21
TSP Emissions (ton)	17,872	31,263	16,172	1,700.00	9.51	15,091.30	48.27
Hg Emissions (kg)	5,426	20,496	5,117	309.32	5.70	15,379.78	75.04
NMVOC Emissions (ton)	36,976	31,309	28,834	8,141.82	22.02	2,474.65	7.90
Health Impacts (Eco-indicator approach)							
Climate Change (DALY)	30,162	34,111	22,349	7,813.03	25.90	11,762.42	34.48
Air Pollution (DALY)	51,243	70,065	42,029	9,214.22	17.98	28,036.21	40.01
Total Impact (DALY)	81,405	104,176	64,377	17,027.25	20.92	39,798.63	38.20
Health Impacts (ExternE approach)							
Acute Mortality (cases)	113.0	228.3	87.7	25.25	22.35	140.57	61.58
Acute Mortality (YOLL)	84.7	171.1	65.8	18.88	22.30	105.35	61.56
Chronic Mortality (cases)	1,428.7	2,223.0	1,136.7	291.98	20.44	1,086.23	48.86
Chronic Mortality (YOLL)	14,282.4	22,223.2	11,369.0	2,913.40	20.40	10,854.14	48.84
Resource Indicators							
Domestic Resource Share (%)	52.51	44.35	58.51	(6.00)	-	(14.16)	-
Domestic Gas Reserve after 2015 (tcf)	16.88	17.32	17.60	(0.72)	(4.24)	(0.27)	(1.59)
Renewable Share (%)	1.95	1.95	9.87	(7.92)	-	(7.92)	-
Social Indicator							
Domestic Employment (person-year)	80,323	77,594	94,109	(13,786.53)	(17.16)	(16,515.16)	(21.28)
Decentralization Ratio 2015 (%)	6.98	6.98	23.32	(16.34)	-	(16.34)	-

Table 6.6 Overall Impacts of the Three PDP Options (continued)

Impact Indicators	2015			Difference			
	PDP-Gas	**PDP-Coal**	**Renew.**	**Gas-Renew.**	**%**	**Coal-Renew.**	**%**
Economic Indicators	2003-2015 (NPV million THB)						
Generation Costs	2,583,545	2,571,413	2,461,623	121,922.04	4.72	109,790.31	4.27
GDP Contribution	905,674	896,067	929,672	(23,998.10)	(2.65)	(33,605.33)	(3.75)
BOP Effect	1,677,871	1,675,346	1,531,951	145,920.14	8.70	143,395.64	8.56
Fuel Costs	1,756,419	1,726,282	1,573,750	182,668.19	10.40	152,531.23	8.84
	In 2015 (million THB)						
External Costs	283,722	366,420	217,178	66,543.61	23.45	149,242.24	40.73
Fuel Costs	281,287	262,207	222,805	58,481.88	20.79	39,402.42	15.03
Generation Costs	408,723	400,606	366,541	42,182.10	10.32	34,065.07	8.50

Source: Own Calculation

- Economically, PDP-Renewables will reduce generation costs by 4.7% (compared to PDP-Gas) and contribute with almost 24 billion THB more to GDP (equal to 2.7% more compared to PDP-Gas) for the whole period. It will also reduce the import burden by 145.9 billion THB (around 8.7% lower than PDP-Gas). Regarding environmental and health impacts, in 2015, PDP-Renewables will reduce external costs by 23.5% or around 66.5 billion THB compared to PDP-Gas and almost 150 billion THB compared to PDP-Coal.
- In terms of domestic resource, PDP-Renewables will maintain a domestic resource share at around 58% of the total power generation and prolong the national gas reserve lifetime with around 4 years. More importantly, with nearly 10% renewables in its fuel mix at the end of the period, PDP-Renewables provides a good strategic move toward less natural gas dependency in the longer term.
- Politically, PDP-Renewables is the only option that can help the Thai power sector to reach the government targets of both energy efficiency and renewable energy development.

Based on these results, PDP-Renewables is highly recommended. However, because impact analyses are normally based on planning assumptions, which, in many cases, are also highly contestable, a sensitivity analysis is also required and will be discussed in the next section to confirm the reliability and validity of these results and their policy implication.

6.8 Sensitivity Analysis I : Environmental and Health Sensitivity

As the main focus of this study is health and related impact assessment, the first sensitivity analysis is dealing with the uncertainties in emission factors and health impact factors of the main power technologies. Of course, all these factors vary greatly in different contexts due to various factors, which to some extent are difficult to forecast today, as discussed in Chapter 5. It is, therefore, important to test to which extent these analyses reach the same results on the basis of the variability of environmental and health coefficients.

6.8.1 Environmental Impacts

In the environmental aspect, the sensitivity analysis will focus on the changes in emission factors of six pollutants. For CO_2, this analysis applies the lowest international references for greenhouse gas emissions from coal, natural gas, and lignite power generation technologies (for old and new power plants). For the other four pollutants, of which the emission can vary greatly, different percentages of reductions of emission factors of coal, natural gas, and lignite power generation technologies (in both old and new power plants) are tested in order to if a certain level will change the previous conclusion in environmental and health aspects.

The results of Table 6.7 show that, with an emission reduction of up to 60% (except CO_2) in all coal, natural gas, and lignite technologies, PDP-Renewables will still achieve the best results, i.e. the least polluting options, except for the case of TSP in which PDP-Gas provides the better results.

When the analysis moves to 65% and 70% emission reduction (except CO_2), PDP-Renewables achieves half of the best emission results, namely the best results in CO_2, SO_2, and Hg emission. At this point, PDP-Gas is the best option for NO_X and TSP emission and PDP-Coal is the best option for the reduction of NMVOC emissions.

The second part of Table 6.7 presents the emission reduction in two main renewable technologies; i.e. biomass and biogas. The results from this table show that, with 20% emission reduction (except CO_2) in biomass and biogas, technologies, PDP-Renewables will mostly achieve the best results of up to a 70% emission reduction in coal, natural gas, and lignite technologies (except CO_2), instead of 60% as previously tested. Even at a 75% emission reduction in coal, natural gas, and lignite technologies (except CO_2), and a 20% emission reduction (except CO_2) in biomass and biogas, technologies, PDP-Renewables will still be the best possible option of three indicators, namely CO_2, SO_2, and Hg emission.

With these results, it can be concluded that PDP-Renewables is the best possible option with up to around 65-70% reduction in emission factors of all coal, natural gas, and lignite power generation technologies. In addition, if the emission reduction of biomass and biogas is taken into account (at a 20% reduction level), the total result will be a 75% reduction in emission factors of all main fossil-based technologies in Thailand.

It should also be noted that, in this sensitivity analysis, the changes in the economic results of emission reduction technologies are not taken into consideration. If additional investments or costs are required to achieve a lower emission rate, the economic disadvantage of PDP-Gas and PDP-Coal (compared to PDP-Renewables) will certainly become larger, and, therefore, these two will be less preferable PDP options.

Table 6.7 Sensitivity Analysis of Environmental and Health Impacts (Eco-indicator Approach) from Emission reduction

Impact Indicators	2015			2003-2015		
	Gas	**Coal**	**Renewables**	**Gas**	**Coal**	**Renewables**
	60% Emission Reduction (except CO_2) in Coal, Gas and Lignite					
Greenhouse gas (million Ton CO_2)	123.67	138.49	**91.75**	1,172.36	1,213.83	**1,032.86**
NO_X (ton)	176,695	219,345	**172,317**	1,864,606	1,983,973	**1,863,238**
SO_2 (ton)	90,986	148,850	**73,883**	1,220,439	1,382,384	**1,160,106**
TSP (ton)	**7,761**	13,118	8,920	**101,811**	116,803	109,533
Hg (kg)	2,191	8,219	**2,087**	22,728	39,599	**22,418**
NMVOC (ton)	15,625	13,358	**13,280**	145,853	139,508	**129,233**
Health :Climate Change (DALY)	25,972	29,084	**19,268**	246,196	254,905	**216,901**
Health : Air Pollution (DALY)	21,514	29,043	**20,317**	243,412	264,483	**240,825**
Total Health Impact (DALY)	47,486	58,127	**39,585**	489,608	519,389	**457,726**
	65% Emission Reduction (except CO_2) in Coal, Gas and Lignite					
Greenhouse gas (million Ton CO_2)	123.67	138.49	**91.75**	1,172.36	1,213.83	**1,032.86**
NO_X (ton)	**156,112**	193,431	157,307	**1,667,385**	1,771,832	1,688,112
SO_2 (ton)	80,789	131,420	**66,377**	1,112,006	1,253,708	**1,060,552**
TSP (ton)	**6,919**	11,606	8,316	**92,136**	105,253	100,534
Hg (kg)	1,921	7,196	**1,834**	20,024	34,786	**19,764**
NMVOC (ton)	13,845	**11,862**	11,984	130,859	125,308	**116,499**
Health :Climate Change (DALY)	25,972	29,084	**19,268**	246,196	254,905	**216,901**
Health : Air Pollution (DALY)	19,037	25,625	**18,507**	218,915	237,352	**218,849**
Total Health Impact (DALY)	45,009	54,708	**37,776**	465,111	492,257	**435,750**
	70% Emission Reduction (except CO_2) in Coal, Gas and Lignite					
Greenhouse gas (million Ton CO_2)	123.67	138.49	**91.75**	1,172.36	1,213.83	**1,032.86**
NO_X (ton)	**135,530**	167,518	142,297	**1,470,165**	1,559,690	1,512,985
SO_2 (ton)	70,592	113,990	**58,872**	1,003,574	1,125,033	**960,998**
TSP (ton)	**6,076**	10,094	7,712	**82,461**	93,704	91,534
Hg (kg)	1,651	6,172	**1,582**	17,320	29,973	**17,110**
NMVOC (ton)	12,066	**10,366**	10,688	115,865	111,107	**103,765**
Health :Climate Change (DALY)	25,972	29,084	**19,268**	246,196	254,905	**216,901**
Health : Air Pollution (DALY)	**16,560**	22,206	16,698	**194,418**	210,221	196,874
Total Health Impact (DALY)	42,531	51,290	**35,966**	440,614	465,126	**413,775**

Note: Bold figures indicate the best PDP option in each impact indicator.
Source: Own Calculation

Table 6.7 Sensitivity Analysis of Environmental and Health Impacts (Eco-indicator Approach) from Emission reduction (continued)

Impact Indicators	2015			2003-2015		
	Gas	Coal	Renewables	Gas	Coal	Renewables
	70% Emission Reduction (except CO_2) in Coal, Lignite and Gas plus 20% Emission Reduction in Biomass and Biogas					
Greenhouse gas (million Ton CO_2)	123.67	138.49	**91.75**	1,172.36	1,213.83	**1,032.86**
NO_X (ton)	134,438	166,426	**133,192**	**1,460,074**	1,549,600	1,465,271
SO_2 (ton)	70,477	113,875	**57,858**	1,002,407	1,123,865	**955,684**
TSP (ton)	**5,995**	10,012	7,012	**81,671**	92,914	87,867
Hg (kg)	1,650	6,172	**1,574**	17,311	29,965	**17,071**
NMVOC (ton)	12,018	10,317	**10,315**	115,477	110,719	**101,811**
Health :Climate Change (DALY)	25,972	29,084	**19,268**	246,196	254,905	**216,901**
Health : Air Pollution (DALY)	16,448	22,094	**15,758**	193,372	209,175	**191,945**
Total Health Impact (DALY)	42,419	51,178	**35,026**	439,567	464,080	**408,846**
	75% Emission Reduction (except CO_2) in Coal, Lignite and Gas plus 20% Emission Reduction in Biomass and Biogas					
Greenhouse gas (million Ton CO_2)	123.67	138.49	**91.75**	1,172.36	1,213.83	**1,032.86**
NO_X (ton)	**113,856**	140,512	118,182	**1,262,854**	1,337,458	1,290,144
SO_2 (ton)	60,280	96,445	**50,353**	893,974	995,189	**856,129**
TSP (ton)	**5,152**	8,500	6,407	**71,996**	81,365	78,867
Hg (kg)	1,381	5,148	**1,322**	14,607	25,152	**14,417**
NMVOC (ton)	10,238	**8,822**	9,019	100,483	96,518	**89,077**
Health :Climate Change (DALY)	25,972	29,084	**19,268**	246,196	254,905	**216,901**
Health : Air Pollution (DALY)	13,970	18,676	**13,948**	**168,874**	182,044	169,970
Total Health Impact (DALY)	39,942	47,759	**33,217**	415,070	436,949	**386,871**

Note: Bold figures indicate the best PDP option in each impact indicator.
Source: Own Calculation

6.8.2 Health Impacts (Eco-indicator Approach)

Since the health impact analysis in the eco-indicator approach derives from the pollutant emission level of the three PDP options, the sensitivity analysis in this approach is closely related to the previous environmental sensitivity analysis. Therefore, the changes in emission factors are also applied to the sensitivity test of health impacts in the eco-indicator approach.

Table 6.7 also confirms that, in a health perspective, PDP-Renewables will provide the best results up to a 65% emission reduction (except CO_2) in all coal, natural gas, and lignite technologies. When it approaches a 70% emission reduction (except CO_2), PDP-Gas becomes the best possible option in relation to the air pollution impact on health. However, at this point, PDP-Renewables will still be the best PDP option in relation to climate change impacts on health and also total health impact.

When the emission reduction in biomass and biogas are taken into account (at the same level of 20% emission reduction), PDP-Renewables will continue to provide the best results up to a 75% emission reduction in all coal, natural gas, and lignite technologies.

This confirms that PDP-Renewables is the best PDP option in a health perspective with up to 70-75% emission reductions in all main fossil-based technologies.

6.8.3 Health Impacts (ExternE Approach)

Apart from the sensitivity analysis in the eco-indicator approach, the calculation of health impacts on the basis of health impact coefficients, as applied in the ExternE project, is also tested. Following the same concept, health impact coefficients of all coal, natural gas and lignite power technologies, which can also vary greatly, are assumed to be reduced by equal percentages. The health impact results will be recalculated as presented in Table 6.8.

Table 6.8 shows that PDP-Renewables will achieve the best results up to a 75% reduction in health impact coefficients of coal, natural gas, and lignite technologies. With a 80% reduction in health impact coefficients, PDP-Renewables will still be the best option for most of the health impact indicators, except from chronic bronchitis. PDP-Gas is the best option of most indicators, when health impact coefficients of coal, gas, and lignite approach a reduction level of 85%.

Therefore, the ExternE approach, confirms, to an even higher degree, that PDP-Renewables is the best option for health with up to a 75-80% reduction in health impact coefficients of all main fossil-based technologies. Within this range, it is a quite confirmative suggestion that PDP-Renewables should be the healthier option for Thai society.

6.9 Sensitivity Analysis II : Fuel Price Sensitivity

The assumption of fuel price is certainly crucial to every energy planning process. Moreover, it is almost impossible to provide a realistic prediction today of the riskier world energy market of tomorrow. In this situation, the sensitivity analysis of different fuel situations is useful, not only to find the least-cost solutions in different situations but also to search for the options which are most in an uncertain future.

In this study, three different price scenarios are applied to the fuel price sensitivity analysis. The base case scenario takes its point of departure in the assumptions used in the existing PDP, i.e. the 2003 normal price situation. As the base case scenario, its results have already been presented earlier in previous sections of this chapter. The second scenario (the so-called situation II) is the scenario of an increasing natural gas price in Thailand, up to the highest level of 2005/2006. The last scenario (the so-called situation III) is the situation in which the prices of both imported coal and biomass increase proportionally to the natural gas price because of their substitution effect, as shown in the statistical correlation analysis and observation discussed in Chapter 3. The economic analysis results of these two additional scenarios will be compared to the base case scenario, as shown below.

Table 6.8 Sensitivity Analysis of the Health Impacts of the reduction of Health Impact Coefficients

Items	Unit	2015			2003-2015		
		Gas	**Coal**	**Renewables**	**Gas**	**Coal**	**Renewables**
	75% Reduction in Health Impact Coefficients for Coal, Lignite, and Gas						
Acute Mortality	Cases	32.9	61.7	**28.2**	523.2	603.9	**501.3**
Acute Years of Life Loss	Years	24.7	46.3	**21.1**	392.3	452.8	**376.1**
Acute Hospital Admission	Cases	142.3	171.7	**123.7**	1,507.1	1,589.3	**1,431.4**
Chronic Mortality	Cases	412.7	611.2	**385.4**	4,898.3	5,454.0	**4,859.9**
Chronic Year of Life Loss	Years	4,126.0	6,111.2	**3,858.6**	48,971.8	54,527.7	**48,610.0**
Chronic Bronchitis (Adult)	Cases	261.3	394.1	**251.2**	3,242.0	3,613.7	**3,222.2**
Chronic Bronchitis (Children)	Cases	3,606.4	5,476.7	**3,479.7**	45,296.4	50,530.7	**45,010.7**
	80% Reduction in Health Impact Coefficients for Coal, Lignite, and Gas						
Acute Mortality	Cases	27.6	50.6	**24.2**	462.2	526.7	**444.1**
Acute Years of Life Loss	Years	20.7	38.0	**18.2**	346.6	395.0	**333.2**
Acute Hospital Admission	Cases	115.8	139.4	**104.6**	1,259.6	1,325.4	**1,214.1**
Chronic Mortality	Cases	345.3	504.1	**336.2**	4,208.1	4,652.6	**4,234.2**
Chronic Year of Life Loss	Years	3,452.3	5,040.4	**3,366.3**	42,073.0	46,517.8	**42,356.7**
Chronic Bronchitis (Adult)	Cases	**215.7**	322.0	217.9	**2,776.5**	3,073.9	2,800.5
Chronic Bronchitis (Children)	Cases	**2,971.7**	4,467.9	3,015.9	**38,797.6**	42,985.1	39,120.0
	85% Reduction in Health Impact Coefficients for Coal, Lignite, and Gas						
Acute Mortality	Cases	22.2	39.5	**20.2**	401.2	449.6	**386.9**
Acute Years of Life Loss	Years	16.7	29.6	**15.2**	300.9	337.2	**290.3**
Acute Hospital Admission	Cases	89.4	107.0	**85.5**	1,012.1	1,061.4	**996.9**
Chronic Mortality	Cases	**277.9**	397.0	286.9	**3,517.8**	3,851.3	3,608.6
Chronic Year of Life Loss	Years	**2,778.5**	3,969.6	2,873.9	**35,174.3**	38,507.9	36,103.4
Chronic Bronchitis (Adult)	Cases	**170.2**	249.9	184.7	**2,311.1**	2,534.1	2,378.7
Chronic Bronchitis (Children)	Cases	**2,337.0**	3,459.2	2,552.1	**32,298.9**	35,439.6	33,229.2

Note: Bold figures indicate the best PDP option in each impact indicator.
Source: Own Calculation

6.9.1 Impact on Fuel Costs

An increase of the natural gas price in Situation II will lead to a sharper increase of fuel costs for PDP-Gas, which is already the most expensive PDP option in terms of fuel costs. In 2015, the shift from the base case to situation II will raise the fuel costs of PDP-Gas from 281.3 billion THB to 333.3 billion THB, Since PDP-Gas mainly depends on natural gas, the additional increase of imported coal and biomass prices (Situation III) has a much lower effect on its fuel costs, as seen in Figure 6.19. These higher costs make PDP-Gas much less attractive compared to PDP-Coal and especially to PDP-Renewables.

Certainly, as it is much less dependent on gas, the increased price of natural gas in situation II has little effect on PDP-Coal (Figure 6.19). Even with an increase of the imported coal price in situation III, the fuel costs of PDP-Coal is still lower than those of PDP-Gas in situation II (its fuel costs in Situation III are 310.4 billion THB in 2015). In this perspective, PDP-Coal is the more secure option compared to PDP-Gas, in both scenarios.

With the same logic of comparison, it is quite clear that PDP-Renewables provides the best secure option in an uncertain future. In Situation II, the fuel costs of PDP-Renewables are only 257.4 billion THB (or 22.8% lower than PDP-Gas) and, in Situation III, its fuel costs are only 260.9 billion THB (or 22.1% lower than PDP-Gas). As shown in Figure 6.19, in both scenarios, its fuel costs are even lower than the base case scenario of both PDP-Gas and PDP-Coal. In other words, with the investment in PDP-Renewables, the Thai power sector can stabilize its future fuel costs at a lower price than the existing PDP plan (or PDP-Gas).

6.9.2 Impact on Generation Costs

The sensitivity analysis of generation costs reveals almost the same pattern of impact as previously shown in the fuel costs analysis. Figure 6.20 shows that, in 2015, the increase in natural gas prices will raise the generation costs of PDP-Gas from 408.7 billion THB in the base case scenario to 460.7 billion THB in the second scenario (or Situation II). However, the increase in the prices of imported coal and biomass in Situation III will make only a little difference in its generation costs (only up to 462.5 billion THB), which is still higher than PDP-Coal and much higher than PDP-Renewables. Therefore, this confirms the previous conclusion that PDP-Gas is much less attractive considering fuel price uncertainties.

Although PDP-Coal still has an advantage over PDP-Gas in its lower costs, this advantage is smaller when it comes to generation costs compared to previous fuel costs. In 2015, the generation of PDP-Coal in Situation III is 448.8 billion THB, which is only slightly lower than PDP-Gas. However, its generation costs in Situation III are still lower than those of PDP-Gas in situation II.

Despite its higher capital and O&M costs, PDP-Renewables still holds its advantage as regards low generation costs in all three pricing situations. In 2015, the generation costs of PDP-Renewables in Situation II are 401.1 billion THB (12.9% lower than PDP-Gas) and in situation III 404.6 billion THB (12.5% lower than PDP-Gas), which is even lower than the generation costs of PDP-Gas in the base case scenario and only slightly more than the generation costs of PDP-Coal in the same scenario (400.6 billion THB). Therefore, PDP-Renewables is the best PDP option in dealing with a future high price situation.

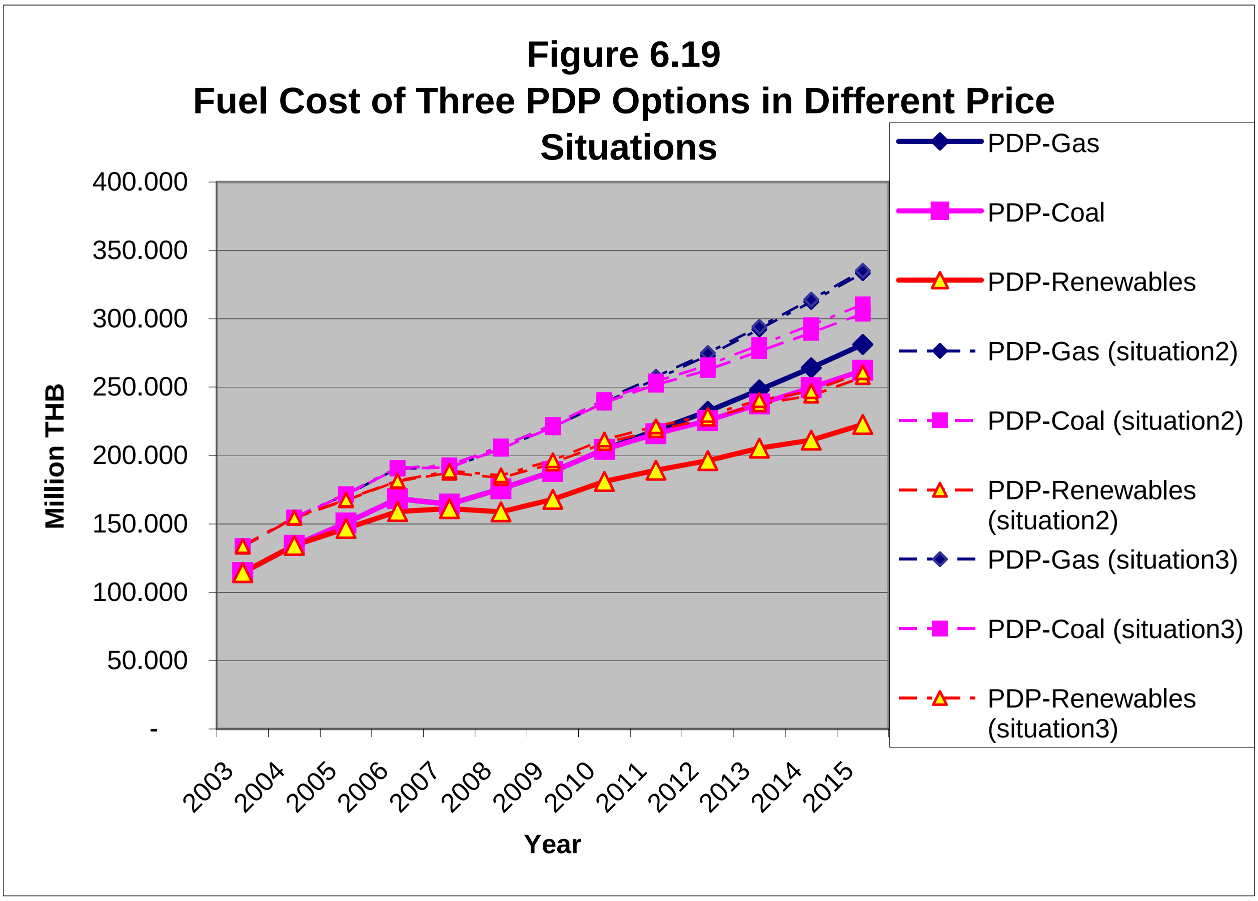


Figure 6.19
Fuel Cost of Three PDP Options in Different Price Situations
Million THB
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP-Gas
PDP-Coal
PDP-Renewables
PDP-Gas (situation2)
PDP-Coal (situation2)
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PDP-Renewables (situation3)

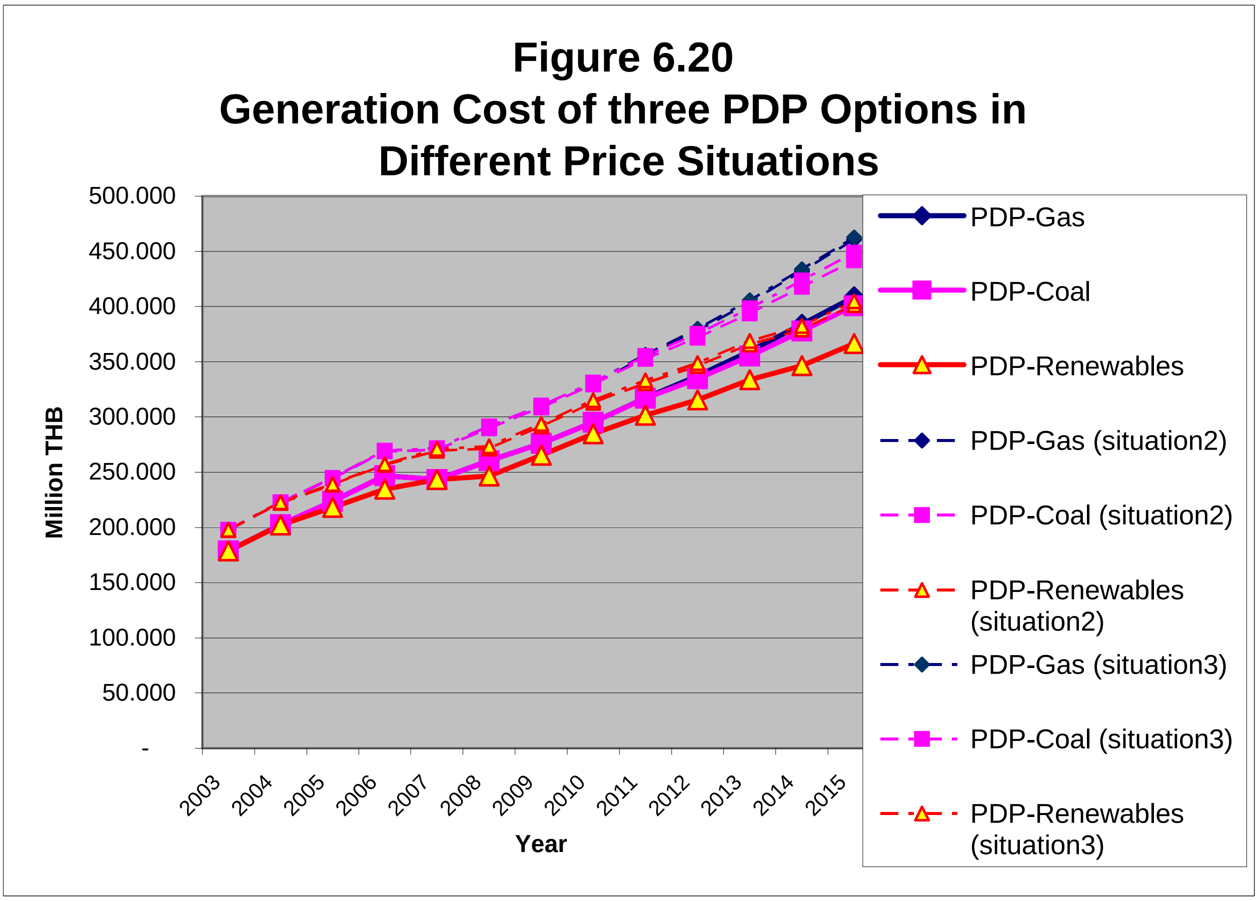


Figure 6.20
Generation Cost of three PDP Options in Different Price Situations
Million THB
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
PDP-Gas
PDP-Coal
PDP-Renewables
PDP-Gas (situation2)
PDP-Coal (situation2)
PDP-Renewables (situation2)
PDP-Gas (situation3)
PDP-Coal (situation3)
PDP-Renewables (situation3)

6.9.3 Impact on Balance of Payment

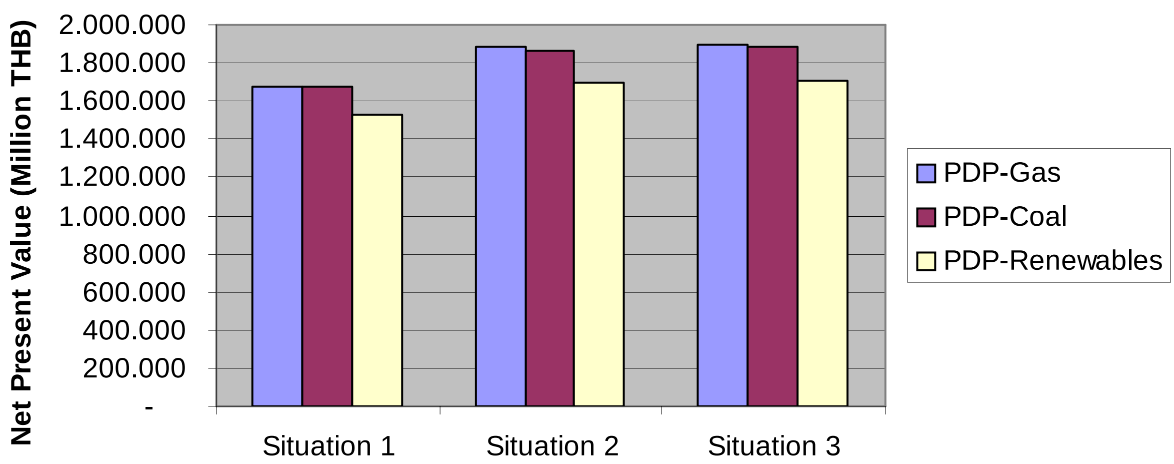
Figure 6.21 presents the impact on balance of payment (or import burden) in total present value terms. It indicates almost indifferent effects of increasing fuel prices between PDP-Gas and PDP-Coal, especially in Situation III. In Situation III, the total present value of the import burden from PDP-Coal will be 1,883.2 billion THB, compared to an impact burden from PDP-Gas of 1,890.4 billion THB.

As in the base case scenario, PDP-Renewables still provides import savings to Thai economy in both Situations II and III. In Situation II, the total present value of import savings achieved by PDP-Renewables is 180.2 billion THB for the whole period compared to PDP-Gas (or equal to 9.6% savings). This shows the larger import saving compared to the base case scenario. In Situation III, when the increasing price of biomass is also assumed, the import savings of PDP-Renewables (compared to PDP-Gas) have dropped slightly to 179.3 billion THB (or 9.5% saving).

This suggests that PDP-Renewables is a good choice to stabilize the national balance of payment by reducing import costs, especially when import burdens increase due to higher fuel prices, as is the case today.

Therefore, all these results of the fuel price sensitivity analysis confirm that, among the three PDP options, PDP-Renewables is the best option for Thai society to mitigate the risk of increased fuel prices, as experienced today. Its advantages can all be seen in terms of lower fuel costs, lower generation costs, and lower import costs, which are all crucial to the growth and stability of Thai economy.

Figure 6.21
BOP Effect of Three PDP Options in Different Price Situations



6.10 Sensitivity Analysis III : High Demand Growth Sensitivity

Apart from their different fuel mixes, another main difference between PDP-Renewables and the other two PDP options is the demand growth expectation. Although the predicted figures of peak demand in 2004 and 2005 are much closer to the figures of PDP-Renewables than those of the other two options, as previously shown in Chapter 5, several expansionist planners are continuously concerned about the return of an unexpected high growth economy and, consequently, a high electricity demand growth. As discussed in Chapter 5, they prefer to keep over-estimating in order to ensure system reliability and business expansion. This sensitivity analysis will deal with this concern by analyzing the flexibility of PDP-Renewables in relation to the maintenance of system reliability as well as its environmental, health, social, and economic advantages.

The analysis will begin by changing the assumption of PDP-Renewables' power demand growth rate after 2006 to the same growth rate as of other PDP options (i.e., from 5.2% to 6.5% GDP growth assumption). Then, the adjustment of PDP-Renewables is required to meet the new peak demand, by accelerating renewable energy and DSM investment by 10% (from normal PDP-Renewables), delaying the plan for scaling down the Mae Moh power plant (from a 1,200 MW reduction to a 900 MW reduction), and installing 2,100 MW of gas combined-cycle power plants by 2015.

Through this adjustment, it is ensured that PDP-Renewables can secure the power system for the whole period with an adequate reserve margin. Consequently, the impact analysis of the adjusted PDP-Renewables will be checked and compared to the existing PDP, or PDP-Gas, which is preferable from a health perspective compared to PDP-Coal. The results of the comparison are presented below.

6.10.1 Environmental and Health Impacts

Table 6.9 shows that although the environmental impacts of the adjusted PDP-Renewables, the so-called PDP-Renewables (High), are generally 8-9% higher than those of the original PDP-Renewables (except in Hg emission with an increase of only 1.5%), PDP-Renewables (High) still provides the better result compared to PDP-Gas in all environmental indicators. The advantage in greenhouse gas emission reduction is still more than 19%. For other pollutants, the emission reduction ranges from a 2% reduction in TSP to a 17% reduction in SO2. This confirms the environmental advantage of PDP-Renewables over PDP-Gas in a high demand growth situation.

At the same time, Table 6.9 also confirms the health advantage of PDP-Renewables (high) over PDP-Gas. In mortality assessment, PDP-Renewables (high) has around 220 cases less than PDP-Gas, which equals a 17.2% reduction in acute mortality and a 13.9% reduction in chronic mortality. In terms of the loss of healthy life years (or DALY), in total, PDP-Renewables (high) can still save 11,323 healthy life years (around a 13.9% reduction compared to PDP-Gas) of the total Thai population. Therefore, in conclusion, with a 7-9% increase in impacts compared to the base case scenario, PDP-Renewables can still maintain its health benefits over PDP-Gas in the high demand growth scenario.

Table 6.9 Sensitivity Analysis of Health and Environmental Impacts in a High Demand Growth Scenario

Impact Indicators	2015			Difference			
	PDP-Gas	PDP-Renew (high)	PDP-Renewables	Gas-Renew (High)	%	Renew (high) - Renew	%
Environmental Indicators							
Greenhouse gas Emissions (million Ton CO_2)	143.63	116.12	106.42	27.51	19.15	9.70	9.11
NO_X Emissions (ton)	423,683.71	384,373	352,438.57	39,310.55	9.28	31,934.58	9.06
SO_2 Emissions (ton)	213,351.13	176,488	163,949.01	36,863.13	17.28	12,538.98	7.65
TSP Emissions (ton)	17,871.96	17,514	16,171.96	357.72	2.00	1,342.28	8.30
Hg Emissions (kg)	5,425.96	5,193	5,116.64	233.20	4.30	76.12	1.49
NMVOC Emissions (ton)	36,975.79	31,628	28,833.98	5,347.72	14.46	2,794.09	9.69
Health Impacts (Eco-indicator approach)							
From Climate Change (DALY)	30,162	24,385	22,349	5,777.04	19.15	2,035.99	9.11
From Air Pollution (DALY)	51,243	45,697	42,029	5,545.77	10.82	3,668.45	8.73
Total Impact (DALY)	81,405	70,082	64,377	11,322.81	13.91	5,704.44	8.86
Health Impacts (ExternE approach)							
Acute Mortality (cases)	112.96	93.57	87.71	19.38	17.16	5.86	6.68
Acute Mortality (YOLL)	84.67	70.19	65.79	14.48	17.11	4.40	6.68
Chronic Mortality (cases)	1,428.71	1,229.48	1,136.73	199.23	13.94	92.75	8.16
Chronic Mortality (YOLL)	14,282.41	12,296.67	11,369.01	1,985.74	13.90	927.66	8.16

Source: Own Calculation

6.10.2 Economic Impacts

Table 6.10 indicates that, with additional investments to meet a higher expected demand, PDP-Renewables (High) is characterized by 1.8% higher generation costs, 1.4% higher import burden, and 1.5% higher fuel costs compared to the original PDP-Renewables. However, all these costs of PDP-Renewables (High) are still lower than those of PDP-Gas (i.e. 3.1% lower generation costs, 7.4% lower import burden and 9.1% lower fuel costs). The economic savings in terms of generation costs is still nearly 80 billion THB and in terms of BOP is still more than 124 billion THB (both in present value term) compared to the normal scenario. Concurrently, with more investment, the GDP contribution of PDP-Renewables (high) becomes 2.3% higher than the contribution of the original PDP-Renewables, which results in a 45.3 billion THB higher GDP contribution compared to PDP-Gas (around 5% of PDP-Gas). The external costs of PDP-Renewables (high) are also 16.8% lower than those of PDP-Gas. With all these figures, Table 6.10 confirms that, in a higher growth situation, PDP-Renewables still yields the better economic results compared to PDP-Gas. Thus, from an economic point of view, PDP-Renewables is clearly preferable to PDP-Gas.

Table 6.10 Sensitivity Analysis of Economic Impacts in a High Demand Growth Scenario

Impact Indicators	2015 PDP-Gas	2015 PDP-Renew (high)	2015 PDP-Renewables	Difference Gas-Renew (High)	Difference %	Difference Renew (high) - Renew	Difference %
2003-2015 (million THB in present value)							
Generation Costs	2,583,545	2,504,629	2,461,623	78,915.92	3.05	43,006.12	1.75
GDP Contribution	905,674	950,963	929,672	(45,288.69)	(5.00)	21,290.59	2.29
BOP Effect	1,677,871	1,553,666	1,531,951	124,204.61	7.40	21,715.53	1.42
Fuel Costs	1,756,419	1,597,266	1,573,750	159,152.07	9.06	23,516.11	1.49
In 2015 (million THB in nominal term)							
External Costs	283,722	236,040	217,178	47,681.76	16.81	18,861.85	8.68
Fuel Costs	281,287	242,432	222,805	38,854.76	13.81	19,627.12	8.81
Generation Costs	408,723	395,933	366,541	12,790.10	3.13	29,392.01	8.02

Source: Own Calculation

6.10.3 Social and Domestic Resource Impacts

Like in the analyses of other impacts in this sensitivity test, PDP-Renewables (High) also yields better results than PDP-Gas in all resource and social indicators, as shown in Table 6.11. With higher investment, it even provides higher benefits compared to the original PDP-Renewables in terms of domestic resource share (from 58.5% in the original PDP-Renewables to 59.1% in PDP-Renewables (High)), renewable share (from 9.87% to 9.98%) and domestic employment (from 94,109 to 103,070 person-years). Therefore, it is clear that PDP-Renewables is still a better solution than PDP-Gas, also in a high growth situation.

Although Tables 6.9-6.11 do not present the impact indicators of PDP-Coal, the figures of PDP-Renewables (high) in these three tables can be directly compared to the figure of PDP-Coal in Table 6.6, in which the advantage of PDP-Renewables (high) in all impact indicators can be seen clearly.

The results of this sensitivity analysis represent the flexibility of PDP-Renewables in coping with a higher demand growth situation and its ability to maintain all advantages over the other PDP options. Therefore, the concern of high growth economy and power demand should not inhibit the support and implementation of PDP-Renewables.

This sensitivity analysis also provides very practical suggestions to Thai energy policy. Based on the better performance of PDP-Renewables, instead of following PDP-Gas and announcing for new IPPs agreement in 2006, the Thai government may delay the IPP bidding process and check the high growth assumption until 2008 (in order for the 700MW new gas combined-cycle plants to be ready in 2013). PDP-Renewables also reduces the expected number of IPP biding requirements in 2015 considerably from 12,600 MW to only 2,100 MW.

However, since this suggestion is based on PDP-Renewables (High), the investment in renewable energy and DSM must be implemented as mentioned in PDP-Renewables (High) in order to gain both its benefits and its flexibility in the case of a high growth situation.

Table 6.11 Sensitivity Analysis of Resource and Social Impacts in a High Demand Growth Scenario

Impact Indicators	2015			Difference			
	PDP-Gas	**PDP-Renew (High)**	**PDP-Renewables**	**Gas-Renew (High)**	**%**	**Renew (High) - Renew**	**%**
Resource Indicators							
Domestic Resource Share (%)	52.51	59.06	58.51	(6.55)	-	0.55	0.00
Domestic Gas Reserve after 2015 (tcf)	16.88	17.48	17.60	(0.60)	(3.55)	(0.12)	(0.66)
Renewable Share (%)	1.95	9.98	9.87	(8.03)	-	0.11	0.00
Social Indicator							
Domestic Employment (person-year)	80,323	103,070	94,109	(22,747.84)	(28.32)	8,961.31	9.52
Decentralization Ratio (%)	6.98	22.34	23.32	(15.37)		(0.97)	

Source: Own Calculation

6.11 Sensitivity Analysis IV : Low Demand Growth Sensitivity

The last sensitivity analysis is based on the opposite assumption compared to the previous one. Instead of higher growth demand, this sensitivity analysis assumes that, within a couple of years, the over-demand forecasting may become too obvious to ignore and will lead to an expansionist strategy in the Power Development Plan.

Operationally, it may be decided that the existing PDP, or PDP-Gas, must lower its installed capacity requirement to what is expected in PDP-Renewables, i.e. no over-investment is done, but natural gas is still preferred to renewable energy technologies. Over-investment may certainly have several negative consequences in terms of health and economic impacts. It is, therefore, important to re-check whether PDP-Renewables still yields better results than the PDP-Gas with no over-investment effects or PDP-Gas (low).

As mentioned in Chapter 5, another benefit of this sensitivity analysis is the decomposition analysis of the overall benefits (or advantages) of PDP-Renewables.

As previously discussed in this chapter, these benefits may be divided into two main categories; namely forecasting effect and renewable energy effect. The forecasting effect refers to the difference between PDP-Gas and PDP-Gas (low). With the same expectation of future electricity demand, the renewable energy effect refers to the difference between PDP-Gas (low) and PDP-Renewables. These two effects are compared to the overall effects, which is the difference between PDP-Gas and PDP-Renewables as mainly discussed in this chapter, and converted into a percentage decomposition analysis. This decomposition analysis of the benefits of PDP-Renewables' will provide an insightful answer to whether both revising demand forecasting and renewable energy investment are required in PDP-Renewables and, consequently, in policy suggestion.

6.11.1 Environmental and Health Impacts

Table 6.12 provides a clear picture that, in environmental and health perspectives, PDP-Gas (low), or PDP-Gas with no over-investment, cannot provide the better results compared to PDP-Renewables in all environmental and health indicators. For example, in terms of environment, in 2015, PDP-Gas (low) still emits 18.2 million tons of CO_2, 37,700 tons of SO_2, and 271.8 kg of mercury more than PDP-Renewables. In terms of health, PDP-Gas (low) still has 161.5 additional cases of chronic mortality and 23.8 additional cases of acute mortality compared to PDP-Renewables, in 2015. At the same time, with PDP-Gas (low), the Thai population is still expected to loose 8,184 more healthy life years compared to PDP-Renewables.

Therefore, it is quite obvious that revising the demand forecast is not enough to achieve the same level of benefits as with PDP-Renewables. The decomposition analysis provides the answer that, in terms of environmental benefits, the forecasting effect plays a major role in NO_X and NMVOC emission reduction, and the renewable effect plays a more significant role in the emission reduction of SO_2, TSP, and Hg. In the case of the reduction of greenhouse gas emissions, both the revise of demand forecasting and the introduction of renewable energy play more or less equally important roles.

In terms of health, the decomposition analysis in the eco-indicator approach shows that the forecasting and renewable effects play equally important roles in reducing the loss of healthy life years of the Thai population. In the ExternE approach, these two effects also have almost an equal share of saving people from chronic mortality, though the renewable energy effect will play a much more important role in reducing acute mortality. In overall, it is fair to say that both effects have equally important roles in protecting the health of Thai people.

Thus, in both environmental and health perspectives, revising the demand forecasting and investing in renewable energy are both essential to promoting a healthier PDP option.

6.11.2 Economic Impacts

Eliminating the over-investment from PDP-Gas (i.e., change to PDP-Gas (low)) can reduce unnecessary costs, from investment to fuel costs, which finally results in the reduction of the generation costs of PDP-Gas. In this situation, the generation costs of PDP-Gas (low) become slightly lower than those of PDP-Renewables (around 7.8 billion THB difference for the whole period). However, PDP-Renewables still maintains its advantages over PDP-Gas (low) in all other economic indicators. Compared to PDP-Gas (low), PDP-Renewables contributes with nearly 70 billion

THB more to the national economy and lowers the import burden by 62 billion THB for the whole period. It also reduces the external costs from power generation by 37.1 billion THB a year in 2015.

Based on these figures, the benefit of PDP-Gas (low) in terms of lower generation costs (around 0.3% lower) seems to be much smaller than its disadvantage in terms of lower GDP contribution and higher import burden. Therefore, PDP-Renewables is still the most preferable option, though its advantage in lower generation costs is lost if the existing PDP, or PDP-Gas, decides to follow the same assumption of lower future electricity demand growth.

Table 6.12 Sensitivity Analysis of Environmental Impacts in a Low Demand Growth Scenario and Decomposition of the Effects of PDP-Renewables (Compare to PDP-Gas)

	2015			**Difference**			**Effect Decomposition (percentage)**	
Impact Indicators	**PDP-Gas**	**PDP-Gas (low)**	**PDP-Renew**	**Gas-Gas(low)**	**Gas(low)-Renew**	**Gas-Renew**	**Gas-Gas(low)**	**Gas(low)-Renew**
Demand Growth	*High*	*Low*	*Low*					
Types of Effect				*Forecast*	*Renew.*	*Overall*	*Forecast*	*Renew.*
Environmental Indicators								
Greenhouse gas (million Ton CO_2)	143.63	124.60	106.42	19.02	18.18	37.20	51.13	48.87
NO_X (ton)	423,684	376,876	352,439	46,807.74	24,437.39	71,245.13	65.70	34.30
SO_2 (ton)	213,351	201,608	163,949	11,742.97	37,659.14	49,402.11	23.77	76.23
TSP (ton)	17,872	17,442	16,172	430.32	1,269.68	1,700.00	25.31	74.69
Hg (kg)	5,426	5,388	5,117	37.54	271.78	309.32	12.14	87.86
NMVOC (ton)	36,976	30,730	28,834	6,245.70	1,896.12	8,141.82	76.71	23.29
Health Impacts (Eco-indicator approach)								
Climate Change (DALY)	30,162	26,167	22,349	3,994.86	3,818.18	7,813.03	51.13	48.87
Air Pollution (DALY)	51,243	46,395	42,029	4,848.34	4,365.88	9,214.22	52.62	47.38
Total Impact (DALY)	81,405	72,562	64,377	8,843.20	8,184.06	17,027.25	51.94	48.06
Health Impacts (ExternE approach)								
Acute Mortality (cases)	113.0	111.5	87.7	1.47	23.77	25.25	5.84	94.16
Acute Mortality (YOLL)	84.7	83.6	65.8	1.11	17.78	18.88	5.85	94.15
Chronic Mortality (cases)	1,428.7	1,298.3	1,136.7	130.45	161.53	291.98	44.68	55.32
Chronic Mortality (YOLL)	14,282.4	12,977.9	11,369.0	1,304.55	1,608.85	2,913.40	44.78	55.22

Source: Own Calculation

Table 6.13 Sensitivity Analysis of Economic Impacts in Low Demand Growth and Decomposition of the Effects of PDP-Renewables (Compare to PDP-Gas)

Impact Indicators	2015			Difference			Effect Decomposition	
	PDP-Gas	**PDP-Gas (low)**	**PDP-Renew.**	**Gas-Gas(low)**	**Gas(low)-Renew**	**Gas-Renew**	**Gas-Gas(low)**	**Gas(low)-Renew**
Demand Growth	*High*	*Low*	*Low*					
Types of Effect				*Forecast*	*Renew.*	*Overall*	*Forecast*	*Renew.*
Economic Indicators	2003-2015 (NPV in million THB)							
Generation Costs	2,583,545	2,453,809	2,461,623	129,736	(7,814)	121,922	106.41	(6.41)
GDP Contribution	905,674	859,848	929,672	45,826	(69,824)	(23,998)	(190.96)	290.96
BOP Effect	1,677,871	1,593,961	1,531,951	83,910	62,010	145,920	57.50	42.50
Fuel Costs	1,756,419	1,668,727	1,573,750	87,691	94,977	182,668	48.01	51.99
External Costs in 2015 in nominal	283,722	254,259	217,178	29,463	37,081	66,544	44.28	55.72

Source: Own Calculation

Furthermore, the decomposition analysis in Table 6.13 provides an insightful notion of the significance of revising demand forecasting and applying renewable energy in order to lead PDP-Renewables to its better economic results. As the forecasting effect contributes with more than 100% to lower generation cost compared to PDP-Gas (which means that all benefits come from forecasting effects, including the compensation for the higher costs of renewable energy), it is clear that revising demand forecasting is a very important policy suggestion to lower the generation costs of PDP-Renewables. Oppositely, renewable energy is very essential to the increase in the GDP contribution, including the compensation for GDP loss caused by the scaling down of investment as a result of lower demand expectation. To reduce import costs, fuel costs, and external costs, both the revised demand forecast and renewable energy play almost equally important roles.

Therefore, in short, the combination of revised demand forecasting and renewable energy makes it possible for PDP-Renewables to reach its economic advantage, as previously shown in this chapter.

6.11.3 Social and Domestic Resource Impacts

Table 6.14 indicates that, even with no over-investment effect in PDP-Gas (low), PDP-Renewables continues to yield the better results in all resource and social indicators. In fact, with lower investment in fossil-based power plants, PDP-Gas (low) achieves the most negative results in renewable share and domestic resource share. This is due to the fact that, in PDP-Gas, the renewable energy investment is based on a 5% share of the new fossil-based power plants, according to the renewable portfolio standard (RPS) scheme. In other words, based on PDP-Gas (low), the Thai government's target of achieving a 6% renewable share in 2011 cannot be reach. PDP-Gas (low) will also reduce the domestic employment from 80,323 person-years in the original PDP-Gas to 62,172 person-years, in 2015.

In terms of the decomposition analysis, Table 6.14 also confirms that the renewable energy effect, with more than 100% contribution, takes all responsibility for increasing the domestic share, the renewable share, and the decentralization share of power generation, and also for creating employment, while the revise of the demand forecasting plays a major role only in maintaining the domestic gas reserve.

Table 6.14 Sensitivity Analysis of Resource and Social Impacts in Low Demand Growth and Decomposition of the Effects of PDP-Renewables (Compare to PDP-Gas**)**

	2015			**Difference**			**Effect Decomposition**	
Impact Indicators	**PDP-Gas**	**PDPGas (low)**	**PDP-Renew.**	**Gas-Gas(low)**	**Gas(low)-Renew**	**Gas-Renew**	**Gas-Gas(low)**	**Gas(low)-Renew**
Demand Growth	*High*	*Low*	*Low*					
Types of Effect				*Forecast*	*Renew.*	*Overall*	*Forecast*	*Renew.e*
Resource Indicators								
Domestic Resource Share (%)	52.51	52.07	58.51	0.44	(6.44)	(6.00)	(7.36)	107.36
Domestic Gas Reserve after 2015 (tcf)	16.88	17.39	17.60	(0.50)	(0.21)	(0.72)	70.43	29.57
Renewable Share (%)	1.95	1.04	9.87	0.91	(8.83)	(7.92)	(11.45)	111.45
Social Indicator								
Domestic Employment (person-year)	80,323	62,172	94,109	18,151	(31,937)	(13,787)	(131.66)	231.66
Decentralization Ratio 2015(%)	6.98	6.96	23.32	0.02	(16.36)	(16.34)	(0.12)	100.12

Source: Own Calculation

In overall, the revised demand forecasting, as suggested in PDP-Gas (low), is still far from enough to provide better environmental, health, economic, resource, and social conditions as done in PDP-Renewables. In other words, just scaling down an investment plan is not an adequate healthier and attractive option. The shift from fossil-based technology to renewable energy is certainly required. However, revising the demand forecasting still plays a major role in creating several environmental and health benefits, as well as in lowering generation costs, which is a very important political issue in the Thai power sector. Therefore, in short, revising demand forecasting and investing in renewable energy contributes to making PDP-Renewables a healthier choice and an easier choice to make, at the same time.

6.12 Public Responses and Opinions

The early version of the impact analysis together with the relevant experiences on sustainable energy development at regional and local levels have been presented to public forums from January to July 2005, as described in Chapter 1. The aims of providing information to the public and make the public participate in forums are a) to get public feedback on this impact analysis and its policy consequences, b) to achieve a broader understanding of the practical issues of sustainable energy in Thailand and c) to stimulate public discussions about the strategic directions of the Thai power sector.

These following points summarize the issues which have been publicly discussed and treated during these public forums.

- With recent experiences of negative health impacts of power generation (as shown in Chapters 1 and 4), Thai people are fully aware of the environmental and health consequences of power generation, including new power plant projects. Therefore, they are interested in learning more and discussing healthier policy alternatives.
- The regional sustainable energy trips and fairs, which were organized as parts of the public forum, are very useful in bridging the more abstract strategic choices and technical impact assessment at the national level and the actual potential and reference cases at the regional and local levels. Thus, they stimulate more insightful public discussions during the forums.
- In general, the PDP-Renewables is highly welcome, mainly due to its economic and environmental health benefits. The PDP-Coal is much less attractive for local people due to its limited local economic benefits and its negative environmental and health consequences.
- Another important benefit of the PDP-Renewables in the local people's viewpoint, which has not been included in this impact assessment, is the value-added creation and price stability of their agricultural by-products and wastes. This can be an important benefit to an agricultural society like Thailand. However, in order to distribute this value added more equally to Thai farmers, the organization of supply chain, pricing structure (both for biomass inputs and power outputs) and ownership structure needs to be discussed. Otherwise, all value-added benefits will be handed into the few hands of those who control the supply chain, the price, or the investment in new power plants.
- The benefits of the decentralized power system have been confirmed during the forums. In the Mae Kam Pong case, this system means that local villagers, who rely on micro hydro power, need to take good care of their community and natural forest[1]. In biogas cases, the excess gas output, wasted heat, and organic residual materials can be organized and shared within the communities[2]. Even in conflict cases, local people also experience less difficulty in dealing with biomass power plants, compared to large fossil-based power plants, due to their smaller impacts and less power imbalances.
- Although, in general, renewable energy provides significant benefits to health, several renewable projects have, in practice, damaged the local environment and people's health, especially the dust from biomass power plants. Thus, an

environmental and health protection mechanism with the appropriate public participation process is certainly required, even in the case of distributed renewable energy power plant projects.

- In some places (especially in the Northeast and the South of Thailand), local people are highly interested and already have some experiences in developing their own local and regional energy plans in order to exploit their own potentials for sustainable energy development. This idea and movement can be very useful if it can interlink with and integrate into the national power development plan and impact assessment.
- During the sustainable energy trips and policy discussions, several unfavorable and unfair regulations of sustainable energy development have been identified. This includes the problems in connecting to the grid, the pricing system, the discrimination of import tax, and unclear policy directions and mechanisms. Therefore, to support PDP-Renewables, the forums suggested re-establishing the new policy mechanism and institutional arrangement. All these institutional and regulative issues will be discussed in the next chapter.

Since all public discussions did not dig deeply into the technical details of impact analysis, this study will not claim for the full public agreement or public support to its results. What can be concluded so far is that this impact analysis and its general conclusions are in line with the concerns, experiences, and aspiration of the Thai public. In other words, it is now receiving more cognitive and normative support from the Thai public.

Lastly, it is also important to note that this study has never received the direct feedback from the utilities and government institutions. However, in July 2005, after the public forums, EGAT publicly denied to revise its PDP[3] as suggested in the study and forum. Nevertheless, in November 2005, MoEn and EGAT accepted the idea of lowering its power demand forecasting[4] [5]. After the Interim regulator was set up in December 2005, the Interim regulator also planned to revise the demand forecasting and, consequently, the PDP and IPP bidding as planned in the existing PDP[6].

Concerning the renewable energy investment, as PDP-Renewables follows the Thai government target for renewable energy development, there is no counter-argument to this study presented in public. However, the unfavorable institutional frameworks, as mentioned earlier (and will be discussed in detail later), remained unchanged until the end of 2005. Implicitly, it seemed to become a “non-action policy”, especially when the EGAT privatization was on the top of the agenda for Thai power politics in 2005.

6.13 Conclusion

As healthy public policy aims to create a supportive environment for healthy living and, at the same time, to make the healthier choice an easier choice to make for decision-makers, this study provides a wide range of impact assessments, ranging from health to economic perspectives, to create a basis for policy discussion in Thai society. The results show that

- **PDP-Renewables is the cleaner solution**. Through the lower power consumption and renewable energy generation, the emission of greenhouse gas as well as main air pollutants will be significantly reduced. The levels of greenhouse gas, NOx and SO2 emission can almost be stabilized at the end of the planning period.
- **PDP-Renewables is the healthier option**. It produces lower health risks and has lower health impacts in terms of mortality, chronic diseases, and loss of healthy life years. Through PDP-Renewables, annually around 300 lives are expected to be saved and 3,000 people are able to avoid chronic diseases. It is also able to bring down the number of negative health impacts, despite its higher power generation and levels of service.
- **PDP-Renewables is a social benefit**. Due to its higher domestic investment and fuel share, PDP-Renewables creates more jobs and provides more opportunities for society to take more control over the power system through decentralized power generation.
- **PDP-Renewables is a feasible choice**. It requires only small additional investment, which consequently yields lower generation costs, lower import burden and higher GDP contribution to Thai economy.
- **PDP-Renewables is the more self-sufficient path**. It depends less on imported fuels and depleting national natural gas resources. More importantly, with almost a 10% share of renewable energy in 2015, it paves the way for a renewable future.
- **PDP-Renewables is the more secure and flexible investment option**. It involves less risk in dealing with higher fuel prices. It can also cope with both higher and lower demand growth and maintain its benefits over other PDP options.
- **PDP-Renewables is a way to for reach political targets.** As shown in this chapter, within three PDP options, PDP-Renewables is the only option that enables the Thai power sector to reach the government's goals of 6% renewable share and 1:1 energy intensity.
- **PDP-Renewables is a desirable direction**, as shown through the public forums and media, to counteract various problems faced by the Thai power sector, including higher negative health impacts, higher generation costs, higher import burden, and higher social conflicts from power generation and power generation projects.

Like other impact analysis and energy modeling, limitations and uncertainties will always accompany the assumptions used in the analysis (discussed in Chapter 5). However, the sensitivity analysis shows that the benefits of PDP-Renewables can be confirmed within the wide range of uncertain and contestable emission and health impact factors for main fossil-based technologies. The results can also be firmly applied to both low and high demand growth scenarios as well as normal and high fuel price situations.

Perhaps, the most sensitive uncertainty of PDP-Renewables is how to make it happen in reality. This is due to the fact that, although the Thai government has now realized that Thailand has a huge potential of renewable energy and has even set up targets to utilize this potential, nothing has changed much in relation to the creation of supportive institutions and regulations which would meet the target during the period of this study. It is quite obvious that if renewable energy cannot enter into the market, PDP-Renewables will not be a viable option for the Thai power sector. This is the reason why, in the next chapters, the focal point will be on supportive institutional frameworks and, more importantly, on how to make this plan come true.

Although this analysis does not provide a long-term future perspective as usually done in sustainable energy planning, it still firmly shows that the next 10 years will be a critical period for the Thai power sector and Thai society. Within these 10 years, with nearly a 10% renewable energy share plus wise demand-side management, we, as Thai society, may stabilize and lower the negative health and environmental impacts as well as aim for a more renewable future. On the contrary, within these 10 years, we might also run out of our natural gas resources, depend more and more on imported fuels and put our economy into much riskier situations. Even worse, we may experience a future with much higher environmental and health impacts, which certainly end up with more social tensions and conflicts. Hopefully, this impact analysis may contribute with some informed perspectives to the public deliberation of our critical future choices.

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Chapter 7
Supportive Institutional Framework and Public Regulation

The results presented in the previous chapter show several advantages of PDP-Renewables compared to the other two PDP options in various aspects, especially in health and economic perspectives. The question, then, is how to implement PDP-Renewables in reality. Apart from the availability of resources and technologies, as earlier discussed in Chapters 3 and 5, the appropriate institutional framework and public regulations are certainly keys to transforming PDP-Renewables into real actions. This chapter aims to provide recommendations on supportive institutional frameworks and public regulations, which are needed in order to pursue PDP-Renewables in the Thai power sector.

This chapter will begin with an analysis of the specific institutional reform needed in the Thai power sector to support the real implementation of PDP-Renewables. Then, the existing Thai power market and governance structure, as a main institutional framework, will be analyzed and followed by the analysis of present pricing regulations. Later, practical experiences in grid access and interconnection will be presented. After that, the existing planning practices will be investigated, before environmental and health protections will be discussed.

In each aspect of the institutional framework and public regulations, the problems of the existing framework and regulations will be introduced. Then, the main contestation of different policy discourses will be analyzed to provide a better understanding on how and why they think differently about institutional frameworks. As the outcomes of these policy contestations, recent and foreseeable policy changes will be summarized.

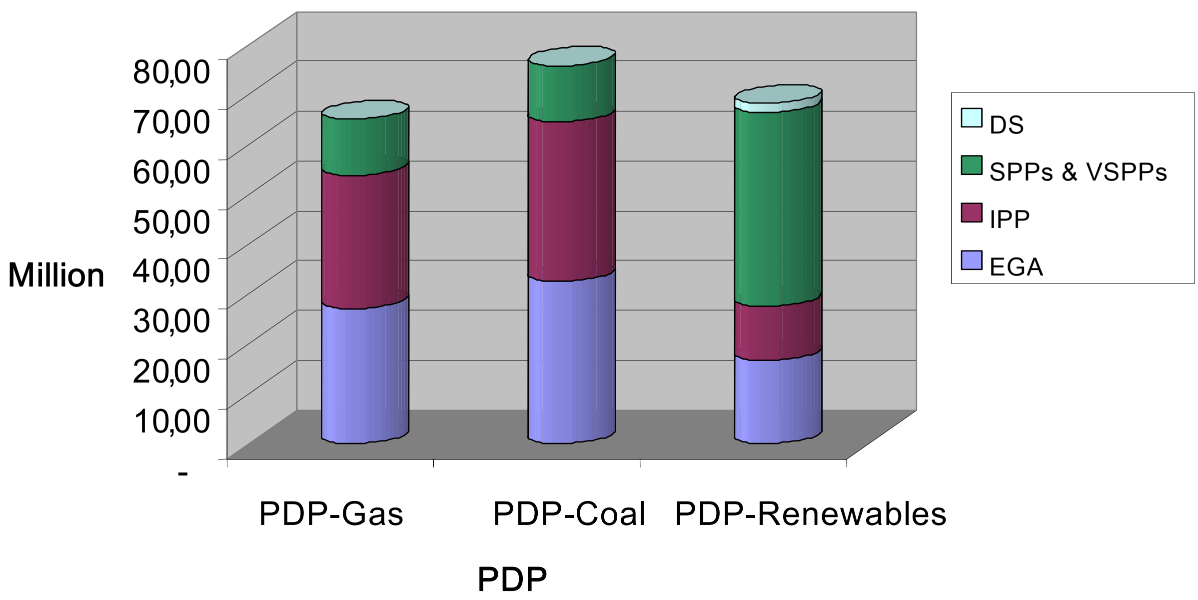
Based on the analyses of these main aspects of institutional framework and regulations, a recommendation for supportive institutions and regulations will be provided. However, the further question is still how to transfer these recommendations to reality. Therefore, the last section of this chapter will provide a suggestion to this question, by highlighting the importance of cognitive and normative contestations between different policy discourses and five main strategies to convince the actors of the Thai power sector that the recommended changes are based on appropriate cognitive and fair normative pillars, as well as on sound regulations and practices.

7.1 The Need for Institutional Reform

From the analysis in the previous chapters, it is obvious that policy changes towards a healthier option in the Thai power sector do not only require technical solutions or fuel changes. They also involve new forms of organization, practices, and investing and earning profits in the power sector.

Figure 7.1 provides a clear picture on how the investment scheme must be changed if PDP-Renewables is to be the most desirable option and real action plan for Thai society. While PDP-Gas and PDP-Coal basically require the investment from large power producers, like EGAT and IPPs, as usually done today, PDP-Renewables involves much more investment by Small and Very Small Power Producers (SPP and VSPP) and also demand-side management. The sensible questions are, "does this required investment scheme already exist?" or "how can we prepare this supportive investment scheme in order to put PDP-Renewables into practice?".

Figure 7.1 Investment Requirement Classified by Investors



The recent experiences from the historical analysis in Chapter 4 and the field studies cannot provide an optimistic answer. Although renewable energy increases its importance in the Thai power sector with a quite impressive growth in recent years, the Thai power sector in general is still under the control of the monopoly chain and a few big powerful investors. The recent practical experiences from the field visits and policy workshops, as partly presented in Box 7.1, still show that several institutional obstacles exist to increasing the influence of renewable energy producers in the Thai power sector. These obstacles relate to different aspects of the institutional framework and regulations, from market and governance structure to interconnection practices and from pricing to environmental regulations. Each of them requires further analysis, as will be shown throughout this chapter.

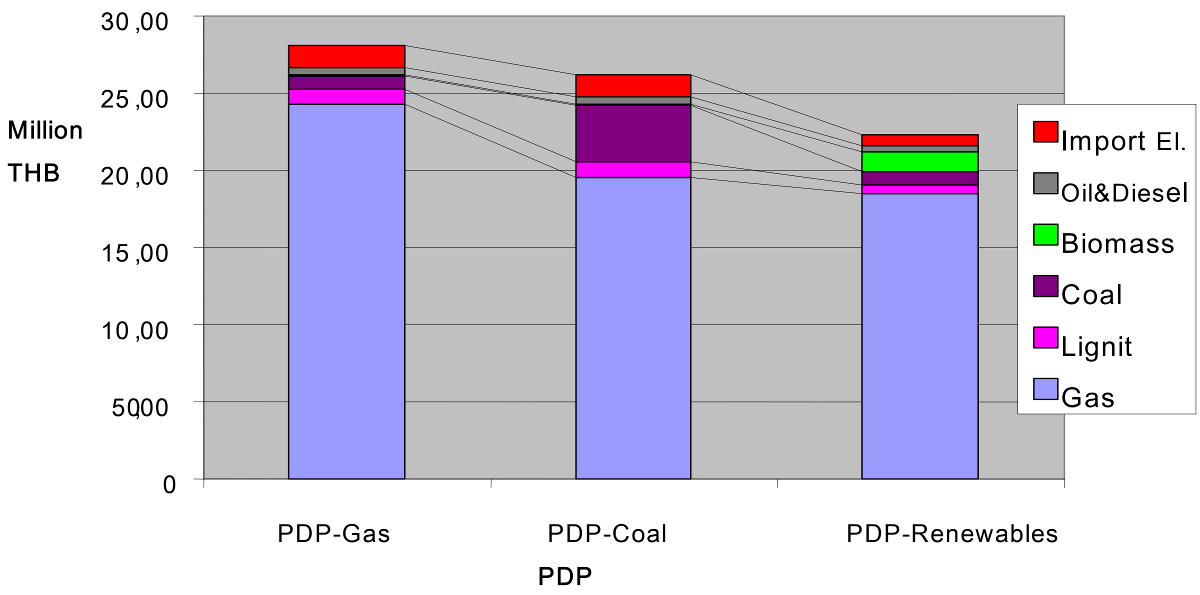
Box 7.1 Existing Problems for Renewable Power Producers Identified during Field Visits and Discussed at Policy Workshops

- 31% of renewable power producers (equal to 60% in terms of installed capacity) still sell electricity at rates lower than the EGAT avoided costs (EGAT marginal costs at the lower voltage).
- Only 16% of renewable power producers received 5 years subsidy for their power sold to the grid
- Only 17% of all Very Small Power Producers' (VSPP) applications get the contract and their payment.
- 40 rooftop PV at houses in Bangkok have been forced to transmit their electricity for free due to a disagreement in the certification of the inverter used.
- Renewable power producers have to pay their own costs of upgrading the grid for their interconnection.
- Co-generation SPP have not been able to gain access to the grid since 1999. This market now only gives access to utilities and their subsidiaries.
- Several biomass projects cannot develop further because of local protests due to ineffective environmental regulations.

More pessimistically, it is also hardly to imagine that the powerful big investors, like EGAT and IPPs, will easily accept the changes from PDP-Gas to PDP-Renewables. This transition is expected to reduce their investment opportunities (and consequently their profit earnings) to less than half of their status quo position. Moreover, apart from the power investment market, PDP-Renewables will also affectthe fuel market. As shown in figure 7.2, PDP-Renewables will lead to the reduction of PTT's gas market (as a monopoly seller) in the power sector (the most important gas-consuming sector) by 24% in 2015. As PTT was the highest profitable company in Thailand's stock exchange in 2005, it is expected to protect its market.

Therefore, only by stressing the previous conclusion that "PDP-Renewables is healthier, viable, and even more economically feasible", a healthy public policy may be introduced in the Thai power sector. To ensure that PDP-Renewables it put into action, huge efforts must be done to make the institutional framework and regulations support this PDP.

Figure 7.2 Fuel Market in 2015 in Three PDP-Options



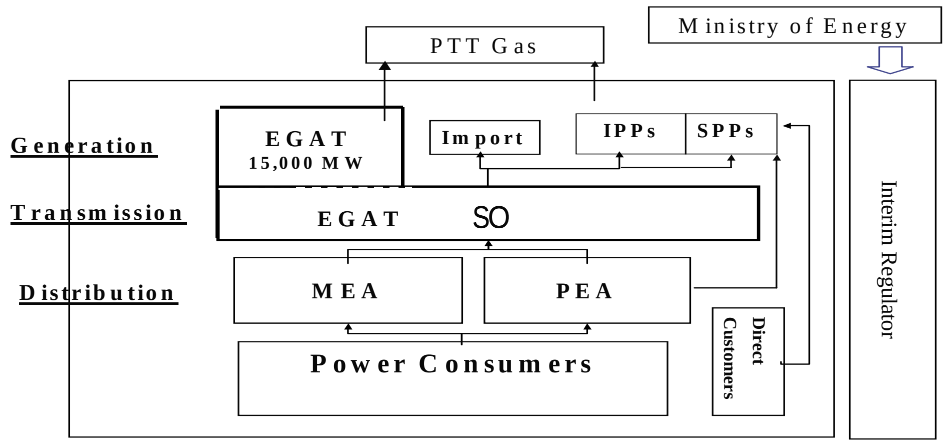
7.2 Market and Governance Structure

Power market structure and governance structure are the major structures of the institutional framework. They, explicitly and implicitly, determine the choices and opportunities, the responsibilities and the authorities of, and interactions between different actors in the market or power system. However, both market and governance structure can also be changed and shaped by various factors; including political ideologies or ideas, new technologies, influences from power producers or consumers, international pressures, etc. As shown in Chapter 4, the power market structure in Thailand has gone through a process of changes for more than a decade. Some changes do provide more opportunities for renewable energy, but others do not. This section focuses on the existing market and governance structures and the problems related to these. As power structural changes will take place on a continuous basis, this section also provides an overview of the contestation of the power structure, though it was partly discussed in Chapter 4.

7.2.1 Present Market Structure

The present market structure is characterized by the Enhanced Single Buyer (ESB) model, which allows EGAT to hold its monopoly power as transmission and system operator and, at the same time, still be the largest power producer[1]. The word "single buyer" means that all IPPs and SPPs must sell electricity through EGAT, except for VSPPs (who supply electricity directly to MEA or PEA) and their own consumption. In other words, EGAT is also a single provider to MEA and PEA. MEA and PEA are also single distributors in the Bangkok metropolitan and provincial areas, respectively. At the same time, EGAT is also obliged to buy natural gas, a main fuel source, only from PTT. Therefore, this model is really "a monopoly chain model".

Figure 7.3 Enhanced Single-Buyer (ESB) Model



Source: NESAC, 2003[2].

Although, the decision from the supreme administrative court in March 2006 stopped the EGAT privatization process, this market structure still remains. In other words, the "private monopoly" planned by the Thaksin government has returned to "state monopoly". In fact, EGAT still holds its share in the two largest IPPs, which, apart from running their own power plants, also take part in several SPP shareholdings (as shown in Figure 4.3). During the negotiation on privatization in 2005, EGAT also fought for controlling a 50% share when constructing new power plants and keeping the rights for its subsidiaries to take part in the IPP bidding of the other 50% of new projects[3].

The Thaksin government also planned to privatize MEA and PEA and list them on the stock exchange market with the same monopoly model. Due to the court decision and political oppositions, this plan is now postponed, but the monopoly remains.

7.2.2 Present Governance Structure

Apart from their superiority in the power market structure, the three enterprises, as state-owned enterprises, also play several crucial roles and have authorities in the power governance structure. Apart from their operational function, they still play important roles in policy and planning, especially in terms of the investment plan. Moreover, they still have authorities in the regulatory process, including in the approval of new power plants (held by EGAT), the approval of IPP, SPP, and VSPP purchasing agreements, and the technical standards of interconnecting with the grid[4]. In other words, they have the authorized power to decide who should gain access to the grid and how they should connect and operate within the grid system.

Table 7.1 Roles and Authorities of Different Institutes in the Present Power Governance Structure

Roles	MoEn.	EGAT	PEA	MEA	Regulator
Policy Roles					
Fuel Mix	●	●			?
Investment Plan	●	●	●	●	?
Social Policy	●				?
Regulation Roles					
Electricity tariff	○	○	○	○	●
Demand forecasting	●	○	○	○	●
Technical Standard	○	●	●	●	
Approval	●	●	●	●	?
Operational Roles					
Generation		●			
Transmission		●			
System Operator		●			
Distribution			●	●	

Note: ● represents the major roles and ○ represents the minor roles.

Source: Adapted from NESAC, 2003[5].

Although the Thaksin government decided to establish an interim regulator in December 2005, the roles of this interim regulator are still unclear and quite limited. At present, the clear role of the regulator is tariff setting. EGAT’s approval right (as a tool to control private power producers) is not transferred to the interim regulator and the regulator does not have the authority to control EGAT directly (but needs to pass through ministerial or cabinet authorities). In the early 2006, the interim regulator and the Ministry of Energy participated in a tense debate on the responsibility for establishing IPP bidding rules, since the regulator denied allowing EGAT’s subsidiaries to take part in the IPP bidding, as suggested by the Ministry. Certainly, the conditions are hard for the regulator, who does not possess any real authorized power. Moreover, the regulator can be appointed and dissolved easily only by the minister’s decision.

7.2.3 Problems within the existing structure

In short, with this existing market and governance structure, renewable energy producers have to run their business under marginalized conditions. They are competing on the monopoly market, where their strongest competitors (i.e, EGAT and its subsidiaries in the generation sub-sector) are their monopolistic buyers. Moreover, these monopolistic players, (i.e., EGAT, MEA, and PEA) possess the key authorized rights to conduct business with renewable power producers.

As all these enterprises run the same business (i.e., generation and distribution) in a profit-oriented way (under the national champion idea) and without a proper governance mechanism, these authorized powers can protect their vested interests and may, consequently, constitute an institutional barrier for renewable energy producers, as later shown in this chapter.

One of the mechanisms applied to avoid unfair regulation is the effective intervention from an independent regulator. However, at the moment, the regulator in Thailand is interim, has just been established, is not independent (can easily be dissolved by the Minister), and does not have a clear role or the full authority to regulate the market. Although the interim regulator may play a role in the development of a fair market for renewables, this opportunity is still highly uncertain and, therefore, less effective.

7.2.4 Contestation in the Market and Governance Structure

As shown in Chapter 4, the contestation in the market and governance structure has been obvious and tense for more than a decade. In practice, as EGAT is the most important agent on the Thai power market, the privatization of EGAT has always been a center in the policy discussions. However, the achievement of a better market and governance requires much more than an EGAT transformation. The summary of the contestation at different levels is presented in Table 7. 2.

To maintain monopoly power, both state monopoly and private monopoly discourses try to maintain the roles and authorities of EGAT, as a system operator and the largest generator with a great transmission and some regulatory power (as earlier discussed). In other words, they both prefer the enhanced single buyer model. The difference between these two discourses relates to the ownership of EGAT. While the state monopoly discourse suggests preserving EGAT as a state-owned enterprise for reasons of national security and system reliability, the private monopoly discourse wishes to transform EGAT into a public company, which is listed on the stock exchange market, to expand the investment and make higher profitability according to the concept of the national champion. Although they share some similarity in market and governance structure, the differences in their cognitive and normative pillars, have always made the contestation between these two discourses tense and usually linked to a concept of economic nationalism.

The power pool discourse, which dominated the policy discussion during the period of 1997-2000, suggests a completely different model. Based on the neo-liberalistic concept of market efficiency, the policy recommendation of this discourse is to divide EGAT into three generation companies and one transmission company and set up the power pool as a new system operator. Then, these generators and other IPPs should compete on the power pool market[6]. However, the power pool discourse fails to recognize that these generators and IPPs are still in control of the overall generation capacity and, more importantly, have a dense business relationship with each other, including cross-shareholding, which will easily lead to the abuse of the oligopolistic market power. After the electricity crisis in California and the election victory of the Thanksin government, this proposal has not been on the political agenda since 2001.

The decentralization model wishes to improve participation and accountability in the Thai power system. This discourse aims to break down monopoly power, but it does not believe completely in the market mechanism, as suggested in the power pool model. The discourse emphasizes fairly access to the grid, reduced conflicts of roles and interests, and strong regulatory power by suggesting the separation of generation and transmission and the establishment of a new independent system operator and an independent regulator[7]. However, this discourse has never come to dominate the policy discussion in the Thai power sector.

Table 7.2 Contestation in the Power Market and Governance Structure

Market Model	State Monopoly	Power Pool	Private Monopoly	Decentralization
Cognitive Pillar	National security through state authorities	Market Efficiency	Being the "national champion"	More participation and transparency
Normative Pillar	Higher system reliability	Competitive-led improvement Market mechanism	Higher profitability and business expansion	Higher accountability and fairness
Regulative Pillar	EGAT=SO+G+T -EGAT= state-owned enterprise with full authorities -No regulator	- Power pool = ISO - Separation between G & T - Market decides - Independent regulator	- EGAT= SO+G+T - EGAT= Listed company with some state authorities - Interim regulator	- Separation between G& T - New ISO - Independent regulator
Main Criticism	- Inefficiency - Unfair to other producers	- Higher risk - Oligopolistic market power	- Unfair to other producers - More monopoly	- Less system reliability - Fantasy idea

Note: SO = System Operator, G = Generation, and T = Transmission

7.2.5 Recent and Foreseeable Outcomes

After coming into power in 2001, the Thaksin government had a clear plan to change the Thai power structure into a private monopoly model as a way to create a “national champion” and stimulate investment on the stock exchange market. The master plan of power pool was postponed and finally cancelled in 2003. In 2004, the Thanksin government faced a strong opposition against the EGAT privatization plan, led by the EGAT labor union (i.e. state monopoly discourse). With the vast majority in parliament and new political tactics (as explained in Chapter 4), in June 2005, the Thanksin government succeeded in launching the EGAT privatization and planned to sell the EGAT share in November 2005.

However, in November 2005, Thai consumer organizations (i.e., decentralization discourse) brought this case to the Supreme Administrative Court due to an unlawful decision-making process and the negative impacts this had on public interest. One day before distributing EGAT’s share in Thailand stock exchange, the administrative court ordered the temporary halt of the initial public offering of the share in order to reconsider the case. In response to the consumer organizations’ argument, the Thaksin government set up the interim regulator in December 2005. However, in March 2006, the administrative court declared that the EGAT privatization process was unlawful and, therefore, cancelled the privatization process. EGAT has now regained its state monopoly position.

With the high political disturbance in Thailand in 2006, it is difficult to clearly foresee a change in the market and governance structure. The political influence of the private monopoly discourse is highly dependent on the political power of the Thaksin government. The state monopoly discourse now experiences a status quo position. With the won court case and the new interim regulator, the decentralization discourse has gained more public and institutional attention in its contestation. However, it seems that, in 2006, there is no clear sign that the market and governance structure will be either maintained or revised.

7.3 Pricing Regulation

Pricing regulation is among the most important institutional factors determining the pace of renewable energy development, since it directly affects the returns of renewable power producers. With different pricing criteria and rules, it also determines how renewable energy is developed, operated and integrated into the power system.

7.3.1 Existing Pricing Schemes

The most important pricing scheme for renewable energy in Thailand is the "firm and non-firm Small Power Producers (SPP)" pricing scheme, which was introduced in 1992, when the electricity market was opened to private producers for the first time. In fact, it is rather a general scheme, since this pricing scheme is used for both renewable and non-renewable power producers and it does not categorize the power producers according to types of technology and fuels, but on the basis of their guaranteed generation availability (Table 7.3).

Firm renewable SPPs have to a) generate electricity at least 4,670 hours/year, b) include March, April, May and June (the peak period in Thailand), c) have monthly capacity factors from 0.51 to 1.00, and d) shut down their maintenance during off-peak months with the maximum of 35 days in a 12-month cycle. The payment to firm SPPs includes the monthly capacity or availability payment (in THB/kW/month) and energy payment (in THB/kWh), which are based on EGAT's long-run avoided capacity and energy costs[8].

Non-firm SPPs are normally those who fail to meet the criteria for firm SPPs. Although, they have more flexible schedules for their power generation, they can only receive an energy payment based on EGAT's short-run avoided energy costs[9]. Normally, the payment they receive is much lower than the one given to firm SPPs (showed in detail later). Unsurprisingly, with the seasonal characteristics of their biomass resources, most of the current and foreseeable renewable power producers (both in terms of number and installed capacity) are and will be non-firm SPPs (see Table 7.4).

In 2002, the Thai government decided to use the Energy Conservation Fund (Encon Fund) for providing the first 5-year subsidy to renewable SPPs on the basis of a single-round bidding program. Renewable SPPs candidates had to submit a bid for the required amount of subsidy and the lowest bids were accepted up to either the specific amount of sold capacity or the limited subsidy budget. In the case of the currently operational SPPs, 16 out of 44 renewable SPPs received this subsidy[10]. Since the bidding was only one round, new projects developed after this date had no chance to apply for subsidy.

At the same time, the Thai government also set up another scheme for very small power producers (VSPP) with less than 1 MW capacity sold to the grid. Due to their smaller size, they have great difficulties in applying for firm or non-firm SPPs. The VSPP pricing scheme is similar to the net metering system in the USA, where the excess capacity generated by renewable producers will spin back the existing customer's electricity meter and the customer can save it for future use. In Thailand, in the case of excess generation, the payment will be based on EGAT's wholesale Time of Use (TOU) rate (including Ft or fuel adjustment tariff)[11]. Therefore, unlike the SPPs, the price of power generated by VSPPs is based on the on-peak and off-peak basis rather than the availability of its generation.

Table 7.3 Overall Pricing Scheme for Renewable Power Producers in Thailand

Pricing Schemes	Implementation year	Capacity sold to the grid and other conditions	Pricing Principles
1. Non-firm SPPs	1992-present	≤ 90 MW ≤ 4,670 Hours/yr.	- Only Energy payment (previously based on fuel oil, now based on natural gas)
2. Firm SPPs	1992-present	≤ 90 MW > 4,670 Hours/yr., incl. March-June	- Capacity Payment (in 2001; 479 THB/kW/month) - Energy Payment
3. Very SPPs	2002-present	≤ 1 MW	- Net metering system - EGAT wholesale price - Time of day tariff (On peak & off peak basis)
4. 5 yrs. Subsidy Bidding for SPPs	Only in 2002	≤ 90 MW	- Minimum requested subsidy for 5 yrs.
5. Renewable Portfolio Standard (RPS)	Planned to be in 2006	-	- 5% of renewables in each IPP bidding proposal - Minimum aggregate price offer

Table 7.4 presents the current situation of renewable power producers in Thailand. In total, the installed capacity of renewable energy in Thailand has reached 1,000 MW with almost 500 MW sold to the grid. In terms of installed capacity, more than 95% of renewable power generations are under the firm and non-firm SPP pricing scheme, both in the cases of existing and new-coming producers. It is clear that, for the existing SPPs, non-firm SPPs have the majority in terms of installed capacity, while firm SPPs are selling more electricity to the grid. But this observation may be changed soon, since the majority of the newcomers are non-firm SPPs, both in terms of installed and sold capacities. Although VSPPs are quite small in their overall installed capacity, in terms of the number of producers, they constitute a share of almost 60% of the total renewable power producers in Thailand (see Table 7.5).

Figure 7.4 shows the development trend in cumulative installed capacity and power sold to the grid by renewable SPPs. It is obvious that the rapid growths in installed capacity and power sold to the grid have taken place after 2001. The new installed capacity and new power sold to the grid in these three years constitute more than 50% of the total cumulative installed capacity and power sold to the grid.

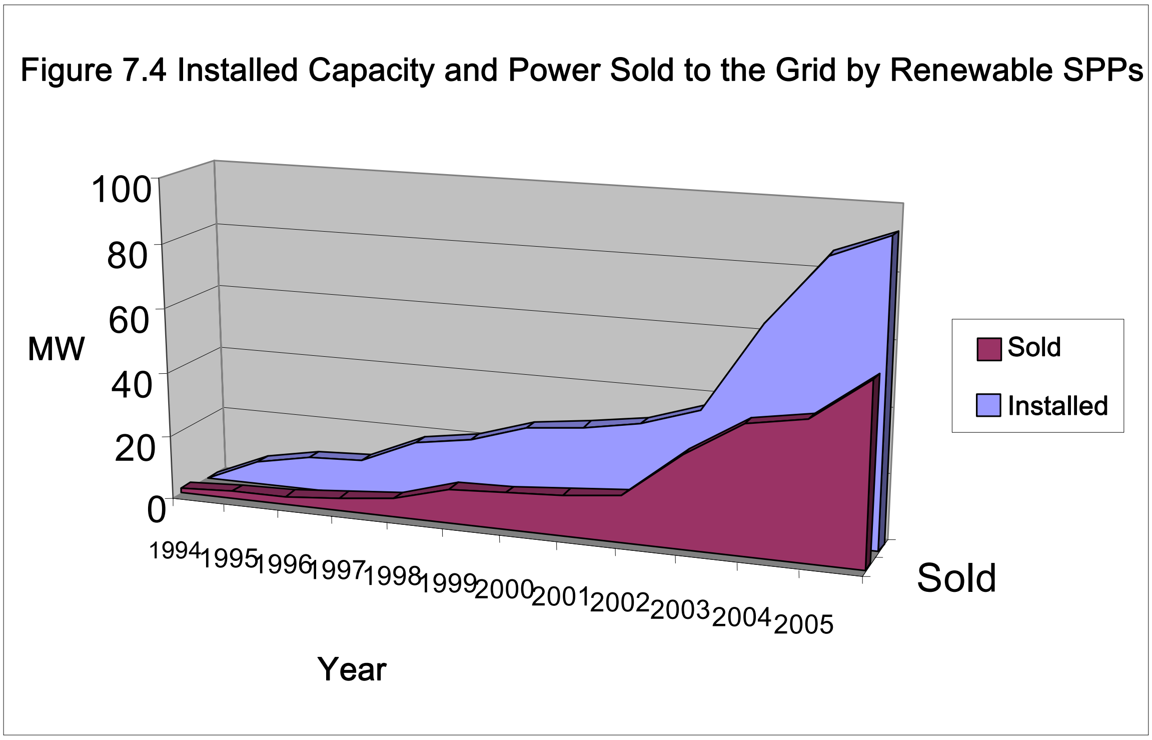
In terms of the electricity purchasing price trend (Figure 7.5), in general, as EGAT's avoided costs are based on increasing natural gas prices, renewable energy producers will now receive much higher prices compared to ten years ago. Since they receive both capacity and energy payment, the Firm SPPs can get the best price compared to non-firm SPPs and VSPPs. In general, non-firm SPPs receive much lower prices in these schemes, because they receive energy payment regardless of their generation time. Non-firm SPPs have always received the lowest price, except during the period of 2000-2001, when their energy payment was still based on fuel oil and the price of fuel oil was rapidly increasing (then government changed their reference of avoided costs to natural gas in 2001). In the case of VSPPs, as they received the EGAT wholesale price with on-peak and off-peak criteria, in general, their average prices are quite close to those of firm SPPs.

Table 7.4 Present Renewable Generation by Installed Capacity and Power Sold to the Grid (unit: MW)

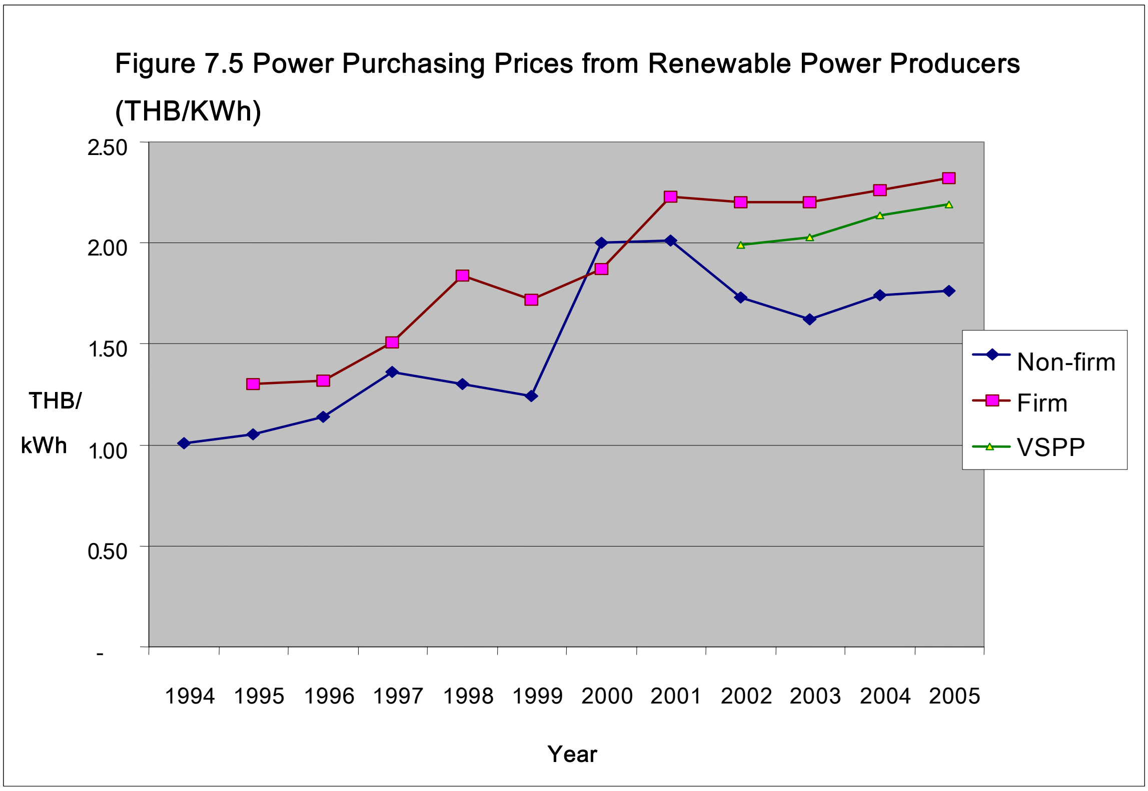
Types of RE Project	Installed Capacity						Power Sold to the Grid					
	Biomass	Biogas	PV	Micro-hydro	Wind& Geo	All RES	Biomass	Biogas	PV	Micro-hydro	Wind &Geo	All RES
Already Sold to the Grid or to Users												
Firm SPP	357.2	-	-	-	-	357.2	244.2	-	-	-	-	244.2
Non-Firm SPP	571.2	-	-	-	-	571.2	184.3	-	-	-	-	184.3
VSPP	10.1	5.4	0.5	-	-	16.0	3.9	3.3	0.5	-	-	7.7
EGAT	-	-	0.5	-	0.5	1.0	-	-	0.5	-	0.5	1.0
Others	-	7.0	22.2	43.6	-	72.9	-	-	-	43.6	-	43.6
Total	938.5	12.4	23.3	43.6	0.5	1,018.3	432.4	3.3	1.0	43.6	0.5	480.7
Only Contract Signed & In Process												
Firm SPP	81.3	-	-	-	-	81.3	61.8	-	-	-	-	61.8
Non-Firm SPP	175.7	-	-	6.7	-	182.4	104.3	-	-	-	-	104.3
VSPP	3.2	7.5	0.1	-	-	10.8	1.8	5.5	0.1	-	-	7.3
EGAT	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	-
Total	260.2	7.5	0.1	6.7	-	274.5	167.9	5.5	0.1	-	-	173.4
Total RE Projects												
Firm SPP	438.5	-	-	-	-	438.5	306.0	-	-	-	-	306.0
Non-Firm SPP	746.9	-	-	6.7	-	753.6	288.6	-	-	-	-	288.6
VSPP	13.4	12.9	0.6	-	-	26.9	5.6	8.8	0.6	-	-	15.0
EGAT	-	-	0.5	-	0.5	1.0	-	-	0.5	-	0.5	1.0
Others	-	7.0	22.2	43.6	-	72.9	-	-	-	43.6	-	43.6
Total	1,198.8	19.9	23.4	50.3	0.5	1,292.8	600.2	8.8	1.1	43.6	0.5	654.2

Source: Compiled from EPPO, 2006[12].

Note: Others include the renewable energy projects by DEDE, PEA, and other private projects that are not part of the SPP or VSPP programs.



Source: Compiled from EPPO, 2006[13].



Source: Compiled from EPPO, 2006[14].

7.3.2 Problems with the Existing Schemes

In principle, the price of renewable power "should at least be equal to the avoided cost of electricity on the lower voltage grid of a distributor" (i.e. the wholesale price at which a municipal grid operator buys electricity from the transmission network) "plus a premium reflecting the renewables' social and environmental benefits"[15].

However, in practice, this concept is not fully applied in Thailand. In the case of VSPP, the concept of avoided costs is fulfilled as theVSPPs sell their electricity to MEA and PEA and use the EGAT wholesale price as their reference. But, they do not receive any additional payment to reflect their positive contributions to environment and society.

In the SPP scheme, based on the marginal cost of 1.93 THB/kWh at a 115 kV line (where most SPPs connect and sell their electricity to the grid)[16], only firm SPPs (both with and without 5 years subsidy) can get more than EGAT's avoided costs, as seen in Table 7.5. In the case of non-firm SPPs, all of them receive a much lower rate. In 2005, the average purchasing price for non-firm SPPs without 5 years subsidy was only 1.76 THB/kWh. With the average 5 years subsidy, only few non-firm SPPs can receive the exact amount corresponding to EGAT's avoided costs for the first 5 years of their operation. In fact, it is fair to say there is no subsidy at all for non-firm SPPs and VSPPs in Thailand.

Table7.5 Price Comparison between Different Power Purchasing Schemes

RE Producers	No.	Installed Capacity (MW)	Power Sold (MW)	Power Sold with subsidy (MW)	Average Price in 2005 (THB/kWh)	Average 5 yr. Subsidy (THB/kWh)	Price + Subsidy (THB/kWh)	Time Of Day Tariff
Firm SPP with 5 yrs Subsidy	9	250.60	201.40	144.70	2.32	0.17	2.49	No
Firm SPP w/o 5 yr. subsidy	3	106.60	42.80	-	2.32	-	2.32	No
Non-firm SPP with5yrs. Subsidy	7	157.00	70.00	59.60	1.76	0.17	1.93	No
Non-firm SPP w/o 5 yr. subsidy	25	414.20	114.30	-	1.76	-	1.76	No
VSPP	59	16.02	7.65	-	2.19	-	2.19	Yes
Total	103	944.42	436.15	204.30				

Source: Compiled from EPPO, 2006[17].

As seen from the Table, the criteria of "firm and non-firm" SPPs is the main obstacle to achieving a fair renewable energy production. The critera block 42% of the renewable power sold by non-firm SPPs (equal to 60% of total renewable installed capacity) in order to get a fair rate of their power contributions (even without mentioning their positive externalities). The results of this unfair pricing scheme are the lower investment in the power generation of the renewable non-firm SPPs (compared to their potentials) and their lower electricity sales (compared to their installed capacity), as seen in many cases during the field visits.

By taking into account the seasonal nature of biomass resources, this criterion can be biased against the renewable power generation. Compared to VSPPs, most of non-firm biomass SPPs can easily shift their generation schedules to supply more power during the peak period, if they receive a financial reward for doing so.

However, with the main criteria of 4,670 operation hours in total and without regard to the actual demand need in the system, this opportunity is blocked. This leads to a lose-lose situation in which the SPPs receive much lower prices and lose their investment incentive, while the power system loses the potential back-up capacity from non-firm SPPs, which could be used for both peak load management and grid stability, as most of them are located on the lower voltage part of the grid. Practically, EGAT considers the non-firm power sold a non-dependable capacity, meaning that EGAT still needs to invests in (or purchases from) somewhere else for an amount equal to the value of the power capacity of non-firm SPPs, in order to fulfill their planning and operating criteria.

As Table 7.6 shows, the majority of newcomers (with a signed contract and in a contracting process) under SPP schemes (in terms of installed and sold capacity) are the non-firm SPPs. Therefore, if this pricing problem continues, 60% of the power generated by the newcomers will face this unfavorable and unfair condition. Under these conditions, the full potential of biomass power will hardly be utilized. The 5-year subsidy program, although it helped in stimulating biomass energy investment during the period of 2002-2005 as presented in Table 7.7, is only a one-round bidding without a clear future direction. Moreover, the scale of subsidy is relatively small, especially for non-firm SPPs, who receive an amount lower to or, at most, equal to EGAT's avoided costs for their power generation. As shown in Table 7.5, firm SPPs turn out to be those who get more benefits from the subsidy schemes. Last, it is important to repeatedly note that this subsidy is only for five years of their operation. This subsidy is certainly not a premium "reflecting the renewables' social and environmental benefits". On the basis of this, the 5-year subsidy contributes very little to the stimulation of renewable newcomers, as clearly shown in Table 7.7.

Table 7.6 Classification of Renewable Power Producers by Purchasing Price compared to Wholesale Price

Price Category	Types of Producers	No. of producers	Installed Capacity (MW)	Power Sold (MW)	Share in No. (%)	Share in Installed Capacity (%)	Share in Power Sold (%)
Already Sold to the Grid							
Higher than Wholesale price	Firm SPP	12	357.20	244.20	11.65	37.82	55.99
Same level as Wholesale price	VSPP	59	16.02	7.65	57.28	1.70	1.75
Lower than Wholesale price	Non-firm SPP	32	571.20	184.30	31.07	60.48	42.26
Total		103	944.42	436.15	100.00	100.00	100.00
Already Signed Contract and In Process							
Higher than Wholesale price	Firm SPP	6	81.30	61.80	10.00	29.61	35.63
Same level as Wholesale price	VSPP	37	10.83	7.33	61.67	3.95	4.23
Lower than Wholesale price	Non-firm SPP	17	182.40	104.30	28.33	66.44	60.14
Total		60	275	173	100.00	100.00	100.00

Source: Compiled from EPPO, 2006[18].

Table 7.7 Contribution of SPP Subsidy Program to New SPP Projects

Item	No.	Installed Capacity (MW)	Power Sold (MW)	Share of Subsidized Projects (%)		
				No.	Installed Capacity	Power Sold
Projects Sold to the Grid during 2002-2005						
Project with 5 yrs subsidy	7	185.4	142.2	38.89	30.26	47.37
Total Projects	18	612.6	300.2			
Projects with Already Signed Contract and In Process						
Project with 5 yrs subsidy	2	24.7	21.7	8.70	9.37	13.06
Total Projects	23	263.7	166.1			

Source: Compiled from EPPO, 2006[19].

7.3.3 Proposed RPS Scheme and Its Foreseeable Problems

In August 2003, the Ministry of Energy introduced the Renewable Portfolio Standard (RPS) as a main mechanism for renewable energy support without any prior public consultation. The RPS requires new fossil fuel power plants to procure renewable power; either by purchasing it from renewable energy producers and certificates or by investing in their own renewable projects, with an investment equal to 3-5% of their installed capacity[20].

Although, in principle, Thailand's RPS is quite similar to the Tradable Certificate System (TCS) or the Green certificate or RPS in other countries, in detail, there are a number of significant differences which link to the effectiveness of this scheme. The main differences are the following;

- Instead of defining renewable requirement in terms of energy outputs as usually done, the Thai RPS version refers to installed capacity.
- The requirement only applies to new fossil fuel power plants, not the existing ones and not for new large hydro power plants.
- Existing SPPs are not allowed to participate in the RPS scheme, but newcomers (or new projects) can register both for SPP (or VSPP) and RPS.
- Instead of establishing the certificate market, it is an attempt to include the RPS proposal into an IPP bidding process, which means that, in the bidding, each potential IPP must offer both 95% fossil fuel-based capacity and 5% renewable capacity and the price competition will be based on the aggregate offer.

In fact, the debates about the effectiveness of this RPS schemes (or TCS) are echoed internationally. Compared to the Renewable Energy Feed-in Tariff (REFIT), RPS provides less preferable and less certain conditions for innovation and investment. In the situation of fewer sellers and buyers on the certificate market (and in some cases sellers and buyers are the same business enterprises or affiliates), its hypothesis on competition-led improvement is irrelevant and, therefore, ineffective in reducing the costs of renewable energy.

In a European comparison, the countries that apply the REFIT scheme perform much better both in terms of promoting rapid growth of renewables and reducing the costs of renewable power, as well as fostering equipment and other upstream industries for renewable power. In total, three countries, which are pioneers and have implemented the REFIT scheme; namely Germany, Denmark, and Spain, have a share of 85% of the total installed wind capacity in Europe and control more than half of the wind turbine export in the world[21]. In the UK, which has the best wind resource in Europe and has created the TCS system, much less wind power has been installed compared to those three countries, the costs of wind energy are much higher, as seen in Table 7.8, and most of the wind turbines are imported technology.

Table 7.8 The Comparison of Newly Installed Capacity, Market Share (within EU15), and the Price of Wind Energy in Some EU countries in 2003.

Country	Newly Installed Capacity (MW)	Market Share in EU-15 (%)	Prices (Euro cent/kWh)
With Feed-in Tariff System			
Germany	2,645	49.1	6.6-8.6
Spain	1,377	25.6	6.4
Greece	276	5.1	7.8
With Tradable Quota System			
United Kingdom	103	1.9	9.6
Italy	116	2.2	13.0

Source: Quoted by Greacen and Loy, 2006.[22]

Apart from the international debates and experiences, the Thai version of RPS can even lead to more serious problems due to bad modifications. Its foreseeable problems include,

- **Higher Uncertainty.** Since renewable energy producers are required to incorporate their projects into the IPP bidding proposal and the decision will be made on the basis of the aggregate bidding price (IPP+RPS) , renewable energy producers are forced to take risks in identifying the right IPP partners to combine the proposal. In the case of lower demand growth, the IPP bidding may be delayed, and, consequently, renewable energy producers cannot enter into the market through this scheme.
- **Wrong Incentive.** Thailand’s RPS is defined in capacity (MW) not energy outputs (kWh), thus, it will lead to distorted incentives to inflate a nameplate capacity[23]. Consequently, in order to avoid this situation, the regulator needs to set up an arbitrary set of capacity factors, which can lead to a misallocation of resources among different renewable technologies.

- **No Competition for EGAT's RPS**. Under the enhanced single buyer model of the power sector, there is no actual competitive mechanism for EGAT's RPS, since EGAT maintains its right to develop 50% of the new generation capacity without competition. Moreover, within the existing tariff structure, EGAT can pass on all costs, including the RPS procurement, to consumers. Therefore, there is no accountability mechanism to ensure that the price of EGAT's RPS will be appropriately determined, especially if EGAT or its subsidiaries will take part in these renewable projects as they do in IPPs and SPPs[24].
- **Confusion with Other Pricing Schemes.** As new renewable energy producers are allowed to register to both SPP and RPS schemes, without a clear interaction between these two mechanisms, this can lead to a source of confusion and create uncertainty for potential investors (e.g. Can renewable power producers choose which mechanism is best for them or will the government choose for them?)[25].

Obviously, instead of promoting a free and fair market for renewable energy, the Thai RPS schemes will force renewable energy to be dependent on fossil fuel additions and, more importantly, to be dependent on fossil fuel power producers. This policy direction will probably even widen the power gap in the Thai power sector.

Moreover, as PDP-Renewables aims to cut most of the fossil-fuel power plant projects, this RPS scheme cannot be used for promoting renewable energy development in this PDP option. Therefore, a better pricing scheme is required in order to implement PDP-renewables, as a healthier policy option.

7.3.4 Contestation on Pricing Schemes

The discussions and debates on pricing schemes began when the grid was opened to SPPs in 1992. However, it has never reached the top of the agenda in the policy process, especially compared to the debates on market structure. Three main proposals of pricing schemes have been presented; namely a) maintaining firm and non-firm SPP criteria, b) promoting RPS and bidding systems, and c) introducing feed-in tariff system. The public discussions and debates on this policy contestation clearly show the different cognitive and normative aspects of different policy discourses, as concluded in Table 7.8.

In the state monopoly discourse, system reliability and cheap electricity are always highlighted. Utilities always insist on evaluating the SPPs' reliability on an individual basis, using firm and non-firm criteria, rather than an integration basis (where the planned increase of power generation in one area can offset the lower generation in another at a particular time). In this view, renewable energy is a much less reliable power source and should thus receive smaller rewards. The emphasis on cheap electricity makes this discourse neglect the premium payment for the positive externalities of renewable energy generation. In 2003, EGAT also claimed that a higher purchasing price for SPPs increased electricity tariffs, and the EGAT suggested that new SPP contracts should not be made. However, it is important to notice that this SPP price was equal to the price of EGAT's own IPP subsidiaries, while the purchasing amounts of the SPP were much smaller.

In the power pool and private monopoly discourses, the positive externalities of renewable energy are acknowledged and subsidy is accepted as a means to stimulate the development of renewable energy. However, both of them still emphasize cheap electricity. They also believe in applying market mechanisms for renewable energy development, even though, the private monopoly discourse will not apply market mechanisms to the overall power market. To these discourses, the competition within the subsidy scheme is the key to reducing the costs of renewable electricity. This is why the bidding mechanism and RPS are preferable according to these policy discourses.

Table 7.9 Contestation of Different Policy Discourses in Pricing Regulation

Regulative Pillar	Firm & Non-firm SPP	Bidding and RPS	Feed-in Tariff
Policy Discourse	State Monopoly	- Power Pool - Private Monopoly	Decentralization
Normative Pillar	- System reliability in individual plant basis - Lower cost for consumers	- Positive externality of RE - Lowest cost for RE support - Competition-led innovation	- Positive externality of RE - Supportive environment for RE innovation
Cognitive Pillar	- Cheap electricity - RE = Less reliable	- Cheap electricity - Market supportive mechanism	- Cleaner electricity - Open market for RE innovation
Main Criticism	- Unfair price for RE (< avoided cost) - Under counting RE in planning	- High uncertainties for RE (unclear tender offering and depending on IPP bidding scheme)	- Higher costs of RE support - No competition between RE producers

The decentralization discourse highlights both cleaner electricity and more open and stable market conditions for renewable energy development. According to this discourse, all renewable energy producers should be fairly paid for their positive contributions to environment and society. At the same time, the creation of a supportive environment in terms of open and stable market conditions is required to promote the development of renewable energy and associated industries. According to the decentralization discourse, the existing firm and non-firm SPP criteria are certainly unfair to renewable power producers, and RPS will create even higher uncertainties. Therefore, in this view, a feed-in tariff solution is much more appropriate for renewable energy development and certainly required if the contribution of renewable energy is expected to be expanded.

7.3.5 Recent and Foreseeable Changes

Since August 2003, when the government announced RPS as a main mechanism for supporting renewable energy development, there has been no significant change in the pricing scheme from the government side. The RPS regulation rule has been drafted, but important detail conditions, such as exact percentage of required renewable energy, the relationship between RPS and SPP, or how to combine RPS in IPP bidding etc, are still waiting for the interim regulator to decide. The IPP bidding program was postponed from mid-2005 to 2006 and the final decision seems to be uncertain.

In mid-2005, the Energy Planning and Policy Office (EPPO) presented the opinion that the Thai version of RPS may lead to serious regulation complications and suggested that feed-in tariff was a more appropriate solution, but there was no public response to this solution from the Ministry. On the other hand, the EPPO is also working on the expansion of the VSPP scheme to cover the maximum capacity of 6 MW (and later expand to 10 MW) of power sold to the grid, but the final approval has not been given by the policy authorities.

Civil society groups have strongly criticized the RPS mechanism and tried to publicize this issue in 2004 and 2005. Several forums and workshops were organized for discussing the RPS proposal, including one policy forum of this research. Although the media has reported some critiques and suggestions to implement the feed-in tariff mechanism, it is still considered a too "complicated" technical issue by Thai public and media. Therefore, so far, the debate cannot lead to more meaningful public actions and policy changes.

In the field visit of this study, some SPPs suggested that an on-peak and off-peak basis should be applied rather than the firm and non-firm criteria, for the reasons already explained. In the policy forum of this research, some renewable power producers agreed with civic groups that a feed-in tariff would be more suitable for supporting renewable development in Thailand.

This agreement led to interesting changes, when the Federation of Thai Industries (FTI) made a proposal to the Thai government to shift from RPS to feed-in tariff. In the FTI proposal, the specific rates of purchasing prices of different renewable energy technologies were also determined. Later, in March 2006, this proposal was also agreed on by the Department of Alternative Energy Development and Energy Efficiency (DEDE)[26], but with some modification in the feed-in tariff rate, as shown in Table 7.10. Greacen and Loy made the comparison between proposed rates and actual rates in some selected countries, as also presented in Table 7.10 and found that these proposed rates are reasonable, except for the prices of municipal waste (too high compared to other countries) and solar PV (too high compared to other renewable technologies). However, this proposal has not yet passed through any political approval.

Table 7.10 FTI and DEDE Proposed Prices for Feed-in Tariff and Feed in Tariff Rates in Some Selected Countries (Unit: THB/kWh)

Type	FTI Proposal	DEDE Proposal	Germany REFIT rate	Spain REFIT rate	Sri Lanka REFIT rate
Biomass	2.6-2.8	3.2-3.8	3.9-6.4	3.15	3.42
Biogas	3.4-3.5	-	3.9-5.4	3.15	3.42
Municipal Waste	3.9	5.0-6.0	3.1-3.6	3.15	3.42
Micro-Hydro	-	3.0	3.2-4.7	3.15	2.21
Wind Energy	6.0	5.0	2.6-4.1	3.15	-
Solar PV	16.0	15.0	19.7-25.2	20.11	-

Source: Adapted from Greacen and Loy, 2006.[27]

Based on these facts, radical policy changes do not seem occur in Thailand at this point in time. However, civil society groups still plan a more effective public campaign against the RPS mechanism. With a sharp decline in the political popularity of the government, with a victory in court which stopped the EGAT privatization, as well as more empirical results from international experiences about the higher effectiveness of the feed-in tariff mechanism and the policy influences from the industrial side, opportunities are certainly better for achieving a change.

7.4 Grid Access and Interconnection Regulation

Normally, grid access and interconnection issues are regarded in Thai society as more technical issues. However, in practice, not only technical rationality plays a role in regulating grid access and interconnection. In several cases, structural or institutional power within the electricity system, rather than technical rationality, determines the technical regulations. The analysis in this section will mainly be based on an institutional point of view.

7.4.1 Existing Problems

During the field visits (or the sustainable energy trips) and the policy forums, SPPs and VSPPs raised the issue of practical problems of grid access and interconnection based on their own experiences, as presented in Table 7.11.

For SPPs, the main issues are the unnecessary investment and unfair charges. According to the SPP scheme, SPPs are required to invest both in interconnection equipment and upgrading of the grid. Some SPPs do not understand why they are not allowed to connect to the grid at a lower voltage rather than EGAT's 115kV. They also feel that the fact that they are forced to upgrade the grid is unfair, since the utilities own the grid and can use it for any other purposes[28]. Some of them also mentioned problems related to high interconnection and back-up charge and, more interestingly, unsold supply penalty. The supply penalty is applied by PEA when PEA cannot sell electricity supplied by SPPs (through the EGAT transmission line) in some off-peak hours (in some specific areas) and requires SPPs to transfer their electricity payment (from EGAT) to PEA to compensate for PEA's loss of income.

Table 7.11 Practical Problems with Grid Access and Interconnection identified during Field Visit and Policy Forums

Pricing schemes	Practical Problems Found
Firm SPPs & Non-firm SPPs	- High interconnection and back-up charge - Unnecessarily expensive interconnection equipments - Unnecessarily expensive upgrading of the grid - Unsold supply penalty (when PEA cannot sell electricity provided by SPPs)
VSPP	- Bottleneck in registration process - Only 17% of applications can sell and get electricity payment - Disagreement in inverter certification forces 40 PV producers to deliver free electricity to the grid - Continuation of 6-month electricity charges after switching to VSPPs.
Co-generation SPP (apart from biomass)	- No access to the grid (or no new contract) since 1999 - Now only allow for EGAT, PEA, MEA, and their subsidiaries to run new co-generation plants

While all of these issues require case-by-case studies and discussions, amongst these identified problems, two major points are certainly lacking. The first point is the lack of space and mechanisms for SPPs to ask for reconsiderations, as all these regulations have been set up by utilities, which also take part in the same business.

The second major point is the fact that the utilities do not recognize the benefits which SPPs would have in stabilizing the grid by providing the electricity and reactive power at low voltage (as most of biomass power plants are located outside the city district). In the case of the Mitr Phol Biomass power plant (Firm SPP) that can provide 8 MW power for the grid, the investment of one sub-station (for servicing around 6-8 districts) has been saved, while the quality of service can be maintained.

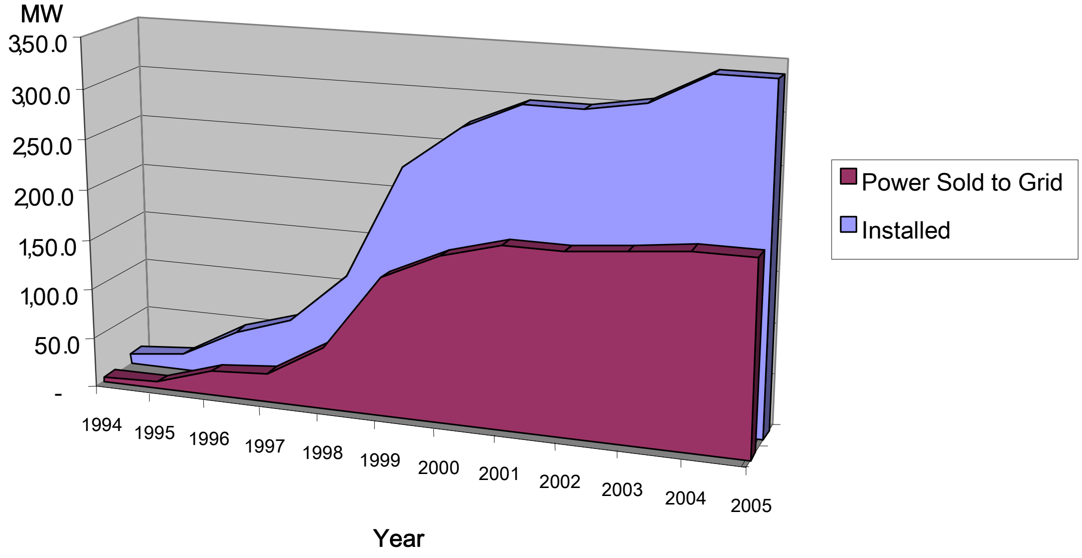
For VSPP, the key problem is their experiences of bottlenecks in the registration process. Until now, only 17% of the applications from VSPP can sell and receive an electricity payment. 40 PV producers in the MEA area cannot get payment for the electricity they have sold to the grid due to a disagreement in the inverter certification. Because, for MEA, the grid stability issue is the main rationale for this disagreement, therefore, MEA refused to pay for these unsecured sources. In other words, due to this reason, MEA is now receiving electricity from these VSPPs for free. Moreover, in reality, MEA never has experience of system interruption from these VSPPs at all.

One VSPP was furious about the rule that forced him to continue paying the electricity bill according to the highest consumption in the six-month record instead of his present consumption (which was close to zero after becoming VSPP). The application of this rule means that he (as well as other VSPPs) has to pay an electricity bill based on his previous consumption for around 6 months before being perceived as a real VSPP (in terms of income). Although the main argument of the utilities is that they have already invested in the services at their previous consumption level, the long application process (normally longer than 6 months) should provide enough time for utilities to prepare for a lower level of consumption, and, therefore, offset this argument.

For non-renewable cogeneration SPPs, the major problem is inaccessibility to the grid, since the cabinet resolution in 1998 decided that electricity should no longer be bought from co-generation SPPs, due to a high reserve margin after the 1997 economic crisis. The exception of this resolution has been made only for EGAT, MEA, PEA, and their subsidiaries. Although the reserve margin is now not as high as before, this rule has not been changed. As a result, there has only been one new co-generation SPP contract since 1998, which is a PTT-EGAT-MEA joint venture for a cogeneration plant in the new Bangkok International Airport. As a consequence, the total installed capacity and the power sold by co-generation SPPs in Thailand have slowly increased after 2001, as shown in Figure 7.6.

Certainly, all these problems are linked to the monopoly market structure and the conflicts of roles and interests, which allow utilities to set up their rules without any possibilities for renewable SPPs to appeal.

Figure 7.6 Installed Capacity and Power Sold by Non-renewable Cogeneration SPPs



7.4.2 Contestation in Accessing, Interconnection and Operations

For the Thai utilities, both in the state monopoly and the private monopoly discourse, system reliability is always a cognitive and normative pillar of their previously mentioned regulations. It is their responsibility and authority to protect grid reliability. In their view, the SPP contribution has been considered as adding more risks and burdens to grid management. Therefore, SPPs should pay for all extra costs which are needed for interconnection and grid management.

However, in the power pool and decentralization discourse, the fair access to the national grid and the benefits of distributed power constitute the key cognitive and normative pillar. In this view, several existing regulations are unfair and present clear cases of conflict of interests. Therefore, both discourses suggested that SPPs should have a fair access to the appeal mechanism, and an independent regulatory body. Concurrently, the concept of joint responsibility in interconnecting investment has also been suggested (for example, SPPs invest in interconnection and utilities invest in grid upgrading)[29]. However, the benefits of distributed power as mentioned above have not been explained to or recognized by the Thai public yet.

Table 7.12 Contestation of Different Policy Discourses in Grid Access and Interaction Regulation

Policy Discourse	- State Monopoly - Private Monopoly	- Power pool - Decentralization
Regulative Pillar	- Whole responsibility for SPP in interconnection and grid upgrading investments - Charges & penalties for system load management - No access for non-renewable co-generation SPPs	- Joint-responsibility (SPP for interconnection and utilities for grid upgrading) - Fair access for co-generation SPPs - Appeal mechanism and independent regulatory body are needed.
Normative Pillar	- System reliability - Interconnection and load management for SPPs are extra risks and burdens to utilities	- Fair access for all producers - Distributed power can help utilities in load management and grid stability
Cognitive Pillar	System reliability is a non-negotiable issue	- Fairness for all producers - Benefits of distributed power

7.4.3 Recent and Foreseeable Outcomes

These issues have not been discussed in the general public or policy discussions. As non-firm SPP contracts are on a year-by-year basis, some SPPs are generally not willing to discuss these issues publicly as they fear reprisals from utilities when purchasing their electricity[30]. These issues seem to be technical issues for Thai public, even though they are associated with a number of structural issues and general normative judgment. The absence of action from the main policy actors means that the situation is unchanged so far.

In the future, changes may happen due to four main factors. First, the changes in the market structure (as discussed earlier) will certainly lead to changes in the normative and cognitive pillar, as well as in authoritative power. Second, with or without structural changes, the interim regulator (established in 2005) may also take more control or, at least, provide space for reconsideration of these issues. Third, the establishment of a renewable power producer group in the Federation of Thai Industries (FTI) in 2005 may have provided a platform for SPPs to take an active role in the policy process and contribute to institutional changes. Last, the general understanding among the Thai public of these issues may also make a difference in the policy process, especially if the policy discussions treat quality of services and fairness in more general terms (and not only in technical discussions).

7.5 Planning Practices

Chapter 5 describes the existing power development planning as a long-term investment planning process. It also presents the criticisms of the PDP process. Therefore, in this section, only a summary of the existing problems will be presented.

7.5.1 Existing Problems

In general, the power development planning process is recognized as a sectoral planning with limited objectives and targets. It is normally carried out to serve sectoral mandates and interests without considering other national development goals and targets. There is no public participation in the process, at all. The power development plan is totally under the control of the Ministry of Energy and EGAT without any clear corrective or public accountability mechanisms.

Concerning other contributions of renewable energy, the existing planning process can also be quite problematic.

First of all, the power development plan only considers conventional technologies as reliable options. Therefore, renewable energy is perceived as a policy requirement rather than a real option. In consequence, the contribution of renewable SPP (mainly Biomass power plants) is fixed at 426 MW until 2015 and other renewable energy generations are placed within the 5% RPS scheme.

Second, in the present planning process, existing and potential non-firm SPPs are not recognized as dependable capacities of the power system. Thus, they do not form part of the planning process and EGAT is required to invest in other power plants (if this amount of dependable capacity is needed to secure system reliability).

Third, in fact, the present planning process is not an actual least-cost analysis (as EGAT always claimed), since several choices have been predetermined earlier, including a 50% share of EGAT in the construction of new power plants, without any prior least-cost analysis.

Last, the assumed future oil prices (which strongly link to the natural gas price) are extremely low. During the planning process of 2004, the price of oil in the governmental model was expected to be 27.5 USD/barrel in 2006, though this assumption was made in July 2004 when the world oil price had already increased. In the model, three scenarios of the world oil price are provided, but all of them show decreasing trends, down to 23-31 USD/barrel in 2015. This unrealistic price assumption will implicitly block the integration of renewable energy in the power system, since the costs of conventional power are expected to be extremely low.

Therefore, with these existing problems, the present power development plan hardly supports the growth of renewable energy, as planned in PDP-Renewables.

7.5.2 Contestation in Planning Practices

Planning practice is one of the most intense contestation areas, though it is not publicly well-known (when compared to market structure). In previous years, the power development plan was always based on EGAT’s least-cost utility planning in order to provide cheap and reliable electricity under the state monopoly discourse. It was the responsibility of experts and technocrats and did not involve any public participation. In this model, renewable energy was not considered an option and environmental, social, and health consequences did not form part of the analysis in the planning process. In Thailand, the consideration of all positive and negative consequences, i.e. impact assessment, is always limited at the level of each project approval process.

In the PDP 2004, when private monopoly became a dominant discourse in Thai power policy, the same process of power development was still used, but with some modifications. According to the private monopoly discourse, the cognitive pillar of planning has changed from cheap and reliable electricity to an expansion of business in order to become the national champion. This change has provided a great normative space for political visions and policy initiatives which are not limited by a least-cost analysis. However, system reliability is still a main norm in planning. While environmental aspects are not considered in the planning analysis, renewable energy has now become a part of the PDP, but as a politically determined option rather than a strategic option (as suggested in PDP-Renewables).

According to the power pool discourse, governmental or sectoral planning is less important, since, in this view, the market can decide the best options both in the short and in the long run. According to this discourse, renewable energy and environmental considerations mainly belong in an occasional subsidy program.

Table 7.13 Contestation of Different Policy Discourses in Planning Process and Practices

Policy Discourse	State Monopoly	Power Pool	Private Monopoly	Decentralization
Cognitive Pillar	Cheap and reliable electricity	Market Efficiency	Visionary national champion	- Cleaner power - Public accountability
Normative Pillar	- Reliability - Least-cost planning - Expert role	- Market can decide	- Political vision - System reliability	- Sustainability - Participation - Accountability
Regulative Pillar - Main Tool	Least-cost utility planning	- Market mechanism	Policy-led planning	Strategic impact assessment
Regulative Pillar - Main Actor	EGAT	Power Pool	Ministry of Energy	- Stakeholder and public participation
Regulative Pillar - Environmental and health aspects	Only at project level	Only at project level	Only at project level	As one of the goals in the power development plan
Regulative Pillar - Renewables' contribution	RE is not an option	RE can compete in the pool with special subsidy	RE is a politically-determined option	RE is a strategic option to consider

To support cleaner power, sustainable development, and more public participation and accountability, the decentralization discourse suggests a change in the planning process from political and expert domination to more stakeholder and public participation. Moreover, it should be a broad-based planning process with national sustainable development goals and targets as its main norms or points of consideration. To pursue this view, strategic environmental assessment is highly recommended in this discourse with environmental and health aspects as the main goals in the planning analysis. Last, to ensure the best possible future, all options should be considered and renewable energy should be highlighted as one of the strategic options of the Thai power sector.

7.5.3 Recent and Foreseeable Outcomes

The critiques of the PDP process have echoed since 1998, when the reserve margin was high and the conflict of two coal-fired power plant projects in Prachuab Kiri Khun was tense. In 1999, the Sustainable Energy Network proposed a PDP which aimed at integrating national development goals in the plan. However, no significant change has taken place yet. Although, in the PDP 2004, major modifications have been made and the general discourse has changed from state monopoly to private monopoly, this change is not clearly defined in the PDP document. It can be seen only through a detailed technical investigation.

During January-July 2005, the results of this study were presented in the policy forums, which showed the weak points of the existing PDP process and its consequences. These results have been publicly reported through the mass media. Although, in several points, the authorities later seemed to accept the critiques from the study (for example, of demand forecasting and unrealistic oil price assumption), the revising of the PDP 2004 has still been carried out behind closed doors. As public participation is still absent in the planning process, without strong public action (such as in the EGAT privatization case) the desirable planning practices are less likely to take place in the foreseeable future.

7.6 Environmental and Health Protection

Environmental and health concerns in Thailand's renewable development are mainly linked to biomass power plants, which represent more than 90% of the present renewable power generation. Concerns were raised after local villagers experienced a negative effect from the dust emission of one biomass power plant in the Chai-nat province in 2001. Later, during 2002-2003, several local protests against new biomass power plant projects emerged, when the government without notice introduced the 5 years subsidy bidding program. As a result of intense protests, some biomass power plants, which had received an initial approval for subsidy, did not receive this subsidy and were not able to develop further and finally, cancelled their projects.

7.6.1 Existing Problems and Government Solutions

During 2002-2003, Suphakij Nuntaworakarn[31] studied two local protests in Singha Buri and Nakorn Sawan and it was found that the problems had arisen due to the following conditions,

- **Improper Decision-making Process**. Detail decisions (including the type, fuel, capacity and location of the projects) were made through a bidding offer without public consultation. After the bidding process, the Energy Conservation Fund (En-Con Fund) required that each project should undergo public consultation, but all important designs (for example their locations and technologies) could not be changed due to the previous bidding commitment. Therefore, public participation in this case was less meaningful and pushed local people to fight for the cancellation of the projects.

- **Controversial Locations**. The locations of both projects were considered by the local people as unsuitable, because they were located very close to the villages and had to use the local infrastructure for the heavy transport of rice husk. A proposal for new locations was made by the local people, but later refused by both project owners and the En-Con Fund, because they were considered to be unfair to other bidding competitors.

- **Mistrust in Environmental Regulations.** The local protests clearly stress the mistrust of the existing environmental regulations. The local populations also faced environmental problems arising from the existing industrial projects in their area and these problems were not solved by the present environmental regulation mechanism. In other words, there is no mechanism which can guarantee that, if negative impacts arise, the power plant operation can be stopped and controlled.
- **Unbalanced Share of Benefits**. As rice husk is a by-product of rice milling, it belongs to the rice miller, not the local farmers. Therefore, the benefits of these projects to local people are quite limited. Although some development funds were proposed by project owners, they were considered to be compensation funds rather than profit sharing.
- **Lack of Deliberative Communication**. Most of the formal communication is a one-way process, from project owners and officers to local people, which create more tensions and mistrust among the population.

As part of the requirement for a final approval of the 5-year subsidy, the En-Con Fund and EPPO suggested the establishment of a tri-parties committee for each project, which should serve as the main mechanism for environmental and health regulation. The committee included members from the local communities, the power plant companies, and the related governmental institutions. The En-Con Fund and EPPO also offered an additional budget for environmental monitoring by the independent organization during the 5 years of subsidy. If environmental problems occur during these five years, the subsidy will be cut off.

Recently, a number of biomass power plants have registered their installed capacities as 9.9 MW, in order to avoid the EIA requirement (which starts from 10 MW) for their approval process. These attempts may aggravate the situation since they create mistrust in the local communities, who may be affected by the power generation, as recently seen in the case of the biomass power plant project in the Surin province.

7.6.2 Recent Experiences from the Tri-parties Committee

This study has looked closely into the recent experiences of the tri-parties committee in some selected cases in the collaboration with local researchers and the National Human Rights Commission. The results found that although the committee establishments provide more opportunities for a two-way communication, some important problems still remain and arise from the practical experiences, including;

- **Unbalanced capacities for accessing and analyzing environmental monitor information and for setting the agenda of the committee meeting**. Mostly, the information is supplied and the agendas of the meetings are determined by the power plant company. The local people face difficulties in scrutinizing the technical environmental information and searching for alternative information apart from the information provided by the company.
- **Limited Contributions from Governmental Organizations**. Since, to the government organizations, the three-part committee only represents an

extra work load without any specific mandates or additional resources, their participation is usually quite passive and, in some cases, the organizations are not represented at the regular committee meetings.

- **No Actual Legal Enforcement.** The central question is whether the committee is able to make any legal decision, as is has been created without the authority of any specific law. Fortunately, during the period of this study, there has been no case which required legal enforcement. Therefore, the effectiveness of this mechanism has not been tested.
- **Unclear Future after the First Five Years.** As one of main aims of the committee is to allow the biomass companies to achieve the subsidy support from the government, the future of the committee is certainly uncertain after the expiry of the 5-year subsidy period.
- **Only End-of-pipe Intervention.** Although the three-part mechanism provides some possibilities for local communities to participate in environmental regulations, it is still placed at the end of the project decision-making process. In fact, local people need to involve much earlier in the process, especially in the project design (such as locations and sizes) as well as in the project approval process (such as in EIA process).

7.6.3 Recent and Foreseeable Changes

After the government's cancellation of the EIA reform attempt in 2004, there has been no big change in the environmental regulation. The report of the study on the Tri-parties committee was formally submitted to the National Human Rights Commission (NHRC) in 2005 and later to the government. Although the NHRC and relating organizations, such as EPPO, have agreed upon the opportunities and limitations of tri-parties committee mechanism, the desired changes do not seem to take place. Basically, the changes (or improvements) are more likely to be implemented on a case-by-case basis.

For example, this study also involved local communities in the Surin provinces, who publicly presented their concerns over the 9.9 MW Biomass power plant project located near their communities in the study and consultation process. This provided an opportunity for them to learn from the previous experiences and consequently to enter in a better discussion with the project owners. As a result, although this project did not require an EIA (due to its size below 10 MW), an Initial Environmental Effects (IEE) study was requested by local people and later commissioned by the project owner in order to support the public consultation process. After the consultation, the monitoring committee was set up with the five parties involved, instead of three parties. The main idea is to involve the local NGOs and local university in order to support the local communities in more technical issues and discussions. In this sense, apart from participation, capacity building is a key for local communities to take more control over their environmental concerns.

7.7 Recommendations for supportive institutional frameworks and regulations

Based on the previous analysis, it is necessary to introduce supportive institutional framework and public regulations for the implementation of PDP-Renewables, as presented below.

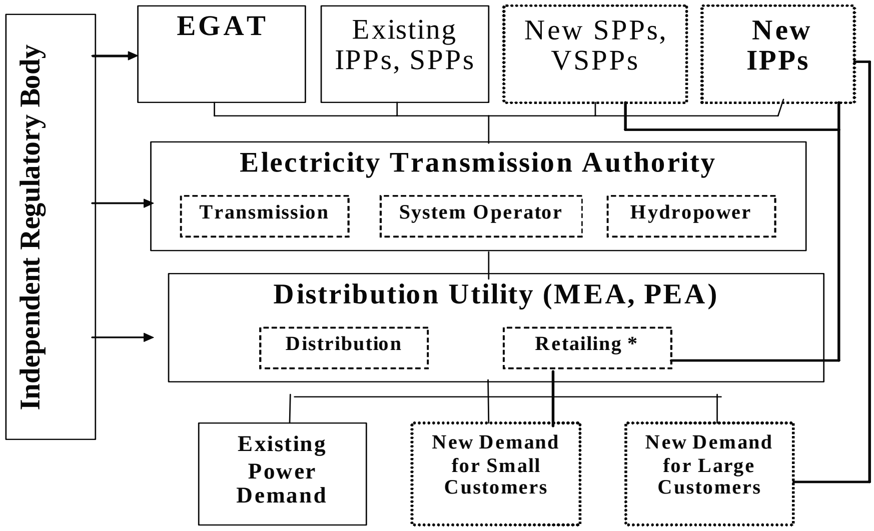
7.7.1 Decentralization Model

To support the increase of the renewable energy contribution, fair market conditions are required. Although the power market structure does not exclusively determine the fairness on the power market, it does strongly affect the attempts to create fair market conditions. The field experiences of renewable energy producers show the difficulties in dealing with authorized monopoly powers. Hence, both the state and the private monopoly discourses are much less desirable in the renewable perspective. At the same time, market mechanisms may lead to an abuse of the oligopolistic market power and an uncertain future for renewable energy innovations. Therefore, in this viewpoint, the decentralization model is more preferable to the renewable energy development.

Compared to the existing enhanced single buyer model, the decentralization promotes four main changes in the power market structure, as illustrated in Figure 7.7.

- Separation of generation and transmission (or unbundling) with the clear intention to provide a fair grid access to all power producers, including EGAT.
- The first suggestion leads to the establishment of a new public transmission authority, which takes full responsibility for transmission management, system operations, and hydro power operations, while EGAT will concentrate only on the generation business.
- The introduction of retailing business, which gives local communities or administrative organizations or other green market initiatives the right to organize and conduct power retailing services for their communities, while PEA and MEA will provide a distribution system but not hold monopoly power (as they do now). This suggestion gives large consumers the possibility of collaborating directly with IPPs and SPPs to secure their electricity needs and the creation of green power retailers for some specific markets (like the tourist business and some offices).
- The establishment of an independent regulatory body with the adequate authorities and capacities and an appropriate decision-making process (including public participation and transparency practices) is necessary to ensure the fairness of deals and operations on the power market and also provide an institutional space for public deliberation of institutional and public regulation issues. The most ambitious plan is to create local power markets, operating within the grid facilities and supports, and connected to the local energy plan.

Figure 7.7 Decentralization Model



***Local communities/administrative org. and green market initiatives can have right for power retailing services, while PEA and MEA will provide distribution system but not hold the monopoly power in retailing (as they do now)**

Source: NESAC, 2004[32].

7.7.2 New Governance Structure

Apart from the market structure, the governance structure is also crucial, since it determines the roles and responsibilities of each actor and their interaction with each other. Although governance structure is a complicated issue, four main principles can be identified, as shown in Table 7.14;

- The distinction of policy, regulation, and operation roles must be clearly made. The conflict of roles (which normally lead to conflicts of interest) should be avoided.
- The Ministry of Energy must play a key role in policy and planning, while five state-owned enterprises must take part in formulating an investment plan to ensure the quality of service needed. However, the regulator is also required to play a main role in avoiding unnecessary investment which may lead to an economic burden for the consumers.
- All regulation should principally be the responsibility of an independent regulator, including technical standard setting and approval or licensing mechanisms. Certainly, with their expertise and responsibilities for the grid, all state-owned enterprises and the Ministry of energy should take part in the regulatory process as main stakeholders.
- All state-owned enterprises; namely EGAT, PEA, MEA, and the proposed Electricity Transmission Authority (ETA), should concentrate mainly on their operation roles. They should be monitored by the independent regulator, especially in system operating, in order to ensure fairness for all stakeholders.

Table 7.14 Recommended Governance Structure for the Thai Power Sector

	MoEn.	EGAT	ETA	PEA	MEA	Regulator
Policy Roles						
Fuel Mix	●	●				
Investment Plan	●	●	●	●	●	●
Social Policy	●					○
Regulation Roles						
Electricity tariff	○	○	○	○	○	●
Demand forecasting	○	○	○	○	○	●
Technical Standard	○	○	○	○	○	●
Approval&Licensing	○	○	○	○	○	●
Operational Roles						
Generation		●				○
Transmission			●			○
System Operator			●			○
Distribution				●	●	○

Note: ● represents the major roles and ○ represents the minor roles.

Source: Adapted from NESAC, 2004[33].

7.7.3 Effective Pricing Schemes

To support the development of renewable energy in PDP-Renewables, fair and certain market conditions are necessary. On the basis of the previous discussions of pricing regulation, Table 7.15 presents overall policy recommendations.

For non-firm SPPs, the major issue is the change from firm and non-firm criteria to "on-peak and off-peak" basis. This change is implemented in order for the SPPs to better represent the contribution of renewable energy based on their capacities and responding to the actual demand. These "on-peak" and "off-peak" should be based on EGAT's wholesale price, as they will sell electricity to the Electricity Transmission Authority (ETA) in the newly proposed structure. Specific contracts for load management in critical periods (like summer) and grid stability for some areas can be made with an additional reward. All these changes will provide the non-firm SPPs with incentives for higher investment and greater responsibility in load management and grid stability.

The firm SPPs have two choices; namely the continuation of existing contracts (as they already receive higher prices) or the change to an "on-peak and off-peak" basis (as suggested for non-firm SPPs) with a specific agreement (and additional payment) for firm load availability in critical periods.

Today, the energy payment to firm and non-firm SPPs is based on the natural gas price, which is sharply increasing during these years. Although, at this moment, this reference can provide windfall benefits to all SPPs, in the longer term, it may offset the benefit of renewable energy in reducing fossil-fuel price fluctuations. At the same time, it can be a risk for renewable energy producers if the situation changes. Therefore, the series of different fuel prices (including some biomass resources) is suggested to reduce the burden of price fluctuations both for SPPs and for Thai economy in general.

Table 7.15 Policy Recommendations for Pricing Regulations

Schemes/ Principles	Policy Recommendations
Firm SPPs	- Continuation of existing contracts or changing to "on-peak and off-peak" basis with specific agreement for firm load availability in critical periods - Change the reference energy payment from "gas" to the series of different fuel prices.
Non-firm SPPs	- Change to "on-peak and off-peak" basis - Based on the EGAT wholesale price (as they will sell to ETA) - Specific contract for load management in critical periods (like summer) and grid stability for some areas - Change the reference energy payment from "gas" and "fuel oil" to the series of different fuel prices.
VSPPs	- Scope expansion from 1 MW to 10 MW
Feed-in tariff	Feed-in tariffs for specific technologies (like PV, Wind) with varied rates based on technological development and resources
Internalization of positive externalities	- Reasonable subsidy based on externality values should be integrated or added into the above-mentioned pricing schemes - Reviewed and adjusted with appropriate timing

For VSPPs, the existing pricing mechanism is quite appropriate. Therefore, the policy recommendation is to expand its scope to cover up to 10 MW of the capacity sold to the grid.

Since the premium for positive externality in renewable generation is not provided for existing SPP and VSPP schemes, it is necessary to integrate reasonable subsidy based on externality values into the above-mentioned pricing schemes.

For presently expensive technologies in Thailand, such as PV and Wind, a feed-in tariff (or REFIT) mechanism is highly suggested. In comparison to the RPS scheme, the REFIT provides more open and stable market conditions for renewable energy development. International experiences also confirm the superiority of REFIT in policy effectiveness. Last, in PDP-Renewables, in which most new fossil fuel power plants are planned to be avoided, the Thai RPS scheme cannot promote faster renewable energy contribution as planned in PDP-Renewables.

7.7.4 Grid Access and Interconnection

As previously analyzed, the problems of grid access and interconnection are related to inappropriate market and governance structures. The proposed changes in both structures, may, therefore, facilitate improvements of grid access and interconnection issues. Among the overall structural changes, the role of the interim regulator, the separation of transmission and the introduction of retailing distributors may provide better conditions for grid access and interconnection. More specifically, the following recommendations are made to improve access and interconnection;

- The establishment of the Independent Technical Standard Organization (ITSO) for reviewing and revising rules, regulations, and technical standards, as well as facilitating the development of knowledge and technologies, regarding interconnections and grid stability

- The promotion of the principle of joint responsibility in the investment in interconnection and grid upgrading.
- The introduction of an upward and downward regulatory market, instead of charges and penalty, to stimulate SPPs in supporting grid management and stability
- The reopening of fair non-renewable co-generation access as one of the options in the power development plan.

With the proposed pricing regulations, all these recommendations will stimulate more renewable energy generation and increase its contribution to the Thai power system. More specifically, they will also upgrade part of the non-firm SPPs to dependable capacity (as required in power development planning). At the same time, they will strengthen the load management and grid stability.

7.7.5 New Planning Practices

To support the increased contribution of renewable energy, as suggested in PDP-Renewables, these following practices are highly recommended,

- A broader focus on national development goals and targets is required in order to realize and internalize the benefits of renewable energy in the planning process, as well as to follow a future direction towards more sustainable energy.
- All options must be opened and critically analyzed. Therefore, renewable energy has to be recognized as a strategic option in the long-term power development plan rather than a marginalized option.
- To understand the overall consequences of different policy options, strategic impact assessment should be applied to all important aspects of sustainable development together with national development goals and targets.
- To ensure the validity and appropriateness of the PDP, more systematic public participation (consultation, option identification, technical and public reviews) is needed.
- Since the future is uncertain, the proper planning process and practice should clearly specify corrective and accountable mechanisms, which will dynamically guide the planning into a sustainable future under realistic conditions.

7.7.6 Supporting DSM and green power retailing businesses

Apart from renewable energy and revised demand forecasting, Demand Side Management also plays an important role in PDP-Renewables. Thailand has an impressive experience in implementing DSM after 1992, which can now claim for 900 MW of the power demand reduction achieved. However, to reach a higher level of DSM potential, as suggested in PDP-Renewables, the following recommendations are useful,

- Introducing the "Negawatt" market for energy efficiency service companies and organizations (ESCO), which allows them to earn profits by reducing the power peak demand.
- Reinforcing the mechanisms under the 1992 Energy Conservation Law to ensure higher utilization of energy efficiency potentials.
- Strengthening the ESCO capacities in order to provide better and broader services for power customers.

7.7.7 Participatory Environmental and Health Protection Mechanism

Although, PDP-Renewables is part of environmental and health protection in itself due to its lower negative impacts on health and environment, renewable energy generation can have some negative environmental and health impacts, especially in the case of biomass power plants. Therefore, a better protection mechanism is needed. This better protection mechanism will not only lead to healthier outcomes of renewable power generation but also better co-operation and trust-worthiness in local communities, which is an indispensable factor for sustainable energy development. Based on the experiences, analyses, and consultations during the study, five key areas must be discussed and improved in order to develop a better protection mechanism;

- Public participation, especially in local communities, must be developed at the starting point and not at the end of the process. Thus, any future policy designs and interventions, such as RPS or Feed-in tariff mechanisms, should be aware of this principle in order to avoid the inappropriate policy process, as earlier seen in the 5-year subsidy program.
- The EIA process must be changed in order to allow more public participation and inputs to play significant roles in the project approval process. It is also necessary for all biomass power plants to produce an Initial Environmental Effects report, before assessing the necessity of a full EIA study.
- To ensure the tri-parties committee and other protection mechanisms, it is necessary to strengthen the capacity of local communities. In the short run, the active involvement of local NGOs and universities (or research institutes) may be useful, but, in the longer term, better public understanding, appropriate tools for local environmental regulations, and more systematic supports from governmental organization must be developed.
- Apart from the local capacity, an effective legal enforcement is also required. If the tri-parties committee wishes to implement an effective environmental regulation, it must found its legal locations or concrete

connections on a strong legal basis. In other countries, licensing for power producers is an influential legal tool, but, in Thailand, the interim regulator does not have the authority to license, and the licensing criteria do normally not consider environmental aspects an important issue.

- The attempt of the Ministry of Energy to develop local, provincial, and regional energy plans during 2004-2006 may also form a good platform for a better environmental protection mechanism. In principle, this participatory planning can be the first place, where local environmental concerns and renewable energy potentials can be matched, discussed, and become increasingly aware of each other. Concurrently, through this process, public awareness and understanding can be improved and, hopefully, capacity can be strengthened.

7.8 Cognitive and Normative Battlefield

Unsurprisingly, to support the development of PDP-Renewables, most recommendations for institutional frameworks and regulations are principally based on the decentralization model, as PDP-Renewables itself also develops from this discourse.

However, in practice, all these recommendations cannot easily lead to real institutional changes, due to the intense contestation of all policy discourses and the domination of other discourses. As already explained in this chapter, the contestation of the four policy discourses is based on different cognitive and normative pillars. In other words, the ways in which they realize and understand the problems and targets of the Thai power system, as well as the main criteria for decision-making with regard to institutions and regulations, differ from one another. As different objectives and criteria are applied to the policy discussions, it is hard to solve or provide final answers by conducting a single technical analysis.

In the future, the contestation and argumentation of cognitive and normative pillars from different discourses will probably pave the way for institutional and regulation changes, supported by a sound regulative pillar and technical analysis. In other words, PDP-Renewables will hardly give rise to an effective policy solution with a supportive institutional ground, without implementing cognitive and normative changes towards fairer access, cleaner power, and higher accountability.

Therefore, although we always discuss and debate the regulative pillar (such as REFIT vs. RPS), the real battlefield for future institutional directions is composed by the cognitive and normative contestations.

7.8.1 Six Decisive Battlefields

On the basis of the analysis in this and previous chapters, five decisive battlefields of cognitive and normative contestations can be identified. These battlefields are crucial to the establishment or the change of institutional and regulation frameworks required to support the further development of PDP-Renewables, as described below,

- *Renewable energy is a competitive option*. To really put renewables on the planning agenda as one of the strategic options, stakeholders and the Thai public must be convinced that renewable energy with DSM is in fact a cheaper and viable option if take into consideration the over-investment, the fuel price risks and the negative externalities of the existing system, as shown in Chapter 6.
- Apart from the excessive costs of some renewable technologies, *the main obstacle to renewable energy development in Thailand is an unfair market power*. Therefore, it is important to acknowledge that fairness is a necessary condition for efficiency and accountability and must be rooted in all aspects of institutional and public regulation in the Thai power sector.
- *Renewable energy can strengthen the system reliability and grid stability*. With their resources and locations and proper mechanisms and incentives for better integration, renewable energy can help the ISO/utilities with load management and grid stability in critical times and areas, rather than constituting an extra burden to system management.

- *Innovation requires supportive environments and investment co-operation, not only competition*. To facilitate domestic renewable energy innovation, firm and fair incentives and collaborations in research and development are needed. Competition alone cannot lead to innovation, as cheaper solutions and imported technologies can easily kill or prohibit future innovation.
- *Renewable energy is a long-term strategy for sustainable development*. Apart from generating economic competitiveness, the investment in renewable energy will lead to better strategic impacts in all aspects of sustainable development, as shown in Chapter 6. Therefore, the formal planning practices in the Thai power sector must be changed in order to realize the broader and long-term benefits of renewable energy.
- *Renewable energy provides more space for public participation, control and accountability in the Thai power sector*. To highlight the real advantage of the "decentralization" model, it is essential to show how this model reduces the "centralized" power relation and provides more opportunities and better mechanisms for the Thai public to gain more benefits from power generation and assume more control over power generation and the power sector at both local and national levels.

If the evidence, experiences and understandings in these six areas can be developed, the cognitive and normative contestations, as well as the public deliberation in the Thai power sector, will gradually increase the support to the decentralization model and renewable energy development

7.8.2 Five Main Strategies

Although cognitive and normative pillars are highlighted in this study, it does not mean that everything is based on the contestation of ideas, world views, and values. Certainly, all cognitive and normative contestations require concrete experiences, reference practices, or sound analysis back-up. At the same time, these concrete experiences and practices must be discussed with the public in a way that can lead to a new (or better) understanding of how different perspectives and different normative criteria can lead to new practices. Therefore, to convince or achieve the understanding and support from stakeholders and the Thai public, five main strategies are highly recommended;.

- **Development of concrete experiences, reference practices and sound analysis on these six decisive points**. Certainly, this study mainly deals with the first and fifth of the battlefields mentioned above, through strategic impact analysis. Other areas still require more concrete or systematic studies and suggestions, especially in terms of fair access of renewable energy producers, the contributions to grid stability, and the governance system which allows Thai people to increasingly participate in and gain control of the Thai power sector.
- **Introduction of Effective Regulations**. Although the battlefields are basically on the cognitive and normative side, the regulative pillars are always the more visible ones in public debates or discussions. Therefore, the formulation and introduction of effective regulations

must be carefully done, requiring, in some cases, detailed technical analysis.

- **Capacity Strengthening**. The Thai power sector is continuously involving more actors; thus, good rules and norms are not sufficient to carry out the radical changes, though they can certainly trigger them. Knowledge, skills, and capacities need to be improved and developed in order to run this decentralization system. However, the absence of required knowledge, skills, and capacities should not be used for postponing the decision and direct it towards a better policy direction. Rather, the capacity strengthening should be strategically built into the policy package within the desired institutional and regulative changes.

- **Policy Communication.** As already mentioned, a wider public understanding and support is crucial to the desired policy and institutional change. Therefore, it is important to make the cognitive, normative bases of the specific regulative pillars obvious to public deliberation. To enrich the deliberation, alternative practices, experiences, and references, as earlier discussed, are very useful. It is also essential to bring the communication and responses back into the formal policy process in order to influence policy changes

- **Political Opportunities.** In highly controversial and conflicting issues, like those of the Thai power sector, we should not expect that every public deliberation process will end up with consensus. In many cases, it is also good for society to learn directly from the experiences. Therefore, it is also necessary to find political opportunities for desirable institutional changes in long-lasting disagreements in order to practice and test them in the real world. With the following careful evaluation, this can be one of the good steps to take in the long-term social learning process in the power policy arena.

7.9 Conclusion

Obviously, the analysis in this chapter shows that most of the institutional frameworks required or recommended for developing PDP-Renewables are not yet present. In other words, PDP-Renewables cannot automatically develop into reality by itself, without significant institutional changes. This result should not lead to the conclusion that PDP-Renewables is not institutionally possible. From previous and recent experiences it can be seen that renewable energy development in Thailand has always looked for a small space to grow with an overall impressive rate, rather than waiting for the complete set of preferable institutions to develop.

The analysis in this study suggests that, with the experiences of the impressive growth of renewable energy and the future potentials for a sustainable and healthier society in mind, PDP-Renewables and its decentralization discourse should be ready to challenge the existing cognitive and normative pillars of the previously dominated discourses. Furthermore, PDP-Renewables must challenge the existing framework in order to establish better an institutional framework and better regulations in the Thai power sector. Only by contesting these cognitive and normative battlefields with the support of a sound regulative pillar and firm practices and knowledge, the desirable long-term institutional changes can take place and ensure the future of PDP-Renewables through better and broader public understanding and support.

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Chapter 8

Policy Results and Reflections

This chapter will present the study's results, reflections and perspective. First, the main analytical results from the previous chapters will be summarized. Then, as the outcomes of the three-year interaction between research and policy processes, the main policy results will be reported. As a result of changed and unchanged policy outcomes within these three years, reflections on healthy public policy through this study will be made.

8.1 Main Policy Results

As one of the objectives of this study is to participate directly in healthy policy and learn from this direct experience, it is very important to summarize the influences or impacts of this study on the policy changes during the three years of study. The main aim of this part is to identify the exclusive contributions of this research attempt, but rather to show how the study participates in the policy processes and how expected and unexpected changes have taken place, seen in relation to the promotion of healthy public policy in the Thai power sector.

8.1.1 Policy Actions in This Study

Table 8.1 presents the timeline of research actions together with the actions and responses from governmental institutes and NGOs (or civil society groups). It is a detailed historical note of three years attempts to promote healthy public policy in the Thai power sector.

Table 8.1 Timeline of Actions and Responses from Governmental and Non-governmental Organizations and from the Study Process

Timeline	Governmental Actions /Responses	NGOs/Civil society Actions/Responses	Actions from the Study
August 2003	Launched the National Energy Strategy with the target of 6% renewables in power generation and introduced the RPS mechanism		
September 2003			The study began
December 2003	Announced the Enhanced Single Buyer Model as the main structure of the power sector and privatization		
January 2004	Announced the EGAT privatization plan	Publicly predicted that the government will increase the tariff before privatization	The article on privatization policy was presented in Thai newspaper
February 2004	Public hearing process for privatization	Organized policy forums on the privatization process	
March 2004	Postponed the EGAT privatization process and called for option study	Big protests organized against the EGAT privatization	
May 2004	EGAT sent the PDP2004 for approval		The article on conflicts between EGAT's PDP and the government's renewable target presented

Table 8.1 (continued)

Timeline	Governmental Actions /Responses	NGOs/Civil society Actions/Responses	Actions from the Study
June 2004	Senate call for public hearing on the EGAT privatization	- NESAC presented alternative power structure - First criticism of the RPS mechanism	Structure of Monopoly chain quoted by NESAC
July 2004	The PDP was in the approval process	NESAC presented the Alternative PDP	The article on the end of cheap oil presented in Thai Magazine
September 2004	The PDP 2004 was approved		The article on comparison between feed-in tariff and RPS presented in Thai Magazine
December 2004	The EGAT privatization plan was discussed within EGAT		The article on 4 years policy evaluation presented to the public before an election
January 2005	EGAT organized Coal –trans Conference to support Coal technology	Organized No-coal forums and campaign during Coal-trans conference	- The preliminary results of the strategic impact analysis of three PDP options presented in the No-coal forum - Sustainable Energy trip in the North of Thailand
February 2005	The Thaksin Government won landslide election		- Sustainable Energy trip and policy workshop in the North-eastern Thailand - The preliminary results of the Strategic impact analysis of three PDP options were reported in Thai and English Newspapers
March 2005	The EGAT Privatization plan started again with the same proposal plus a 50% share of EGAT of new power plants	Organized forums to criticize the privatization plan	- The analysis on the effect of the privatization plan on renewable energy was presented
April 2005	The RPS Regulation was drafted by DEDE	Sustainable Energy Fair organized by ATA	- The study on the governance structure of renewable energy projects began with the consultation process with local communities and researchers
May 2005	EPPO comments on the RPS mechanism and suggest for feed-in tariff		- Joint research on electricity governance in Thailand with other NGOs and research organizations was planned.
June 2005	- Final Cabinet approval of the EGAT Privatization	- Local communities in Surin reached an agreement with new biomass power plants to set up the three-part committee in environmental regulation.	- Sustainable energy fair in Chiang Mai - Sustainable Energy trip and policy workshop in the Southern Thailand - Study on the governance structure of renewable energy projects was presented to NHRC

Table 8.1 (continued)

Timeline	Governmental Actions /Responses	NGOs/Civil society Actions/Responses	Actions from the Study
July 2005	- EGAT denied to revise the PDP2004 and request the regulator to take responsibility in the PDP revising	- NESAC called for the revision of the PDP 2004 - NESAC called for the reconsideration of the RPS mechanism - FTI presented the common concerns on the single buyer model and the RPS mechanism. - NGOs called for feed-in tariff rather than RPS.	- The preliminary results of the Strategic impact analysis of three PDP options were presented in the National Health Assembly - Organized three policy workshops on the Power Development Plan in Energy Crisis, Renewable Energy Policy Strategy, and Governance structure - Outcomes of policy workshops were widely reported by Thai newspapers - Publicly launched the joint research on electricity governance in Thailand, focus on the EGAT privatization process
August 2005	MoEn announced the postponement of the IPP bidding due to lower demand growth	-Predicted that government would raise the tariff before selling the EGAT share on the stock market	- Public seminar on regulatory body and process
September 2005	- Proposal for tariff raising was sent for approval	- Protests against tariff raising started - FTI set up the renewable energy industrial group	
October 2005	- The government declined the tariff raising proposal - MoEn announced for the revising of the PDP due to lower demand growth	Protests against the EGAT privatization started	
November 2005	The Administrative court accepted the case and called for the postponement of the EGAT share distribution in SET during court consideration	CCO brought the EGAT privatization case to Administrative Court and asked for cancellation due to unlawful process	- Preliminary results of Electricity Governance research show the poor governance in the EGAT privatization process - Cases from sustainable energy trips reported in Thai Magazine
December 2005	MoEn set up the first interim regulator		
January 2006	The interim regulator announced the revision of PDP	- Public inputs to the court consideration process	
February 2006	- The government dissolved the parliament and called for early election - EGAT organized the APEC clean coal conference	- Big protests against PM Thaksin	- The final results of the Electricity Governance research were publicly presented to show the poor governance in the EGAT privatization process - The final results of the strategic impact analysis of three PDP options were presented in Thai news

Table 8.1 (continued)

Timeline	Governmental Actions /Responses	NGOs/Civil society Actions/Responses	Actions from the Study
March 2006	- EGAT announced the plan to buy more electricity from biomass and launched the DSM campaign during the peak period - Administrative court made the decision to cancel the EGAT privatization process due to its unlawful process - EGAT announced the revising of the investment plan due to the cancellation of the EGAT privatization		- The final results of the Strategic impact analysis of three PDP options were presented in Thai Magazine
April 2006	- DEDE announced the feed-in tariff mechanism in collaboration with FTI - New load forecast was announced with lower demand prediction		
May 2006	- EGAT started the PDP2006 process		
July 2006	- IAEA and the Office for Atomic Energy for Peace organized public seminars to promote nuclear energy - MoEn advertised coal-fired power plants as an alternative energy		Overall policy recommendations from the study were publicly announced
August 2006	The Democrats, i.e. the largest opponent party, announced an energy policy for the new election which was similar to the policy recommendations presented in this study		Final study results and policy recommendations were presented to NESAC, the interim regulator, Public Forums, and TV broadcasting programs
September 2006			The study was finished

From the table, it can be seen that the relationship between most of the policy participations is not linear. Several policy issues have been interrelated and have required time for changes. The main policy strategy of this research study is to pass through the more influential voices of NGOs and civil society, rather than only submitting or presenting the results to government authorities.

The research actions took place more often during January-July 2005, when the preliminary results of the study were published and the research works were still based in Thailand. Especially in July 2005, three policy workshops were organized and widely reported in Thai mass media. Then, from the end of 2005 until the middle of 2006, policy changes were gradually seen. Many of them did not occur due to consensus in Thai society, but rather on the basis of decisions made by other supreme organizations, strong public actions, and inevitable facts.

8.1.2 Recent Policy Changes

Table 8.2 summarizes the latest policy situation in the Thai power sector. From the table, it is clear that some desirable changes, according to a healthy public policy standpoint, are now taking place. For example, the revising of the PDP with lower demand growth, as suggested in Chapter 6, is now taking place. The privatization of EGAT under the Enhanced Single Buyer model has been cancelled, since March 2006. The Thai government also tends to agree in the effectiveness of the feed-in tariff mechanism in supporting renewable energy development.

However, within these three years, some policy issues do not support PDP-Renewables as a healthy public policy option. Obviously, although the existing PDP2004 is now revised, the new PDP2006 process is not yet publicly opened and integrated with broader national sustainable development goals, as suggested in this study. Concurrently, though the privatization process is stopped, the monopoly chain of power still remains. Although PDP-Renewables does not yet receive any strong objection or criticism, PDP-Renewables is less likely to become the mainstream (or formal) power development plan in the near future. Therefore, both PDP-Renewables and the supportive institutional framework as suggested in Chapter 7 are still uncertain aims for the future.

8.1.3 Case Studies of Policy Changes

To elaborate on these changed (and unchanged) processes, three policy case studies will be summarized. These cases include three main policy decisions related to this study; namely the EGAT privatization, the PDP revision, and the introduction of the feed-in tariff instead of the RPS mechanism.

Table 8.2 Summary of Policy Recommendations from the Study, Initial Responses from the Authorities and Latest Policy Situations in the Thai Power Sector until September 2006

Recommendations	Initial Responses from the Authorities	Latest Situations
On Strategic Impact Assessment Results		
1. Revising demand forecasting (January 2005)	EGAT denied to revise the PDP2004 (July 2005)	MoEn and the interim regulator revised demand forecasting due to lower demand growth (April 2006)
2. More DSM investment	No direct response	EGAT announced the plan for more DSM during peak period in summer (March 2006)
3. More renewable energy investment	No direct response	No positive or negative signs
4. PDP-Renewables is a healthier option	No direct response	No positive or negative signs
5. PDP-Renewables is an economically viable option	The government asserted that Renewables are still expensive (August 2005, July 2006)	No positive or negative signs
6. PDP-Coal has the most negative impacts in a health perspective	EGAT organized the APEC clean coal conference (February 2006)	EGAT introduced more coal-fired power plants in the PDP2006 (May 2006)
On Purposed Institutional Framework and Regulations		
7. The Enhanced Single Buyer Model and the EGAT privatization are not compatible with PDP-Renewables	The government was strict with the ESB model and the EGAT privatization plan	Administrative Court cancelled the EGAT privatization due to unlawful process (March 2006)
8. Introduction of the Decentralization model	The government was strict with the ESB model	No positive signs, the government still worked with the ESB model (March 2006)
9. Clear division of roles in governance structure	No direct response	Interim regulator was set up in December 2005 but without clear authorities or autonomy
10. Changes from Firm and Non-firm SPPs to on-peak and off-peak basis	No direct response	No positive signs
11. Expanding scope for VSPPs from 1 MW to 6 or 10 MW	EPPO took earlier action in expanding the scope for VSPPs	Expanding the scope for VSPPs is still in the process (August 2006)
12. Changes from RPS to feed-in tariff	No direct response	DEDE announced the introduction of the feed-in tariff mechanism in collaboration with FTI (April 2006)
13. Improvement in Grid Access and Interconnection	No direct response	- No positive signs - The interim regulator will take it into consideration soon (August 2006)
14. New practices in the PDP process with broader national objectives and more public participation	No direct response	The PDP2006 is on-going without clear changes or public participation (August 2006)
15. Participatory process in environmental regulation and the governance structure of renewable energy development	-EPPO agreed and continued the work on the Three-part committee - The EIA reform has been stopped since 2003	No positive or negative signs

Note: Timing in parenthesis is the latest information updated in each point.

a) Case I: the EGAT Privatization Process

The EGAT privatization has been one of the most controversial issues in the Thai power sector for almost two decades. The EGAT privatization policy has passed through different political and economic conditions with different privatization models, as presented in Chapter 4. The last attempt by the Thaksin government was based on the private monopoly discourse or the so-called Enhanced Single Buyer model.

The EGAT privatization process is very important to this study, since the monopoly power already leads to unfair market conditions and regulations for renewable power generation, as shown in Chapter 7. Moving towards a private monopoly model with state authority power will certainly worsen the situation and make it more difficult to change it, due to its conflicts of roles and interests.

In January 2004, this study presented an article in a Thai newspaper on the problems of the EGAT privatization in the private monopoly model. Later, during February-March 2004, public forums and protests against the EGAT privatization plan were organized and expanded. In March 2004, the Thaksin government decided to postpone the privatization plan until the new general election in 2005.

After the postponement, the National Economic and Social Advisory Council (NESAC) tried to present an alternative model for the Thai power sector. In May 2004, the study presented the foreseeable conflicts between EGAT's PDP (based on the private monopoly discourse) and the government's target of promoting renewable energy. This contradiction between centralized monopoly power and distributed power generation led to the introduction of the decentralization model by NESAC and this study.

However, in the beginning of 2005, due to the election season and the landslide election victory of the Thaksin government, the EGAT privatization was out of public attention. While public attention was rather weak, the Thaksin government succeeded in reaching an agreement with EGAT executives in protecting the EGAT 50% market share (not including EGAT subsidiaries) and with EGAT employees in providing salary increases and special quota for the EGAT share at a low price. Without any public consultations or hearings, in June 2005, the Thai government announced the completion of the EGAT privatization process.

The study used the EGAT privatization process as a case in analyzing the governance structure of the Thai power sector in May 2005. The electricity governance assessment was carried out in collaboration between Thai research institutes and NGOs (namely the Health Systems Research Institute, the Thai Environment Institute, King Prachadhipok's Institute, Palangthai, and the Confederation for Consumer Organizations) and the World Resource Institute and Prayas Energy Group. The study was publicly launched in July 2005 and the preliminary results were presented in November 2005. The study clearly showed problematic governance structures and practices in the privatization process, especially in terms of the decision-making and the regulatory processes.

Concurrently, in August 2005, Palangthai and other civic groups predicted that the government's decision of raising tariffs would be made before EGAT's listing on the stock market in order to make EGAT's stock more attractive to investors. Later, in September-October 2005, CCO and other civic organizations initiated a strong protest against the tariff raising and the EGAT privatization. After the preliminary results of the study were publicly presented, FCO brought this case to the supreme administrative court and asked for urgent protection.

In November 2005, the supreme administrative court had made the decision to postpone the EGAT privatization for court consideration, just one day before EGAT's offering in the stock exchange.

To offset one of the main critiques from the study and the civic protests, the Thaksin government set up an interim regulator in December 2005. Although the role and authority of the interim regulator is unclear and quite limited, it can be recognized as the first step in reducing the unbalanced power in the Thai power sector.

In February 2006, the final electricity governance assessment was publicly presented and confirmed the poor governance in the EGAT privatization process. Later, in March 2006, the supreme administrative court announced that the EGAT privatization process was unlawful and, therefore, had to be cancelled. EGAT is now back in the state monopoly model.

b) Case II: The Revision of EGAT's PDP 2004

In promoting healthy public policy, the revision or reformulation of EGAT's PDP2004 towards a more realistic demand forecasting, more energy efficiency and increased renewable energy constitute the core of the analysis and policy recommendations of this study. This analysis applies strategic impact assessment to the comparison of ongoing competing policy options; namely the formal PDP option (PDP-Gas), the option preferred by EGAT (PDP-Coal), and the alternative PDP option suggested for the first time by NESAC (PDP-Renewables).

The first preliminary results of this assessment were firstly presented at the People's "No Coal Forum" in January 2005. Then, they were presented at three other regional policy workshops, in connection with sustainable energy trips and the sustainable energy fair (in Chiang Mai) during February-June 2005. The workshops and trips were helpful in assisting local participants and mass media to realize and analyze renewable energy potentials and their positive impacts in comparison with other PDP options. Later, three policy workshops were organized for national policy discussions in July 2005. One of these three workshops dealt directly with the PDP planning process and issues. The preliminary results of this study together with the case findings from sustainable energy trips were well reported in the mass media.

Although several weak points in the existing PDP were clearly pointed out (e.g. the overestimation of demand or the extreme low oil price assumption) and the advantages of PDP-Renewables were highlighted, the first response from the authorities shortly after the workshop was that EGAT denied to revise its PDP since it was implemented for a period of two years and suggested the interim regulator, which was not established at that time, to take care of this job. However, in August 2005, the Ministry of Energy announced the postponement of the IPP bidding round (which was mentioned in the PDP2004) and, later, declared the need for PDP-revising due to slower national economic growth and lower electricity demand growth than previously assumed and expected. After the establishment in December 2005, the interim regulator also announced the revision of the PDP for the same reason. In April 2006, the interim regulator announced the new demand forecast of 38,241 MW in 2016, or a reduction of 5,317 MW compared to the previous demand forecasting. This was quite close to the suggestion of PDP-Renewables of reducing the peak demand by 6,421 MW.

In May 2006, EGAT began its PDP process again, now referred to as the PDP2006, after the revision of the demand forecasting. Today, it seems that the PDP2006 process is still not open to public participation and discussion. The recommendations for a broader focus on national sustainable development goals and targets and more strategic environmental impact considerations are also less likely to be incorporated in the PDP2006.

Therefore, although the PDP2004 with its fault assumptions was not prolonged, as pointed out by this study, the new planning practices, as suggested in the previous chapter, are not likely to be implemented in the new PDP process.

c) Case III: Moving Towards Feed-in Tariff

As mentioned earlier, among other things, pricing regulation is one of the most crucial institutional factors for the success of renewable development. In Thailand, the most controversial issue in pricing regulation during the study period is the contest between the Thai Renewable Portfolio Standard and the feed-in tariff mechanisms.

In August 2003, one month before this study began, the Thai government announced the decision to use the RPS mechanism as a main policy instrument in reaching the 6% renewable energy target in 2011, without any public consultation. As explained in Chapter 7, some modifications were later made to the Thai RPS version, which gave rise to an increased uncertainty among the renewable energy producers, who were placed in a subordinated position. Great concerns over the inferiority of the RPS mechanism have been raised in academic forums since 2004, though these concerns have never been widely reported to the Thai public.

In May 2004, for the first time, this study stated that the Thai RPS mechanism would, at most, only lead to a renewable contribution of 2% and not 6% as targeted. Later, in September 2004, the comparison between the RPS mechanism and the feed-in tariff, including the extra problems with the Thai RPS version, was presented in the Thai Magazine. During the policy workshops in 2005, both at regional and national levels, this pricing regulation was seriously discussed. Almost all participants agreed that the feed-in tariff is much more suitable for supporting renewable development. In July 2005, the Federation of Thai Industry also stressed in the workshops that they preferred the feed-in tariff mechanism.

Apart from the effort of this study, several academic attempts have been made to support the feed-in tariff. The Energy for Environment Foundation (in 2004) and the Joint Graduated School on Energy and Environment (in 2005) presented a review study and a detailed analysis on pricing regulations. Both of them recommended the feed-in tariff instead of the RPS. In the first half of 2005, the Energy Policy and Planning Office also recommended the feed-in tariff and, at the same time, pointed out the serious problems related to the Thai RPS version. Later, in 2005, FTI also conducted an in-depth study to identify the suitable level of the feed-in tariff rate and presented a policy proposal based on the feed-in tariff. However, in general, the Thai public has not received much information on this policy issue.

Thus, it is quite clear that all academic forums have reached an agreement in favor of the feed-in tariff and this study is just a small part of this academic movement. In April 2006, the Department of Alternative Energy Development and Energy Efficiency (DEDE) also announced the introduction of the feed-in tariff and planned to introduce the feed-in tariff system by September 2006, though this statement was not politically confirmed.

8.2 Reflections on Policy Changes and Impacts

From the experiences of the three years of study and the results of these case studies, the desirable policy changes in a health perspective can take place when;

1. Policy information is available for public deliberation and, more importantly, the Thai public takes the case seriously. This will lead to meaningful public actions and finally desirable policy changes, as seen in the following,
   - The effort of consumer organizations in demonstrating against the EGAT privatization with the private monopoly model, which finally led to the cancellation of the EGAT privatization by the Supreme administrative court.
   - The pressure on tariff raising that forced EGAT to reduce the power generation from fuel oil, buy more power from biomass, and strengthen the DSM program during the peak period in 2006.
2. Concrete or inevitable facts are publicly presented, which force the authorities to change the assumptions and plans, as seen in the following,
   - The lower demand growth that forces the government to revise the PDP2004 with much lower demand prediction.
   - Much higher oil prices (compared to the government's assumption) leading to high natural gas prices and forcing EGAT to invest more in DSM and buy more power from biomass SPPs and also forcing the MoEn to redesign an appropriate fuel mix.
3. Academic agreements can be reached at least at some levels (not necessarily through this study process) and some policy networks and actors use this consensus for adjusting and changing the policy proposal, as seen in the following,
   - The latest change from the RPS to the feed-in tariff mechanism caused by the clear criticism of the Thai version of the RPS from all policy workshops including international experts' opinions and studies. Later the FTI took this suggestion into its policy proposal.
4. New policy institutions and actors (or networks) emerge and participate actively in the policy process, as seen in the following,
   - The effort of FTI's renewable energy group in calling for the feed-in tariff, instead of the RPS mechanism.
   - The establishment of an interim regulator leading to the revision of the demand forecasting and the PDP.

Oppositely, the positive changes are not likely to take place when,

- The public has not been well informed, mostly due to a sophisticated technical style of information or a case-specific information (for example in grid-access and interconnection issues).
- Academic studies and forums are not sufficient in order to understand the issue systematically (as in grid-access and interconnection issues), to raise the issue publicly, and to reach certain levels of academic agreement.

- The government applies a non-action policy strategy, meaning that the government does not explicitly decline a policy proposal but delays its progress (as seen in the call for more renewable energy investment and the VSPP approval process) or does not take it into consideration at all (as seen in the call for broader focus, wider options and more public participation in the PDP process).
- The access to the formal decision-making process is limited (as seen in the PDP process and earlier the EGAT privatization process). Therefore, public inputs do not contribute to the consideration process and, at the same time, the logics and rationalities of the decision (or the options) are never reported to and scrutinized by the public in time.

Therefore, on the basis of these recent experiences, the complete formal change towards PDP-Renewables is hardly taking place, nor is the whole recommended institutional framework suggested by decentralization discourse. It is more likely that the formal policy process will make each decision on a separate basis, but within a full range of implicit influences from different policy discourses. In the near future, some of these following changes may happen;

- The introduction of the feed-in tariff mechanism to support the contribution of renewable energy.
- The interim regulator may consider the grid access and interconnection regulations more seriously and introduce better regulations.
- EGAT may invest more in DSM and biomass power purchasing in order to reduce the investment and generation costs during peak hours, as the public will continuously try to avoid tariff rising.
- Oppositely, EGAT may successfully introduce new coal-fired power plants in the PDP 2006 to reduce the dependency on natural gas.
- To avoid a strong domestic protest against new fossil-fuelled power plants as well as to expand their investment business, EGAT and its subsidiaries may also increasingly invest in neighboring countries.

Interestingly, since the Democrat Party is now supporting the policy direction towards more renewable energy, it is very difficult to predict the policy changes taking place if they come to power in 2007.

8.3 Policy as a Social Learning Process

These reflections from the direct participation in the policy process and the policy analysis in Chapter 4 provide an insight that public deliberations lead to effective public actions and better understanding, and we can thus view the policy processes in the Thai power sector as a social learning process.

Obviously, the policy arena of the Thai power sector has expanded beyond the limited scope of the formal policy process through more than a decade. Although the formal policy process is still very important, no policy decision can be totally ensured by the absolute power of the formal policy process.

Therefore, networks and actors in the policy domain play an important role both in the formal policy process and in framing the issues for wider public discussion and support. This is especially the case after the economic crisis and the adoption of the new constitution in 1997, when different policy discourses and networks have been strongly formed, as explained in Chapter 4.

However, the degree of accessibility to and influence on the formal policy process vary among different policy networks and actors. This variation affects the needs to bring policy issues into public deliberation, especially among those who cannot adequately gain access to the formal policy process. Through public deliberations and actions, the societal domain becomes more important in the policy process, as seen in the protest against the EGAT privatization during the study period.

Traditionally, the Thai public (or societal domain) did not recognize themselves as part of the policy domain. However, they have involved in the Thai power policy process because they are struggling against any form of exploitation, domination, and subjection. In other words, they involve mainly to protect their interests rather than to exert influence on the contents of the policy solutions.

However, public actions cannot easily gain access to the policy process. They require a sharp policy framing (i.e. policy meaning) for broader understanding, an appropriate timing, public space for policy communication (including the mass media), and a policy window (or institutional space) for changes. Even in the case of the EGAT privatization, the “last minute action” was almost too late.

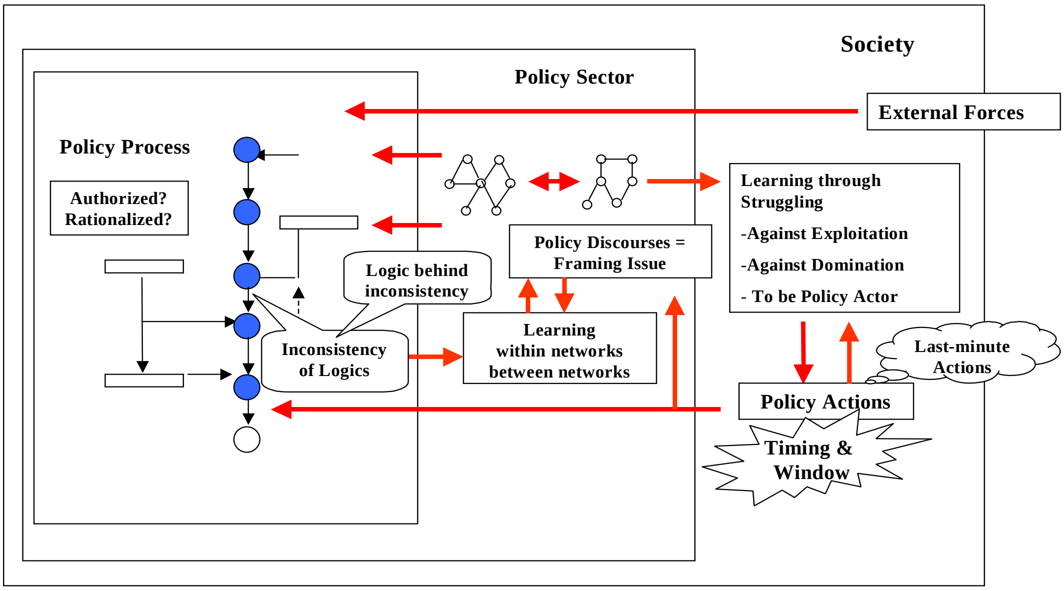
If public action can involve in the policy process, this would be a good opportunity for Thai society to scrutinize and learn about formal policy decisions, assumptions, and alternative proposals. In various cases, public action can lead to a better understanding of “the inconsistency of logic” to be found in policy proposals and decisions, as seen in the EGAT privatization case. More importantly, a deeper public involvement will help Thai society in understanding “the logic of inconsistency”, which is normally the outcome of the powerful influences from some policy actors which aim to protect and expand their benefits. For example, the reason of using extremely low oil price assumptions in the formal PDP process is logically linked to the attempt to protect and promote the natural gas market in the Thai power sector.

Therefore, the public understanding of “the inconsistency of logic” and “the logic of inconsistency” in policy proposals and processes and the recognition of public action are the main elements of the social learning process in the policy arena. They can also be social validity tests of each policy contestation and proposal.

Lastly, the changes of the formal policy process and policy decisions and, at the same time, the changes of policy strategies by different policy networks and actors are the effects of efficient public actions. Public action may also force different policy networks into involving in cross-network policy learning in order to provide better solutions to public needs. It even may lead to the emerging of new policy proposals and discourses.

Figure 8.1 summarizes the overall learning process in the policy arena by emphasizing the interactions between three layers of policy-making and the importance of public deliberations and actions.

Figure 8.1 Policy as a Social Learning Process



8.4 Limitation of Public Deliberation

However, this explanation should not lead to the misunderstanding that a social learning and public deliberation process is easily taking place in all policy issues or processes. The previous reflections also present several main obstacles to public deliberation, public action and social learning process in Thai power policy, including;

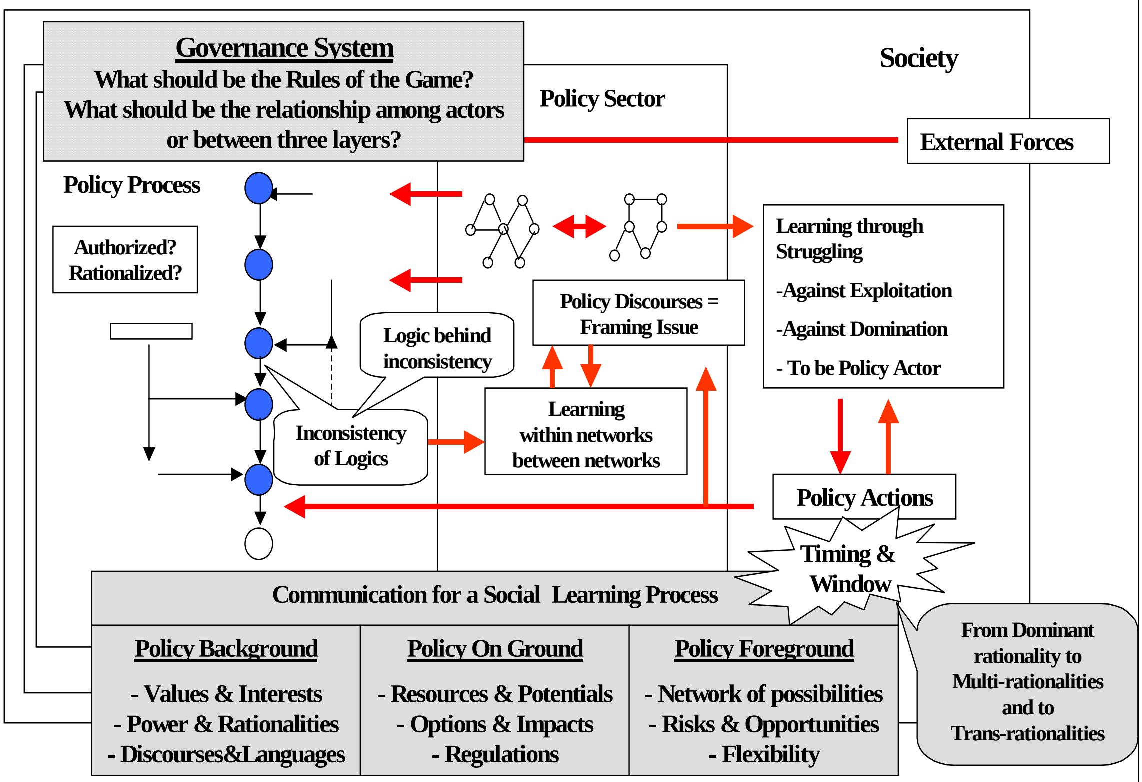
- Several formal policy processes are still closed in their nature, as recently seen in the PDP revision process. Public participation is defined as the hearing of the final proposal, which is far from being enough to introduce new cognitive and normative pillars as well as new planning practices in the formal policy process.
- The government still heavily controls the tempo of the policy process, which is crucial to the way in which some policy proposals are pushed into final decision without adequate public deliberation and, at the same time, to the labeling of some policy proposals as “non-action” policies, without any need for formal announcement.
- Unbalanced opportunities and influences between different policy actors and networks still remain. Some policy actors, like EGAT, are themselves part of the formal policy process.
- Public deliberations and actions cannot be ensured, as public attention and public communication channels (especially the mass media) are highly competitive in relation to different societal issues. Since public actions may not last long, timing and policy window are certainly crucial factors of an efficient attempt.
- Obviously, the policy network and actors supporting PDP-Renewables and the decentralization discourse have limited opportunities in accessing the formal policy process. Their strength relies on their ability to bring issues to public deliberation and action. But, to urge for public deliberation, a sharp policy framing is required. The question is to which extent this policy network will be able to develop the policy framing and raise public awareness.

It is fair to say that viewing policy as a social learning process provides a framework for identifying opportunities and obstacles to policy changes. More importantly, it highlights the actual role of the Thai public in the policy process. Due to public deliberation and action, different policy discourses will be forced to avoid inappropriate (or socially unacceptable) policy choices and, consequently, provide more space for the better policy options to be nurtured and expanded.

8.5 The Future of Healthy Public Policy in the Thai Power Sector

Based on the concept of the social learning process, two basic elements which are required in the policy process are communication and interaction (especially public actions) across the three layers of the policy arena. In this viewpoint, developing a healthy public policy can be seen as an attempt to facilitate or stimulate policy deliberations and policy actions in supporting healthier policy directions across these three layers (also presented in Figure 8.2).

Figure 8.2 Facilitating Healthy Public Policy Process



Therefore, the future of healthy public policy basically depends on four main progresses in;

a) Deliberative Policy Analysis and Communication

As recently experienced, not all policy communication leads to public deliberation, public actions and desirable policy changes. Hence, it is necessary to identify and develop the effective ways of communication in terms of supporting healthy public policy.

Deliberative policy analysis, as an approach to this study, is one of the main attempts to develop more effective policy communications with the aim to promote public deliberations and actions. From this study, three components of policy communication are highly recommended in the development of a healthy public policy in the Thai power sector; namely

- **Policy Background**, which represents the basic values and rationalities of each policy discourse and proposal, is an essential aspect in order to understand the fundamental differences in different policy contestations. The understanding of different basic values and rationalities can help the public to analyze policy options and, more importantly, to justify their own policy actions. In this study, the attempts to provide a better understanding of the policy background can be seen in Chapter 4 (historical and policy discourse analysis) and Chapter 7 (cognitive and normative pillar of institutional framework).
- **Policy On Ground,** which is the policy issue debated or discussed publicly at present, such as different PDP options or pricing regulations. Although, normally, policy on ground dominates the policy communication, it can be further improved through better policy analyses, including the implementation of strategic impact assessment, sustainable energy planning and institutional analysis, as shown in this study. It is also helpful in connecting policy on ground with its policy background(s) in order to ensure the desirable policy directions.
- **Policy Foreground,** which represents the understanding of common and different views of the future. As all policies in today's discussion are created for implementation tomorrow, the future perspectives are certainly crucial for public deliberation. When we look into the future from different points of view, we will propose different policy directions. However, sooner or later, we usually face a common future, both in terms of opportunities and threats. Unfortunately, very few attempts have been made to provide a better understanding of different and common policy foregrounds. In this study, the sensitivity analysis in Chapter 6 has been conducted in order to analyze the flexibility of different policy options within different future scenarios. However, there is still much to accomplish in order to achieve a full understanding of policy foreground(s) for the Thai power sector.

In other words, better policy analysis and communications for healthy public policy require the connection of understanding normative values and rationalities, policy proposals and impacts, and future risks and opportunities. Apart from deliberative policy analysis, strategic impact assessment, sustainable energy planning, and the creation of a sharp policy framing are certainly crucial to reaching public attention, stimulating public deliberation, and encouraging public action.

b) Better Governance System

While more effective policy communications aim to provide a better understanding and facilitate the involvement of public actions from the societal domain in the formal policy process, the urge for a better governance system works in the opposite way. An improved governance system requires transparent and participatory policy processes; in other words, that they take into account different perspectives, values, and interests with fair judgment in the policy-making process. This means that the formal policy process must be open to public interactions.

Through this study, the attempt to assess the governance system in the Thai power structure, using the recent EGAT privatization policy as a main case study, has been developed into a comprehensive report and, consequently, an impressive policy result. This successful experience should pave the way for establishing common understanding, guiding principles, and tools for improving governance structures or systems in Thailand. To support PDP-Renewables as a healthier choice, the main priority in the development of better governance should be given to PDP planning practices, regulatory processes, and environmental regulations.

c) The Roles of Policy Networks/Actors

Since the formal policy processes in the Thai power sector are not widely open and also involve a lot of technical discussions, it is not easy for the Thai public to follow and participate directly in the formal policy processes. To fill this gap, the role of policy networks is crucial. This role includes a) policy monitors or watchdogs, b) policy analysis (including option and impact analysis), c) policy communications, which provide meanings or interpretations of different policy issues and options, d) participation in formal policy processes when opportunities appear, and e) support to public actions, especially the identification of appropriate timing and policy windows. The capacity of each policy network for implementing all these functions is a key to promote healthy public policy in the Thai power sector.

It is also good for Thai society to have more than one policy discourse and network, since they normally provide different viewpoints on the same problem. Thus, having more than one policy discourses provides the opportunity to see and solve (or prevent) problems in different and more creative ways.

However, the more challenging issue is how to use the variety of viewpoints creatively in the policy process. Apart from better policy communications and governance systems, another possibility is to promote policy-oriented learning across the policy networks, instead of perceiving the interactions with other networks as a contestation and political negotiation. The policy-oriented learning across the policy networks can be developed in several forms of policy workshops, working groups for specific issues, and research works.

d) Practical Wisdom (Phronesis)

As elaborated in Chapters 4 and 7, the policy discourse of the Thai power sector has been developed from different perspectives and values, and applied to different rationalities when proposing their policy directions and mechanisms. Hence, to understand different policy discourses and especially to develop a healthy public policy, value judgment is needed in order to identify the desirable aims (or directions) for society. The power analysis is also required to allow and lead the value judgment to be an effective policy decision and action.

This refers to the concept of "phronesis" or practical wisdom, introduced by Aristotle. According to Aristotle, phronesis is an intellectual virtue that is "reasoned, and capable of actions with regard to things that are good or bad for man"[1]. Phronesis is very important since it concerns values and goes beyond scientific and technical knowledge. Therefore, phronesis is an intellectual deliberation by which instrumental rationality is balanced by value-rationality[2].

Phronesis must involve both a true understanding of an end and also identify means to an end determined by moral virtue. As mentioned by Aristotle, "virtue makes us aim at the right mark and practical wisdom makes us take the right means"[3]. Practical wisdom comprehends the various powers and qualities in its deliberations over means and ends, which are highly context-dependent. Therefore, practical wisdom is more likely to be "a sense or a tacit skill for doing the ethically practical rather than a kind of science"[4].

As earlier mentioned in this chapter, the right means towards the healthier end (i.e. PDP-Renewables) are hardly systematically determined through specific policy processes, but rather emerged as outcomes of the struggle between different aspects of policy contestation, thus the ability to deliberate what is good and advantageous for Thai society is crucial to the development of a healthy public policy in the Thai power sector.

Combined with deliberative policy analysis, practical wisdom should allow different policy values and rationalities to play more creative roles together through public deliberation in their contested policy arena. This refers to the concept of trans-rationality, according to which different rationalities are deliberatively analyzed and meaningfully contributed to the following decisions and actions.

8.6 Continued Works

Certainly, in reality, healthy public policy work is an endless project. Due to its dynamics and complexities, policy will change continuously, sometimes in desirable directions and sometimes not. What can be achieved with these three years of study are more likely to be the understandings of a) possibilities and potential benefits of alternative healthier policy directions, b) how policy changes have taken place historically and recently, and c) analytical and operational frameworks for future policy changes. A series of policy works needs to be done in order to develop these understandings and put them into practice, while, at the same time, testing these understandings in real-life situations.

Based on the analysis of this study and the actual development of the future works during April-August 2006, eight research and policy works have been planned for Thailand for 2006 and 2007.

- **Electricity Governance Assessment**, which follows the success of the first governance assessment of the EGAT privatization. The main aim is to provide a common understanding for establishing a better governance system, as suggested in the previous section. In 2006-2007, the focus of the assessment will be on the PDP planning process, the regulatory process, and present environmental regulations.
- **Integration Analysis of PDP-Renewables**, to provide a better understanding of the suggested development of PDP-Renewables and the decentralization model in the existing national grid and how it will contribute to the reduction of costs in load management and grid stability. The idea is not only to contest other policy discourses in cognitive and normative battlefields, as suggested in chapter 7, but also to identify the better pricing regulation for renewable energy in doing so. The Energy-PLAN model is certainly useful for this purpose.
- **Strategic Impact Assessment across the Border.** Since the latest measure of the Thai power industry is to expand its investments to neighboring countries, especially Laos, China, and Myanmar, the strategic impact assessment in this study may have a too narrow scope in terms of geographical area. The new attempt will involve an assessment of health and other impacts of investment options in other countries on their populations and environments, as well as on the Thai population and environment. The possible starting point will be the research collaboration between Thailand and one or two research institutes in these selected countries.
- **A Citizen's Primer in the Thai Power Sector,** As public deliberations and actions become more important in Thai power policy, it is useful and essential to produce a comprehensive handbook for public understanding and analyzing different policy and planning issues. This work has been inspired by the early impressive book of Prayas Energy Group in India[5].
- **Sustainable Energy Fair and Trips for Journalists**, which follow the good experiences of this study. Both the sustainable energy fair and trips provide opportunities for the Thai public to learn about renewable energy potentials, their better strategic impacts, and relating policy issues. The fair

has been planned in relation to the fact that renewable power generation in Thailand has now reached 1,000 MW of installed capacity, showing that PDP-Renewables is a viable option which has better impacts, in several perspectives.

- **Implementation of Feed-in Tariff Pricing Scheme.** Among different public regulations, proper pricing regulation is one of the most important issues in promoting renewable energy. Allowing the Thai RPS to be the main pricing scheme does not only entail more uncertainties to renewable energy producers, but also implies more control over renewable energy development from fossil-fuel power producers. To provide a good and fair ground for renewable energy to grow in this country, the clear target is to shift from RPS to feed-in tariff and to bring the feed-in tariff into force not later than 2007, according to the PDP-Renewables suggested in this study.

- **Regular Series of Policy Workshops,** as partly done in this study, in order to provide a basis for cross-network and policy-oriented learning and public deliberation. The workshop can be part of the above-mentioned future activities or separate activities for other emerging issues in the Thai power sector.

- **Higher Educational Program on Sustainable Energy Planning and Political Economy of Sustainable Energy**, which will be the firm academic basis for future policy works in Thailand, both in terms of policy analysis and capacity strengthening. The academic setting can be both a university (e.g. Kasetsart University) and the Joint-Graduated Schools for Energy and Environment.

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Chapter 9
Conclusion and Perspective

This study has been inspired by the growing concern on human health impacts of power generation in Thailand and the societal need for healthy public policy or, in this case, “the better power for health”. For more than a decade, the human health concern has emerged mainly from the real suffering of several communities located near power plants and large hydro power dams throughout the country. Obviously, the growing concern has led to the strong objection against new power plants by several local communities, which, in many cases, leads to societal conflicts and even violation.

The concept of healthy public policy, introduced through the national health system reform in 2000, aims to address this problem and conflict by placing health on the agenda of policy-making, suggesting better policy directions for health, and making the healthier option an easier option to make. The objective of this study is to elucidate the idea of healthy public policy in the Thai power sector by analyzing the public policy process in the sector, identifying the possible solutions for health, analyzing the impacts of different policy alternatives, recommending the supportive institutional framework for a healthier solution, and reflecting on the actual policy changes which have moved in a healthier direction during the three years of study.

The study has been organized into four main parts. First, the existing public policy process and policy discourses have been analyzed on the basis of historical and deliberative policy analysis. Second, the strategic impacts of three main policy options have been assessed in environmental, economic, and health perspectives. Then, the existing institutional framework has been reviewed in the light of different interpretations from different policy discourses. The aim of this part is to identify the supportive institutional framework for the healthier solutions and how to convert it into reality. Last, all of the attempts of this study and the actual policy changes taking place within the study period have been reviewed and examined, in order to reflect the actual meaning of healthy public policy, or better power for health, in the real politics of Thai society.

9.1 The alternative is technically possible

The result of the review of sustainable energy potentials in Chapter 3 shows that Thailand has great resources for renewable energy development, especially in terms of biomass and solar energy. More importantly, in recent years, the growth of renewable power generation in Thailand has been impressive. In 2006, Thailand has reached 1,000 MW of renewable power generation and half of this capacity has been installed within the last three years. In terms of costs, several technologies, namely biomass, biogas, and micro-hydro power, are now able to compete with fossil-based and large hydro power plants.

However, in total, renewable power generation only accounts for around 2% of the total energy generation in the power sector and less than 10% of the overall predicted renewable energy potential (around 15,000 MW). Generally, it is well accepted that renewable energy has much better impacts on environment and health. Therefore, it is indeed possible for Thailand to use renewable energy as a healthier alternative.

Apart from renewable technologies, Demand Side Management and energy efficiency constitute one of the best alternatives in sustainable energy development, also in terms of economy. In Thailand, the estimated potential of DSM is nearly 3,000 MW. Moreover, the Thai power sector has always been criticized for overestimation of the demand prediction, leading to over-investment and unnecessary negative impacts. Evidently, within the study period, the demand prediction made in 2004 is 900 MW higher than the actual peak demand in 2006. The realistic demand prediction will lead to lower installed capacities by nearly 7,000 MW.

This study takes these three sustainable energy possibilities, namely renewable energy, DSM, and the revision of demand forecasting into consideration in when identifying the possible option for a healthy public policy. In the study, this policy option is referred to as PDP-Renewables.

9.2 The alternative has not been considered in the existing policy process

From the reviews in Chapters 4 and 7, it is clear that the Thai power sector has been developed as a centralized and monopolized system, which pushes renewable energy as a decentralized or distributed power into a marginalized situation. Up to 2004, renewable energy has never been recognized as an alternative when formulating the power development plan. This is why most of the renewable potential has not yet been exploited in the Thai power sector.

At the same time, due to the monopoly structure of the Thai power sector, the expansionist investment strategy is preferable for the authorities, leading to a systematic over-estimation of the future demand and, consequently, over-investment. This expansionist strategy has also undermined the potential of DSM implementation in this country.

With the clear insight that the “cause of the cause” is rooted in the power structure and the policy process, rather than based on technology, the study also digs deeply to understand the policy process and the dynamics within the power sector.

9.3 Different policy discourses lead to different policy directions

Although the Thai power sector was first developed in the 1960s as an absolute government-controlled policy arena within the state monopoly model, societal conditions have gradually forced it to open its policy process. On the one hand, the high economic growth during 1987-1995 produced more private participation in the sector. On the other hand, due to the negative environmental and health impacts, since the 1990s, civil society has also urged for more public participation in the policy process. After the economic crisis in 1997, while the pressures for privatization had continued, the influences of consumer organizations and local protestors had also become stronger. More importantly, the Thai public also pays more attention to the policy debates in the power sector, which, in some case, lead to meaningful public action against the policy directions of the government. It is quite clear that the policy border has now expanded from the full control of government authorities into the area of policy network negotiation and, to some extent, into the societal domain of public deliberations and actions.

Within this expanding scope of the Thai power policy arena, the four main policy discourses of state monopoly, power pool, private monopoly, and decentralization have played crucial roles in determining the policy directions. They suggest different market models, different governance structures, different fuel mixes in power generation, and different levels of environmental and health consideration. In their contestation, all these policy discourses try to provide their own explanation of the situations and problems, to introduce their policy solutions based on their explanation and normative principles, and to highlight their policy interpretations by use of cognitive frameworks. The domination of policy discourses in different periods highly depends on the economic and political conditions, including the external forces, like the world oil price.

The concept of healthy public policy is well integrated into the decentralization policy discourse, which supports a) strong public control and the reduction of monopoly power both in terms of state and private monopoly players, b) a realistic investment strategy to alleviate economic and environmental burdens from over-investment in power plants, c) more contribution of renewable energy and energy efficiency in the Thai power systems, and d) the full integration of environmental considerations at all levels of decision-making.

Although this policy discourse has never dominated Thai power policy, its influential power has been expanded considerably after the economic crisis in 1997. In the situation of high oil prices, strong needs for public accountability, local concerns over environmental and health impacts, and potential renewable energy resources, this decentralization policy discourse is likely to play a more crucial role on the Thai power policy stage.

With this wider policy opportunity, it is important to present a concrete plan for a better and healthier policy direction in Thai society and, at the same time, to compare it with other policy alternatives, especially the existing policy direction.

9.4 PDP-Renewables is a better and healthier option

To analyze the impacts of the different policy options based on these policy discourses, strategic environmental assessment (SEA) is applied to the study. Three power development plan (PDP) options were developed with differences in terms of demand forecasting (representing different expansion strategies), power technologies, and fuel mixes.

PDP-Renewables is an investment option derived from the decentralization discourse. Based on the resource potentials and present available technologies, PDP-Renewables is a viable option according to the existing planning criteria. To compete with PDP-Gas (from the private monopoly discourse) and PDP-Coal (from the state monopoly discourse) in economic terms, PDP-Renewables combines the cheaper solutions (e.g., revision of demand forecasting and DSM) and the competitive solutions (such as, biomass, biogas, industrial CHP, micro-hydro) with the more expensive solutions (like solar PV and wind).

The results show that, compared with the other two PDP options, PDP-Renewable is the cleanest option, due to its lower negative environmental impacts. As a result, it is also a healthier option in relation to the concept of healthy public policy. Through

PDP-Renewables, in 2015, annually 300 lives are expected to be saved and 3,000 people are expected to avoid chronic diseases. With the lower negative impacts on environment and health and its much smaller size, PDP-Renewables is highly expected to reduce the social conflicts over power investment projects. As it depends much more on domestic and renewable resources, PDP-Renewables also provides much better results in terms of employment effect, resource conservation and national energy self-sufficiency.

PDP-Renewables also has good economic outcomes. Compared to the existing PDP (or PDP-Gas), it is expected to decrease fuel costs by 10.4%, to decrease generation costs by 4.7% and to decrease foreign import by 8.7% during the planning period (2003-2015). At the same time, it can contribute with 2.7% more to the National GDP. Since the analysis applies the fuel price of 2003, these economic advantages will increase further if the world oil price remains at the present level. These advantages can be maintained if the power plant investment is needed in the case of higher demand growth. In other words, PDP-Renewables is both a feasible and a flexible choice for long-term investment in the Thai power sector.

9.5 Supportive institutional framework is needed

However, since PDP-Renewables essentially requires different investment schemes (i.e., small and very small power producers rather than EGAT or large private investment or IPPs), it can only become reality if a supportive institutional framework and public regulations have been established. Logically, this supportive framework may not be easily introduced, since both the implementation of PDP-Renewables and this framework can lead to a significant reduction in the investment and fuel markets of the largest players in the Thai power sector and energy market, like EGAT, PTT, and IPPs.

The analytical results show that most of the required supportive framework and regulations for PDP-Renewables have not yet been established. Very small renewable power producers still have a great difficulty in gaining access to the grid, while several renewable SPPs still receive electricity prices lower than EGAT's avoided costs. Very few renewable power producers can get the government subsidy and the subsidy is only granted for the first five years of operation. They also face unfair requirements of interconnection, unfair charges and penalties and delays in their approval process.

a) Market and Governance Structure

All of these problems are deeply rooted in a monopoly market structure and unbalanced governance system, in which the utilities can utilize their authority and market power for protecting their business interests. Therefore, to develop PDP-Renewables, supportive institutional changes must take place on the power market and at the governance structure level. Openness towards the decentralization model, a strong independent regulator, and a clear division of roles and interests among actors are highly recommended.

b) Pricing and Interconnecting Regulations

Obviously, the existing pricing regulations are not attractive or fair to renewable energy investment. In supporting a fair pricing system, the firm and non-firm basis must be, at least, replaced by on-peak and off-peak tariffs. Moreover, to stimulate renewable energy development and innovation in the near future, the feed-in tariff is clearly much more preferable than the Thai version of the RPS. In terms of interconnection regulations, the concept of co-responsibility between utilities and renewable power producers must be applied with fair regulation by an independent regulatory body.

c) Planning Process

Certainly, renewable energy, energy efficiency, and their environmental and health benefits are not the scope of the existing planning practices, leading to the low utilization of the renewable energy potential in Thailand. Therefore, the new planning practices with more open strategic options and a broader focus on environmental and health benefits and national development goals are necessary in order to exploit the potentials and benefits of PDP-Renewables.

d) Policy Process

However, all these unfavorable conditions, like firm and non-firm SPPs or unfair interconnection burdens, derive from the cognitive and normative criteria of their policy discourses (either state monopoly or private monopoly). Therefore, these recommended changes cannot be easily made, since they imply different cognitive and normative pillars, compared to the existing dominating policy discourses. Thus, within the policy contestation, future changes are more likely to be outcomes of cognitive and normative battles. The results of these battles depend very much on the interconnections between concrete experiences and references, sound policy analysis, constructive policy communications, good proposals for effective regulations, and political opportunities. In other words, the policy process in the Thai power sector must be opened to different policy interpretations and discourses.

9.6 Policy changes are also possible but still uncertain

Since one of the objectives of this study is to participate directly in healthier policy changes and learn from this direct experience, it is essential to reflect on the lessons learnt about the influences or impacts of this study on the actual policy changes during the three years of study.

Some desired changes are now taking place. The revision of the PDP with lower demand growth, as suggested in Chapter 6, is now taking place. The privatization of EGAT under the private monopoly discourse or the Enhanced Single Buyer model has been cancelled by the Supreme Administrative Court, after a strong consumer organization movement. With the strong academic backup, the Thai government also tends to agree in the effectiveness of the feed-in tariff mechanism in supporting renewable energy development.

Observably, the desired changes are more likely to occur in situations when a) policy information is available to public deliberation and, more importantly, the Thai public takes the case seriously, as shown in the attempts to stop the EGAT privatization process, b) concrete or inevitable facts emerge and are publicly presented, forcing the authorities to change their assumptions and plans, as seen in the revision of the demand prediction and consequently the new PDP, c) academic agreements can be reached, as shown in the case of the feed-in tariff, and d) new policy institutions or networks emerge and participate actively in the policy process, as seen in the establishment of an interim regulator.

However, within these three years, some policy issues have not been successfully changed. Although the existing PDP2004 is now revised, the new PDP2006 process is not yet publicly open or integrated with broader national sustainable development goals, as suggested in this study. Concurrently, though the privatization process is stopped, the monopoly power still remains. Although PDP-Renewables does not yet receive any strong criticism, PDP-Renewables is less likely to become the formal power development plan in the near future. Therefore, both PDP-Renewables and its supportive institutional framework are still facing an uncertain future.

9.7 Social learning process and policy works must be continued

The reflections from this study show that one specific study cannot by itself make the differences in policy changes. To promote healthier policy changes, it is essential to concentrate on public interactions and deliberations in the policy arena.

From the three years of study, it is clear that meaningful public action is a good opportunity for Thai society to scrutinize and learn about formal policy decisions, their assumptions, and alternative proposals. In various cases, public action can lead to a better understanding of "the inconsistency of logic" to be found in policy proposals and decisions. More importantly, a deeper analysis public involvement will help Thai society in understanding "the logic of inconsistency", which is normally the outcome of the powerful influences from some policy actors who aim to protect and expand their interests. Therefore, the public understanding of "the inconsistency of logic" and "the logic of inconsistency" in policy proposals and processes are the main elements of the social learning process of developing healthy public policy in the Thai power sector.

However, future public deliberations and actions cannot always be ensured, especially when the formal policy process is not open to public participation, the government still controls the tempo of the policy process, and the resources and opportunities of different policy discourse coalitions are highly unequal.

Therefore, to promote more public deliberation towards healthy public policy, several policy works must be implemented in the near future. These policy works include a) the urge for a better governance system in the Thai power sector, b) integration analysis of PDP-Renewables in supporting power system reliability, c) strategic impact assessment across the national border, d) implementation of the feed-in tariff mechanism, and e) continuous public education and policy communications (including successful sustainable energy trips, sustainable energy fair, and policy workshops).

9.8 The Limitation of This Research

This research has three main limitations. First, like other impact assessment studies, this research is limited by future uncertainties and the assumption used in the impact analysis. Although the study tries to cope with this limitation by providing reviews, sensitivity analysis, and policy workshops, it is still difficult to predict tomorrow's uncertainties today.

Therefore, the research does not aim to provide the "final answer" to Thai society. Although it is shown from the strategic impact assessment and sensitivity analysis that PDP-Renewables is more suitable for promoting health, this PDP-Renewables is still not the best possible answer to Thai society. Concurrently, with this limitation, the impacts mentioned in the study are more likely to be the quantifiable "potential impacts" rather than actual amounts. In fact, PDP-Renewables and its potential benefits in different perspectives represent the idea that the healthier choice is possible in the case of the Thai power sector, rather than being a final policy solution in its own sense.

The second limitation links to the study of policy changes in the Thai power sector. As announced in Chapter 1, the core idea of this research is to promote healthier policy changes. Therefore, the value of health in this research is highly acknowledged and identified, including in policy recommendations. In other words, this research takes health as a standpoint for the policy suggestions. However, in the actual policy process, the value of health may not be high, due to the competitive societal values and uncontrollable socio-political conditions, which may affect the policy changes or the actual policy interactions.

Last, since policy changes may take place in the long run, the analysis of policy changes within three years as conducted in this study cannot represent the whole story. The desirable and undesirable policy changes can emerge in every moment due to predictable and unpredictable reasons and influences. Therefore, the reflections of this study are not adequate to provide a complete understanding of policy complexity and to promote desirable policy changes in the long term. The continuation of the policy analysis and interactions is essential in order to cope with this limitation and pursue healthier policy changes in the Thai power sector.

9.9 Perspective on Better Power For Health

Both analytical and political results confirm that healthy public policy and sustainable energy development have their own past, present and future in Thai power policy.

Conceptually and historically, healthy public policy has been well integrated into the policy discourse that supports decentralization and sustainable development through the contribution of renewable energy and energy efficiency. Technically and strategically, a healthy public policy option, like PDP-Renewables, is highly viable, economically feasible and socially desirable in terms of health, environment, and social impacts. Institutionally, the supportive framework and regulations are not yet fully developed due to the domination of conventional views of power sector management. However, with all these potentials and benefits, healthy public policy is now ready to challenge and compete with these dominant cognitive and normative views in developing "better power for health".

Towards the end of this study, it must be concluded that, **in the Thai power sector, the success of healthy public policy in promoting "better power for health" depends on three dimensions of its better "power".**

In physical terms, "**sustainable power**", with renewable power, energy efficiency and effective demand management, is required in order to reduce the negative environmental and health impacts and to promote the economic and social benefits of power generation and investment plans.

In political terms, "**more equal or balanced power**" among different actors in the Thai power sector is essential to ensure that all policy solutions (especially the healthier options) are fairly assessed in the policy process; that all power producers gain access to the grid and achieve a fair price for their electricity and also externalities, and that all public interest is deliberatively protected in all policy decision-making.

Last, in philosophical terms, "**society's wisdom** power", which focuses on the desirable end and the ethically right means, is crucial to the implementation and expansion of the first two dimensions of better "power". In a health perspective, the question of what is good or bad for human beings and society is always relevant and significant. Without this ethical consideration, both sustainable power and more balanced political power will loose their values and ability to change policy directions in the policy process. Together with technical and political solutions, the ethic policy deliberation of society is likely to ultimately determine the success of healthy public policy and the future of sustainable energy in the Thai power sector.

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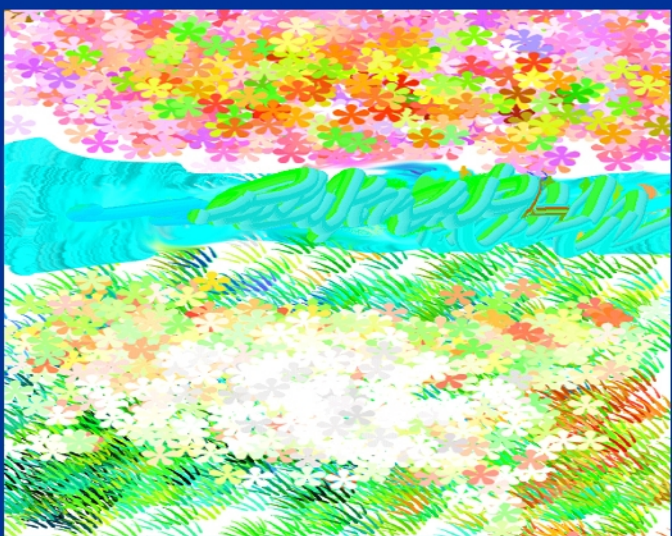
Technically and strategically, healthy public policy options, like higher contribution of renewable energy and energy efficiency, are highly viable, economically feasible and socially desirable all in terms of health, environment, and social impacts. Although, the supportive framework and regulations are not yet fully developed due to the domination of conventional views of power sector management, with all these potentials and benefits, healthy public policy is now ready for challenges and contests in developing “better power for health” in the Thai power sector.

However, in policy contestation with the dominant policy discourses, the concept of better power for health must go beyond the physical dimension of power. The healthier policy solution also requires more balanced political and ethical dimensions of power in the public policy process. Therefore, the integration of three dimensions of power is the key to the development of healthy public policy and sustainable energy in the Thai power sector.



Stream of Life
Where energy is renewable and balanced. All lives are living healthily together
By Miss Warisa Sukkumnoed
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