SUSTAINABLE PROVINCIAL POWER DEVELOPMENT PLAN:

CASE STUDY OF NAKHON SI THAMMARAT PROVINCE

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Art Program in Environment, Development and Sustainability
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นางสาวจริยา เสนพงศ์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
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จริยา เสนพงศ์: แผนพัฒนากำลังผลิตไฟฟ้าอย่างยั่งยืน กรณีศึกษาจังหวัดนครศรีธรรมราช. (SUSTAINABLE PROVINCIAL POWER DEVELOPMENT PLAN: CASE STUDY OF NAKHON SI THAMMARAT PROVINCE)
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การศึกษานี้ได้ทำการสำรวจภาพอนาคตพลังงานและศักยภาพพลังงานหมุนเวียนในจังหวัดนครศรีธรรมราช เพื่อเพิ่มความมั่นคงและการพึ่งพาตนเองด้านพลังงานของจังหวัด โดยข้อมูลส่วนใหญ่ได้จากการทบทวนเอกสารรายงานและข้อมูลสถิติซึ่งรวบรวมโดยหน่วยงานที่เกี่ยวข้องและสถาบันการศึกษา ส่วนความเห็นและข้อเสนอแนะต่างๆได้จากการสัมภาษณ์เชิงลึกและพูดคุยแลกเปลี่ยนความคิดเห็นกับการไฟฟ้าส่วนภูมิภาค หน่วยงานราชการระดับภูมิภาคและระดับท้องถิ่น นักธุรกิจพลังงานหมุนเวียน สมาชิกสภาผู้แทนราษฎรของจังหวัด ผู้นำชุมชน กลุ่มผู้คัดค้านโครงการโรงไฟฟ้านิวเคลียร์และถ่านหิน รวมถึงผู้กำหนดนโยบายทั้งระดับประเทศและระดับท้องถิ่น

ผลการศึกษาพบว่าจังหวัดนครศรีธรรมราชผลิตไฟฟ้ามากกว่าปริมาณความต้องการใช้ภายในจังหวัด ซึ่งแสดงว่ามีการผลิตเพื่อป้อนให้จังหวัดรอบข้างในภาคใต้ และมีแนวโน้มเป็นแหล่งป้อนไฟฟ้าเป้าหมายหนึ่งของประเทศในอนาคต อย่างไรก็ตามการผลิตไฟฟ้าในจังหวัดยังคงพึ่งพาก๊าซธรรมชาติเป็นหลัก โดยที่การผลิตไฟฟ้าจากแหล่งพลังงานหมุนเวียนมีสัดส่วนค่อนข้างต่ำ กล่าวคือ กำลังการติดตั้งโรงไฟฟ้าพลังงานหมุนเวียน ณ ปี พ.ศ. 2554 มีเพียง 42 เมกะวัตต์ ทั้งๆที่ผลการทบทวนเอกสารพบว่าจังหวัดนครศรีธรรมราชมีศักยภาพพลังงานหมุนเวียนมากถึงประมาณ 3,200 เมกะวัตต์ (กรณีไม่คำนึงถึง Dependable Factor) แต่ศักยภาพจะลดลงเหลือประมาณ 1,600 เมกะวัตต์ หากคูณด้วย Dependable Factor ซึ่งการไฟฟ้าฝ่ายผลิตแห่งประเทศไทยใช้ในการจัดทำแผนพัฒนากำลังไฟฟ้าของประเทศ (PDP2010)

เพื่อเป็นการส่งเสริมการพัฒนาพลังงานหมุนเวียน ควบคู่กับการเพิ่มความมั่นคงและการพึ่งพาตนเองด้านพลังงาน จังหวัดควรมีการจัดทำแผนพัฒนากำลังผลิตไฟฟ้าระดับจังหวัด ซึ่งมีความสอดคล้องและสามารถบูรณาการเข้ากับแผนพัฒนากำลังผลิตไฟฟ้าของประเทศได้ การศึกษานี้จึงได้นำเสนอรูปแบบการจัดทำแผนพัฒนากำลังผลิตไฟฟ้าระดับจังหวัดอย่างยั่งยืน โดยในขั้นตอนการพัฒนาแผนจะต้องประกอบด้วยคณะกรรมกรรมการแผนพัฒนากำลังผลิตไฟฟ้าระดับจังหวัด อนุกรรมการสมมติฐานพลังงาน อนุกรรมการพลังงานหมุนเวียน ซึ่งทำงานร่วมกันในรูปแบบองค์การมหาชน อย่างไรก็ตามอำนาจหน้าที่ของแต่ละฝ่ายจะต้องมีกฎหมายรองรับและสอดคล้องกับนโยบายภาครัฐ นอกจากนี้ผลการศึกษายังพบว่า การบูรณาการนโยบาย การจัดทำฐานข้อมูลพลังงานหมุนเวียน และนวัตกรรมเทคโนโลยี คือ ปัจจัยแห่งความสำเร็จในการจัดทำแผนพัฒนากำลังผลิตไฟฟ้าระดับจังหวัด

สาขาวิชา สิ่งแวดล้อม การพัฒนาและความยั่งยืน ลายมือชื่อนิสิต .....
ปีการศึกษา 2555 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.....
ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม .....

: ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY
KEYWORDS : PROVINCIAL POWER DEVELOPMENT PLAN/ RENEWABLE ENERGY/ NAKHON SI THAMMARAT PROVINCE/ SUSTAINABLE ENERGY PLANNING

CHARIYA SENPONG: SUSTAINABLE PROVINCIAL POWER DEVELOPMENT PLAN: CASE STUDY OF NAKHON SI THAMMARAT PROVINCE
ADVISOR: ASSOCIATE PROFESSOR DAWAN WIWATTANADATE, PH.D. CO-ADVISOR: ASSISSTANT PROFESSOR NAEBBOON HOONCHAREON, PH.D. , 129 pp.

The study was carried out to survey an energy outlook as well as renewable energy potential in Nakhon Si Thammarat province in order to enhance energy security and energy self-reliance of the province. Most information were reviewed from reports and statistical data prepared by various related agencies and academic institutes. Dialogues and in-depth interviews were also carried out to collect opinion and suggestion from stakeholders, including Provincial Electricity Authority, provincial and local government agency, power producer business, Member of the Parliament of Nakhon Si Thammarat province, community's leader, the nuclear and coal projects' antagonists, and both local and national energy policy makers.

Regarding to electricity outlook of the province, the study found that electricity generated in the province exceeded its demand, which implies that the province exports electricity to other provinces in the southern part of Thailand and trends to be one of electricity supplier targets for the country. However, electricity generation in the province mainly relies on natural gas, while generating from renewable source only low proportion (installation capacity as of 2011 was only 42 MW). Even though the previous study reported that Nakhon Si Thammarat province had high potential of renewable energy for electricity generation as much as approximately 3,200 MW (without dependable factor), but only about 1,600 MW if multiplied with EGAT's dependable factor using for PDP2010.

In order to promote renewable energy development as well as enhancing energy security and energy self-reliance, the province should have its own power development plan (PDP) which can be integrated with the national plan. Therefore, this present study has proposed a model for sustainable provincial PDP process, where its path way to develop the plan that would consist of accredited committees including provincial PDP committee, provincial energy assumption sub-committee and provincial renewable energy research sub-committee to work under public organization structure and function. However, the authorized local and provincial administratives would be decided by law enforcement and governmental policy. In addition, policy integration, renewable energy database and technology innovation were found to be key successful factors for sustainable energy planning.

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List of Abbreviations

PPA	Power Purchase Agreement Signing
CDM	Clean Development Machanism
SCOD	Scheduled Commercial Operation Date
COD	Commercial Operation Date
EP	Energy Payment
AP	Availability Payment
IPP	Independent Power Producer
SPP	Small Power Producer
VSPP	Very Small Power Producer
EGAT	Electricity Generating Authority of Thailand
MEA	Metropolitan Electricity Authority
PEA	Provincial Electricity Authority
MW	Megawatt
DEDE	Department of Alternative Energy Development and Efficiency
AEDP	Alternative Energy Development Plan
EPPO	Energy Policy and Planning Office
BOI	The Board of Investment of Thailand
ONEP	Office of Natural Resources and Policy
ERC	Energy Regulator Committee
EHIA	Environmental and Health Impact Assessment
GWh	Gigawatt Hour
PDP	Power Development Plan
kWh	Kilowatt hour

CHAPTER I
INTRODUCTION

1.1 Background information

Energy demand, especially 'electricity', has been continuously increasing because it is very much essentials for both human daily life and national economic development. According to the national power development plan (PDP 2010), Thailand's electricity demand has forecasted to increase up to 65,000 MW by the year 2030. While the existing installed capacity is only about 30,000 MW and about 17,000 MW of this must be shut down due to expiration. Therefore, new power plants with total capacity of 57,000 MW must be installed by the year 2030. To achieve sustainable electricity supply, it is necessary to keep balance of various factors like energy supply security, economic development, environment (both local and global level), and social development (including people standard of living, electricity price, and public acceptance). Therefore, the following power plant installation has been proposed as shown in Table 1. However, PDP2010 (2010-2030) planned for increasing power plants by the year 2030 had been revised to postpone the plan for nuclear power plant installation and also to reduce coal fired power plants as well as imported portion, while increasing natural gas combine cycle and renewable energy power plants as shown in Table 2 (PDP2010 Revision 3, approved in 8 June, 2012).

Table 1: Thailand's Power Development Plan 2010

Type of power plant	Number of power plant	Installed capacity (MW)
Natural gas	13	**10,400** (800 MW x 13)
Nuclear	5	**5,000** (1,000 MW x 5)
Coal	9	**7,200** (800 MW x 9)
Renewable energy (RE)		**6,000**
Others and import		**23,400**
Total		**57,000**

Source: EGAT News, June 2011

Table 2: Thailand's Power Development Plan 2010 Revision 3

Type of power plant	Number of power plant	Installed capacity (MW)
Natural gas	24	**29,650**
Nuclear	2	**2,000**
Coal	4	**4,400**
Renewable energy (RE)		**9,516**
Others and import		**9,564**
Total		**55,130**

Source: Energy Policy and Planning Office, Ministry of Energy, June 2012

According to the PDP 2010, natural gas, nuclear, and coal were considered as suitable sources for power based supply in the aspect of economic development as well as supply security due to their huge supply. Meanwhile renewable energy (RE) power plants were considered as suitable sources for keep balance of social and environmental aspects, especially Greenhouse Gas (GHG) emissions. However, most of RE power plants were small to medium capacity and could not continuously supply. Hence, they were not suitable for power based supply, just supplementary. In addition, a study of Energy Research Institute (ERI), Chulalongkorn University, indicated that if the PDP 2010 had been fulfill implemented, GHG emissions per unit electricity of Thailand would decrease from the present emissions of approximate 0.52 kg CO_2eq/KWh to approximate 0.45 kg CO_2eq/KWh by the year 2030 as shown in figure 1, while emission in the PDP2010 Revision 3 was expected to be 0.415 kg CO_2eq/KWh by the year 2030.

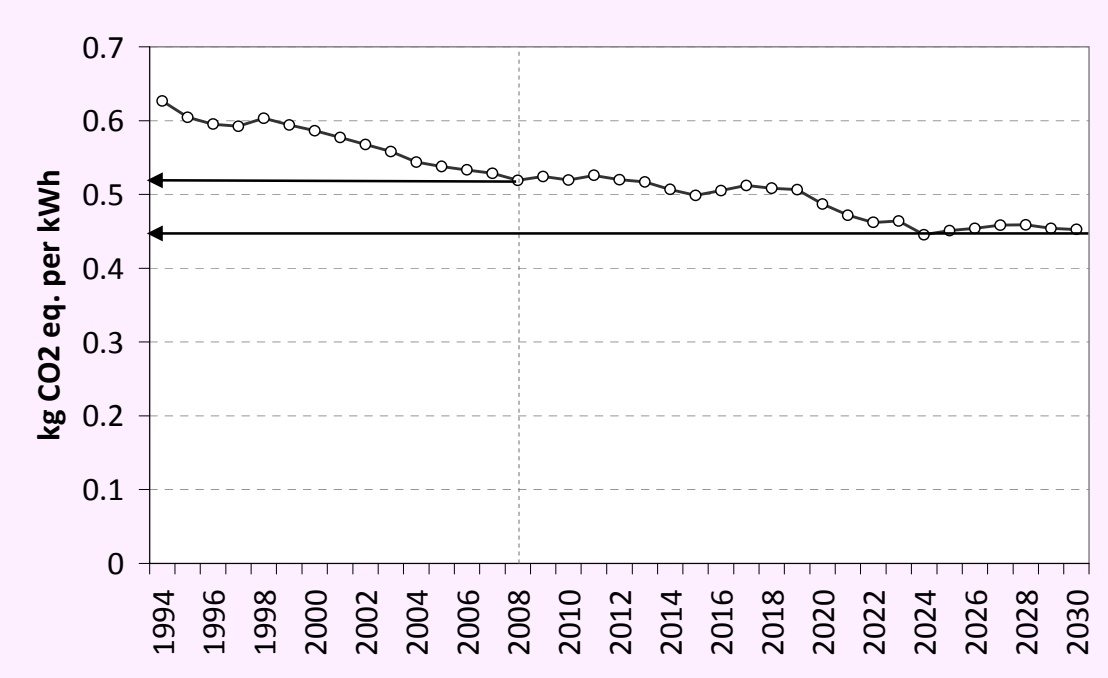


Figure 1: Thailand's GHG Emissions per Unit Electricity Outlook
Source: Energy Research Institute, Chulalongkorn University, 2010

In the global scenario, the Working Group III Special Report on Renewable Energy Sources and Climate Change Mitigation (IPCC, 2011) indicated that renewable energy was a key factor to reduce GHG emission and climate change impacts in both developed and developing countries. The benefits on energy security, environmental friendly and human security were ambitious scenarios which needed to increase effectiveness of energy policies and technologies transfer. The limited practice for developing countries, the most vulnerability group of climate change impacts was the high price of initiative renewable energy. Although it was decreasing trend in fact, the huge investment budget had been inaccessible in some. Hence, to achieve emission reduction, it needed to have both international and national integrated energy policies.

Certainly, trend of renewable energy has directly affected to ASEAN's energy policy. ASEAN Power Grid has been one of the intergovernmental targets of efforts and activities to get a closer reach to agree aspiration goal on reducing regional energy intensity of at least 8% by 2015 (based on 2005 levels), and the collective target of 15% of total installed power capacity from renewable energy sources by 2015. The Ministers has also agreed to consider a higher level of commitment in terms of energy intensity reduction and installation of renewable energy beyond 2015 in reference to other international and regional commitments (AMEM, 2011). Thailand's Alternative Energy Development Plan (AEDP 2012-2022) has promoted production and consumption of renewable energy by setting a challenge target of increasing alternative energy share up to 25% by the year 2022. Therefore, it provides an opportunity for Nakhon Si Thammarat Province to increase renewable energy development, and initiate a bottom-up planning for provincial power management to fulfill national Power Development Plan.

To fulfill the national PDP2010 and AEDP 2012-2022, majority of Nakhon Si Thammarat citizen, especially those in Sichon, Tha Sala, and Hua Sai districts, have called on the government to go green with renewable energy and also called for a Provincial Power Development Plan. To achieve a sustainable provincial power development plan, the province must keep balance of demand and supply of electricity in the province and the new supply would rely on local available sources, in particular renewable energy sources.

The national energy planning obviously indicated that the increasing electricity demand would be secured with additional power plants installation even fulfilled implementation of the national energy efficiency strategy. The government has attempted to diversify fuel mixes for electricity generation and people called on the government to go for renewable energy utilization as well as to enhance self-reliance and sustainable energy management in the province. Therefore, Provincial Power Development Plan with public participation since the first stage would become sustainable. This study aimed to survey potential renewable energy resources in the province, including proposing the model of Provincial Power Development Plan to Nakhon Si Thammarat province developing according to the relevant factors enhancing self-reliance energy management.

1.2 Research objective

1.2.1 To study electricity demand forecast in Nakhon Si Thammarat Province.

1.2.2 To review potential renewable energy resources for electricity generation in Nakhon Si Thammarat Province.

1.2.3 To develop a provincial power development plan in Nakhon Si Thammarat province to enhance self-reliance energy management for sustainability.

1.2.4 To study government support needs for promoting renewable energy in the province.

1.3 Research question

1.3.1 What is situation and outlook of electricity generation and consumption in Nakhon Si Thammarat province?

1.3.2 What are potentials of renewable energy resources for electricity generation in Nakhon Si Thammarat province?

1.3.3 What is renewable energy policy in Nakhon Si Thammarat province?

1.3.4 How to develop sustainable provincial power development plan in Nakhon Si Thammarat province?

1.4 Scope of Study

1.4.1 This study would focus on development of Provincial Power Development Plan in Nakhon Si Thammarat province, the Southern of Thailand.

1.4.2 The provincial power development plan would be focused on the potentials of renewable energy resources, energy supply system, energy consumption and energy management in the province.

1.5 Methodology

The study aimed to develop Provincial Power Development Plan of Nakhon Si Thammarat province to enhance its self-reliance energy management for sustainability. A conceptual framework based on Ana et al., (2010) on Energy Sustainability Indicators for Local Energy Planning. The study would focus on building of provincial renewable energy management and Provincial Power Development Plan of Nakhon Si Thammarat province. Research methods and data collection were following:

1.5.1 Collecting secondary data for the provincial energy management plan focusing on capacity of renewable energy, provincial energy system, energy consumption, as well as energy demand and management in the province.

1.5.2 Mapping the collected data in 1.5.1 with related energy information in the province.

1.5.3 In-depth interview with local government agency, provincial energy authority, business, agriculture, industrial, household and transportation sector, renewable energy project's community leaders, the opponent nuclear and coal communities as representative group of the province on issues of sustainable Provincial Power Development Plan.

1.5.4 In-depth interview with energy policy makers including local, provincial, and national levels.

1.5.5 Analysis of all data and information and then develop Provincial Power Development Plan to enhance its self-reliance.

1.6 Benefits

1.6.1 The forecast of electricity demand as well as potential of renewable energy resources is the needed fundamental information and critical leading to sustainable development of provincial power management.

1.6.2 Ultimate outcome of this study would be the development of provincial energy management plan, including provincial power development plan to cope with energy, environment, economic and social security.

1.6.3 Nakhon Si Thammarat province would become self-reliance energy management and not rely only on the centralized energy system. This management would help Nakhon Si Thammarat province enhance its effective renewable energy planning in the short-term, middle-term, and long-term for sustainable electricity generation, both on-grid and off-grid connection.

CHAPTER II
LITERATURE REVIEW

This section consisted of four major parts. The first part presented energy management for sustainability and the second part presented renewable energy policy leading to Thailand power development plan in the third part and with energy outlook of Nakhon Si Thammarat province at the last.

2.1 Energy Management for Sustainability

Since this research aimed to develop sustainable Provincial Power Development Plan, the following issues were surveyed:

2.1.1 Renewable Energy and Climate Change Mitigation

IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation presented an assessment of the literature on the scientific, technological, environmental, economic and social aspects of contribution of six renewable energy sources to climate change mitigation. It was intended to provide policy relevant information to governments, intergovernmental processes and other interested parties. The summary for policymakers provided an overview of the Working Group III Special Report on Renewable Energy Sources and Climate Change Mitigation (IPCC, 2011). Crossing the barrier of renewable energy development was the vital strategy for developing country to achieve the target of its supply and demand. Limited to access financial resources as barrier factor of technology research and development leaded to its investment was expensive and risk, the electricity price was biased with exclude non-market price economic and the true cost of social and environmental aspects and the poor information and poor government agency coordinators were not accessed to internal expertise in the renewable energy field development and were difficult to increase the renewable energy utilization in country (UN, 2000).

2.1.2 Potentials of Renewable Energy in ASEAN

Renewable energy sources were abundantly available in most of the member countries of ASEAN; however energy situation in 2005 indicated that electricity generation in most of the ASEAN countries depended on conventional sources of energy. Considering also the ever increasing fossil fuel prices and the fact that countries in ASEAN region were abundant endowed with renewable energy sources, the renewable energy technology would become more attractive options for electricity generation in the ASEAN region (Lidula et al., 2007). Focusing on dependent electricity generation natural gas was a key player for electricity generation in Thailand for years and its vulnerability from gas dependency (Thanawat et al., 2008).

Thailand experienced impacts of energy crisis due to dependency on imported fossil fuel and became a major obstacle for national development. To achieve energy security satisfy and the growing demand, Thailand had to review and analyze the relevant factors of energy security, including the review of overall electricity sector, expansion policy and power plant technologies, status of renewable energy in each sectors and barriers for renewable energy development in order to reduce vulnerability from gas dependency.

2.2 Renewable Energy Policy

Concerning various obstacles of renewable energy deployment in developing countries, a challenge framework of new sustainable energy pathway would be initiated. The ASEAN Ministers on Energy Meeting (AMEM, 2011) stated ASEAN guidelines to speed up the implementation of the ASEAN Power Grid and the reliability of operation; safety standards and procedures in generation and transmission; the reference model for investments in the interconnection projects; and issues concerning cross-border sales and transmission of electricity. However, most ASEAN developing countries were facing with various restricts of renewable energy development. In addition, to success on alternative power development plan and energy policy objectives, the policy as well as appropriate law and regulations needed to focus on sufficient energy supply, decreasing energy demand to reduce import dependency, CO_2 emissions, and also renewable energy share increasing (Chuenchom et al., 2011)

In case of Thailand, a new Thailand Alternative Energy Development Plan (AEDP 2012-2021), had been officially announced to increase renewable energy share of the total energy consumption up to 25% by 2021. Main objective of the AEDP was to reduce the fossil fuel import, support national renewable energy technology and local community renewable energy supply as green community. The road map to success AEDP emphasized community participation to produce and used renewable energy widely, incentive system and amendment of laws relevant to renewable energy development. If Thailand achieved this plan, it could reduce oil import up to 574,000 million baht and reduce GHG emissions up to 72 million tones, which could return to carbon credit income up to 23,000 million baht.

This allowed government to encourage renewable energy investment by awarding ‘‘adder tariff’’ or special purchasing rate higher than the price of power generated from mainstream fuels to private power producers depending on types of renewable source used. Both Small Power Producers (SPPs) and Very Small Power Producers (VSPPs) could receive the adder tariff when selling electricity on grid to EGAT or PEA. SPPs supplied electricity with generating capacity between 10-90 MW. whereas VSPP generated power on grid with capacity not exceeding than 10 MW. The adder tariff aimed to renewable energy supplementary as policy level. The SPPs has been continually supported according to Regulation for the Purchase of

Electricity of Small Power Producer 2007 that was declared by electricity utilities in April 9, 2007 (EPPO, 2009). Comparing the installed capacity as of March 2011 with the 15-year of AEDP it was found that only biogas was exceeding the target while the others, especially wind, micro hydro power and biomass were still small proportion though solar energy and municipal solid waste was nearly the target. However, if including the projects under consideration process, was found that all types of renewable energy meet the target (ERI, 2011).

Considering renewable energy target under AEDP 2012-2021, the installed capacity of various renewable energy sources would be accelerated with solar (2000 MW), wind (1,200 MW), micro-hydro (1,608 MW), bio-fuels (4,390 MW), and new energy innovation likes wave and geothermal energy (3 MW). Energy planning in Thailand depended on central energy planning as government policy; therefore, renewable energy policies in province certainly relied on the main policy. Considering in figure 3, it showed the linked renewable energy structure, measurement and institutional support from government. Renewable energy producers required following up the licensing and regulation offices its producer had requested or supported from financial support as loaning; whereas the governmental measurement had addressed adder of feed-in-tariff policy to increase the renewable energy investment in country.

2.3 Power Development Plan (PDP)

In Thailand, since 1982 Power Development Plan (PDP) had been a national level planning with developed and responsible by EGAT during the earliest stage. Then, Ministry of Energy had accredited the PDP sub-committee to review the PDP drafted; whereas EGAT played a main role to draft the PDP and submit to the sub-committee. Although the government gave an opportunity to public participation, there were some critics to the process and result of the generating selected; therefore, the process would increase public acceptance. Energy planning had been applying for National Economic and Social Development Plan for more than 40 years. Not only mentioned Thailand energy supply policy to provide energy for the fundamental needs, but also it stipulated for sufficient energy reserve as energy security, diversified energy sources to reduce risk and dependence, the lowest energy cost, clean energy with less pollution or dirty energy with polluted control technology and utilize the restricted national resources as the highest benefits (Pongthep, 2003).

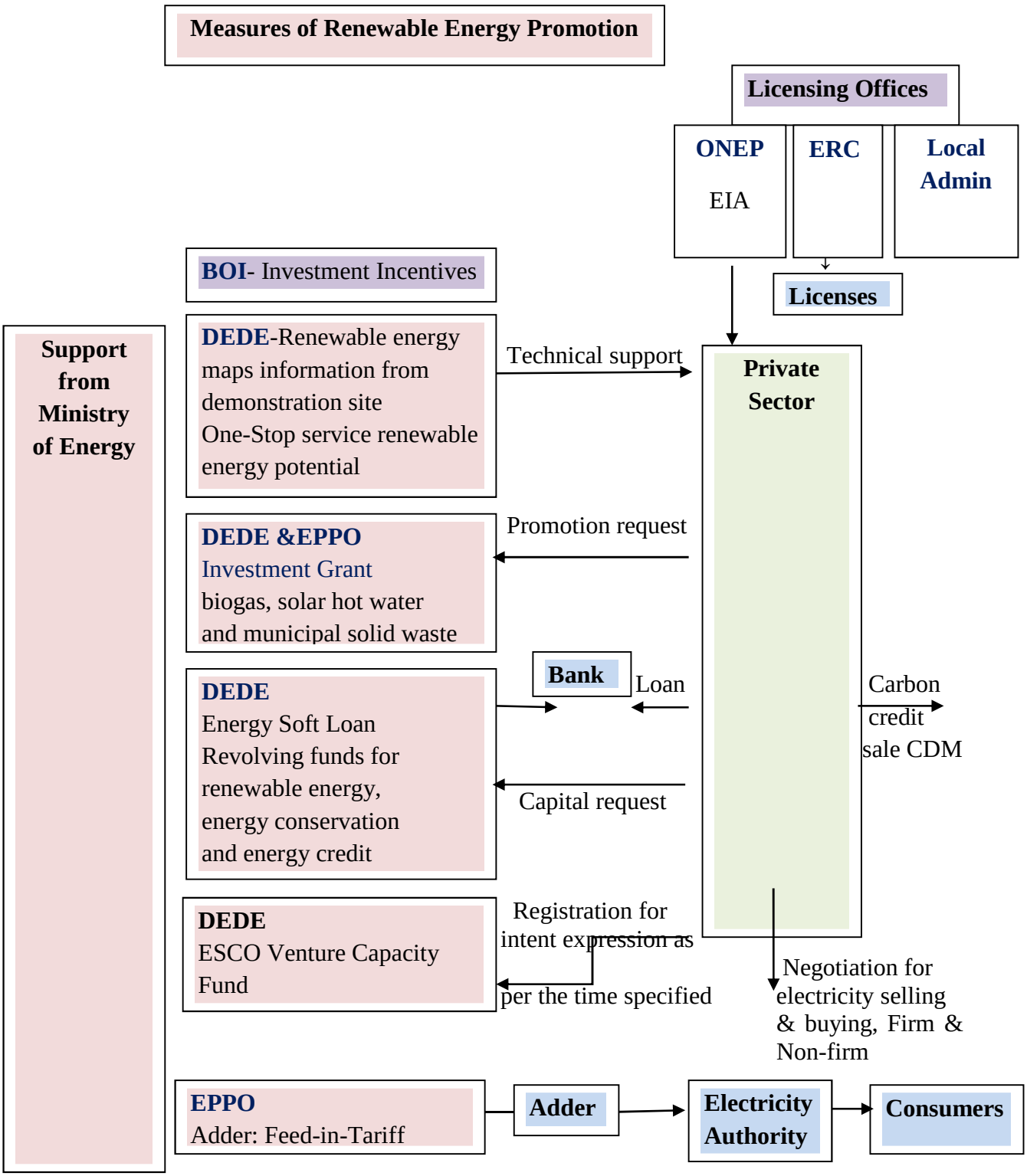


Figure 2: Measures of Renewable Energy Promotion
Source: Department of Alternative Energy Development and Efficiency, 2011

Energy planning evaluated energy demand, energy supply, and potential of alternative energy and energy efficiency to decrease energy consumption. Energy planning could be provided in national, provincial, and community levels which would be integrated for sustainable energy development plan. The national power development plan was developed only by a group of energy expert and policy makers so that it concentrated mainly on energy security needs. Therefore, sustainable Provincial Power Development Plan would become necessary. Being achieve sustainable Provincial Power Development Plan, it would be considered with policy indicators, including locally available finance schemes for energy efficiency and renewable energy, awareness raising campaigns on energy issues, public participation in energy-related policy-making and local authority advice and assistance to the citizens on energy issues.

The Power Development Plan 2010 and 2012 addressed the dependable factor of renewable energy as shown Table 3 which related to the applied number. This assumption was important to calculate the potential of renewable energy in PDP. Country needed to review and conducted more researches on the dependable factor of renewable energy so as to increase its of energy generating proportion however, its dependable factor connected to the amount of renewable energy projects development in nation as strong evidence on energy security to transfer for peak load supply (Chuenchom G., 2012).

Table 3: Dependable Factor of Renewable Energy of PDP 2010 and 2012

Renewable Energy	Dependable Factor (Percentage)
	PDP 2010
Biomass	40
Biomass (rice husk)	70
Biogas	21
Solar	21
Wind	5
Micro Hydro	40
Waste	20

Source: Energy Policy and Planning Office, 2010

The process of PDP started with the future energy forecast conducted by energy forecast sub-committee, which was the first important stage for accurate energy planning. The forecast theory mentioned about the element of good forecast covered the long period forecasting at least 20 years. The energy forecast included some more factors such as at least 15 percent of energy reserve, power plants decommissioning, the population increasing rate, and electricity consumer' behaviors, and so on. The energy demand of electricity utilities and the national economic growth were key factors to be considered for energy security due to the fact that Thailand had centralized energy system which was not stored and needed to be generated to feed whole country demand. The reliable figure of energy forecast reflected to energy security. If the forecast was lower than energy demand, it would be insufficiency energy supply and affected to the economic value. On the other hand, the extremely energy forecast between 1990 and 2011 shown in figure 4 had incidence of electricity expenditure to consumers and national power investment.

The PDP sub-committee consisted of EGAT experts which had knowledge, basic information and high experience to set a plan; however, transparency in discussion, design and deploy, especially public hearing and opinions process since attending at the first process of energy planning, would be realized. The discussion based on alternative plans would raise more public acceptance and transparency (ERI, 2011). Conducting National Power Development Plan 2010, the energy forecast based on load forecast from electricity utilities, Electricity Generation Authority of Thailand (EGAT), Metropolitan Electricity Authority (MEA) and Provincial Electricity Authority (PEA) by forecasting the future trend applying "Regression and Gross Domestic Product (GDP)" base to revise it up to date. The proportion of renewable energy to generate power relied on the previous 15 Years AEDP and SPP Cogeneration as the priority of the PDP planning which based on "Risk Aversion" to avoid the risk of renewable energy and when the "dependent capacity" was secure the renewable energy installed capacity would be adjusted (EGAT, 2009).

Thailand's previous load forecast based on 15 percent of the peak load forecasts yearly standard have affected to excessive power plant projection. Therefore, it needs to consider peak load, energy capacity, the limit of electricity generate, and the lowest cost of electricity producer as the concept of energy planning as the concept of energy planning for PDP. However, the weak point was uncertain result of energy information and ignored the period of power plant operating and efficiency.

In addition, there were many studies reported that Thailand PDP process lack of good governance in the decision making process, public participation and fair competition. The reports also suggested extending the period of each state in PDP process, least a month for each activity (Energy Research Institute., 2011).

Local energy planning was a concept of local energy sustainability, presenting in three dimensions of sustainable development consisting of policy level indicator which was connected to environmental, economic and social aspects (Ana et al., 2010). The consequence of its planning leads to decreasing carbon dioxide emission, air pollution and natural resources. For economic side, it was linked to benefit of local business growth in renewable energy development and green jobs creations, public participant, and well-being for relevant social factor.

To success in a long term energy planning, the indicator composed of the financial support for renewable energy would acknowledge people with energy promote public decision and local authority support on energy issue. It also needs to consider about development of technology to increase capacity of renewable energy in the province. Other policy adaptation applied for the proper provincial conditions covered infrastructure development, efficient energy and technology planning, energy consumption and supply for social expanding, economic growing and natural resources depletion (Mark et al., 2008).

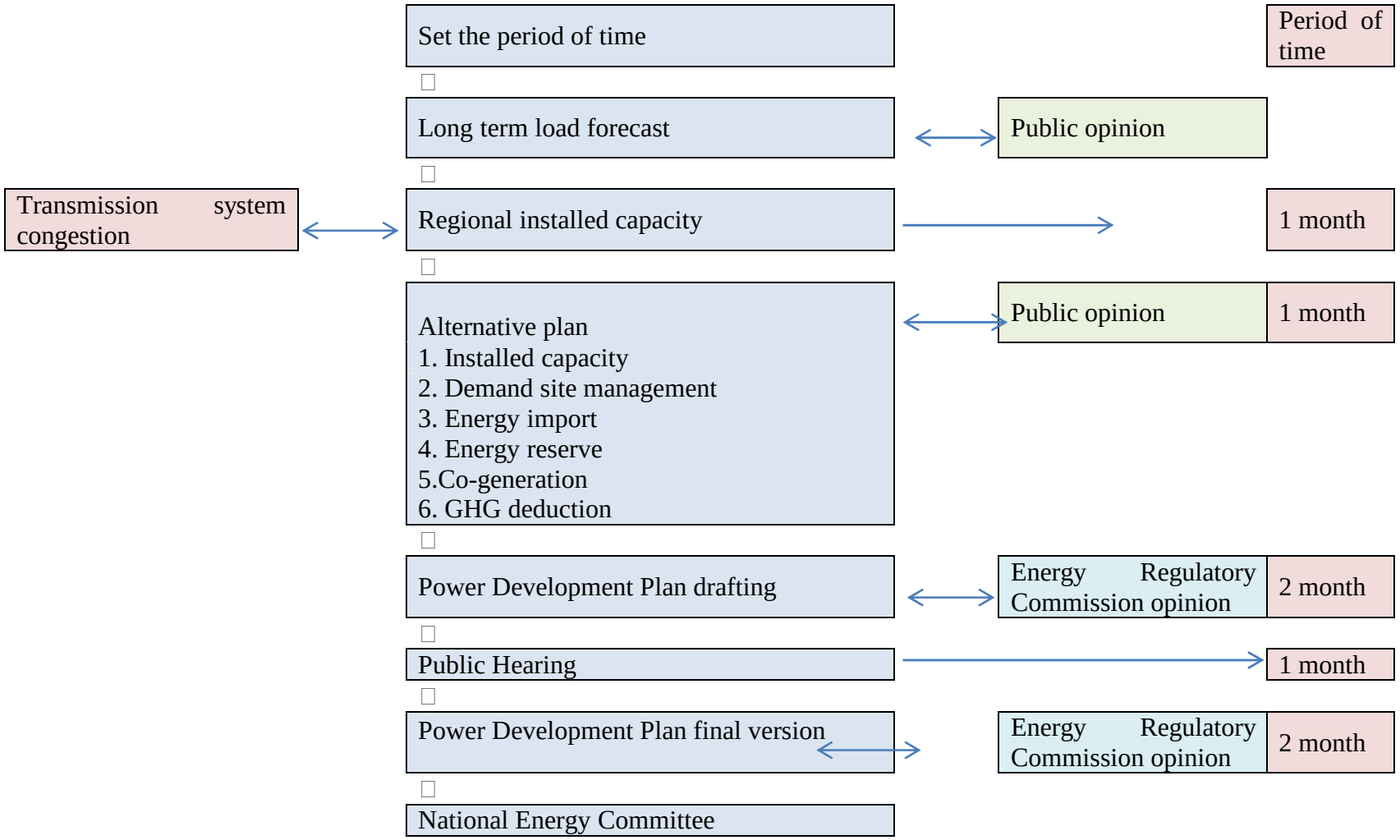


Figure 3: Proposed Process of Power Development Plan

Source: EGAT (2010), Energy Research Institution, Chulalongkorn University (2011)

2.4 Energy Outlook of Nakhon Si Thammarat Province

After reviewing the relevant national and provincial energy management, the study presented potential of renewable energy from diverse fuel sources in the province, capacity of electricity generating from renewable energy sources and a model for sustainable Provincial Power Development Plan. Nakhon Si Thammarat province was one of the fourteen southern provinces in Thailand. It covered 9,942,502 square kilometers which was the 16th largest of country. Its landscape consisted of mountain range in the middle; a long coastal line up to 225 kilometers that covered *six districts* including *Khanom, Sichon, Tha Sala, Muaeng, Pak Phanang,* and *Hua Sai* as well as basin-and-range. The population was annually continuous increasing up to 1,522,561 people in 2010 (Appendix A-A2) with the highest density in Mueang of totally 23 districts.

People livelihood mainly relied on agriculture, with GPP (Gross Provincial Product) growth of 139,905 million baht in 2010, which was the highest value compared to the total income from 2006 to 2010. However, if compared with all 14 southern provinces, the range of its GPP stood at 11 of the southern with GPP per capita was 80,816 baht annually. Trend of investment in province in the 2012 was exactly the same pattern with the previous time but it was significantly in renewable energy investment. The potential of renewable energy industry about wind farm, renewable energy process from palm oil industry to electricity and the Small and Medium Enterprise (SMEs) was tax-exempt up to 8 years benefits (Provincial Development Plan, 2011).

To achieve sustainable power development plan, Nakhon Si Thammarat province needed to keep balance of various concerns including energy security, electricity cost, environmental impacts, and people acceptance. Considering on the southern area of Thailand, it was reported that power plants installation in Southern was totally approximate 2,700 MW, of which 77 percent from natural gas combined cycle, 12 percent from Ratchaprapa dam at Surat Thani province and Bang Lang dam at Yala province, and about 11 percent of natural gas relied on Thai-Malaysia pipeline.

The renewable energy potential from the southern resources in 2009 was higher than 120,000 GWh per year, consisting of solar energy (87%), biomass (6.7%), wind energy (3.4%), hydropower (1.3%), and biogas (0.5%), respectively. In case of Nakhon Si Thammarat province, the highest renewable energy potentials was 15205, 829, 683 GWh/year for respectively solar power, biomass, and wind power. Moreover, there was diversely renewable energy namely biogas, micro hydropower, geothermal, and wave energy (Suwit P. et al.,2010).

Renewable electricity commercially generated in the southern was 24 percent of the total consumption about 536 GWh of 2,300 GWh in the south of Thailand. The highest potential of renewable energy was biomass with 1,000 GWh and 34 percent of hydropower. The highest provincial potential of renewable installation was Surat Thani with 912 GWh annual, Yala province generate renewable energy more than its provincial energy consumption and Krabi province was nearly reach target. Furthermore, Chumporn, Trang and Nakon Si Thammarat provinces were the considerably high potential of renewable energy development to be a majority of its energy supply in the future with potential of renewable energy was 17,088 GWh in 2009. Nakhon Si Thammarat province was the 2nd biggest province of southern part of Thailand.

It was subdivided into 23 districts and the districts were further subdivided into 165 sub-districts and 1,428 villages. The provincial energy demand in 2009 was 262.3 MW of total demand of 1,880 MW for 14 southern provinces of Thailand. The energy consumption in Nakhon Si Thammarat province became the 4th of southern provinces after Song Kla, Surat Thani and Phuket provinces as shown in figure 4.

It was reported that electricity consumption by sector in the province in 2003 was the highest in residential sector(47%), followed with industrial sector (23%), business and service (18%), government sector (6%), and agriculture (3%), respectively (Wilailak, 2005). From the energy supply side, PEA takes responsibility for energy supply in province with five substations as shown in figure5. There are 5 electricity substations including Nakhon Si Thammarat 1, Nakhon Si Thammarat 2, Khanom, Thung Yai, Thong Song and Pak Phanang with line distribution to support more than million citizens.

Furthermore, the status of energy applied as of August 30, 2011 reported that 401,221 of totally 406,349 households could access to electricity on-grid supply whereas 2,299 households used power from solar cell and 2,829 households (0.696%) stayed without electricity, of which mostly were new group from the hill and the new land explorers, significantly at Nop Phitam district including those homeless permanent (Appendix B3).

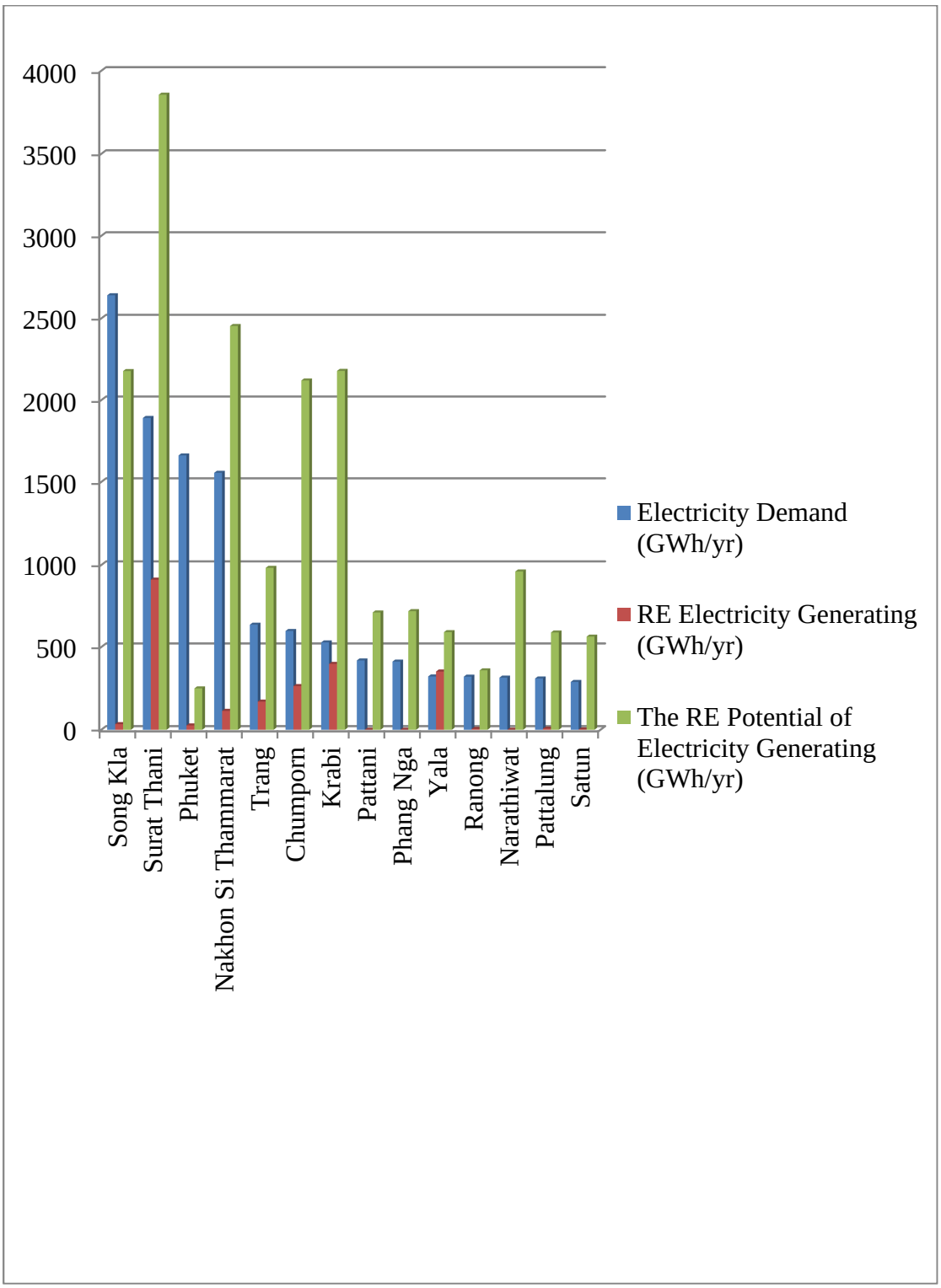


Figure 4: Southern Energy Consumption and Installed Renewable Capacity in 2009

Source: Suwit P. et al., 2010

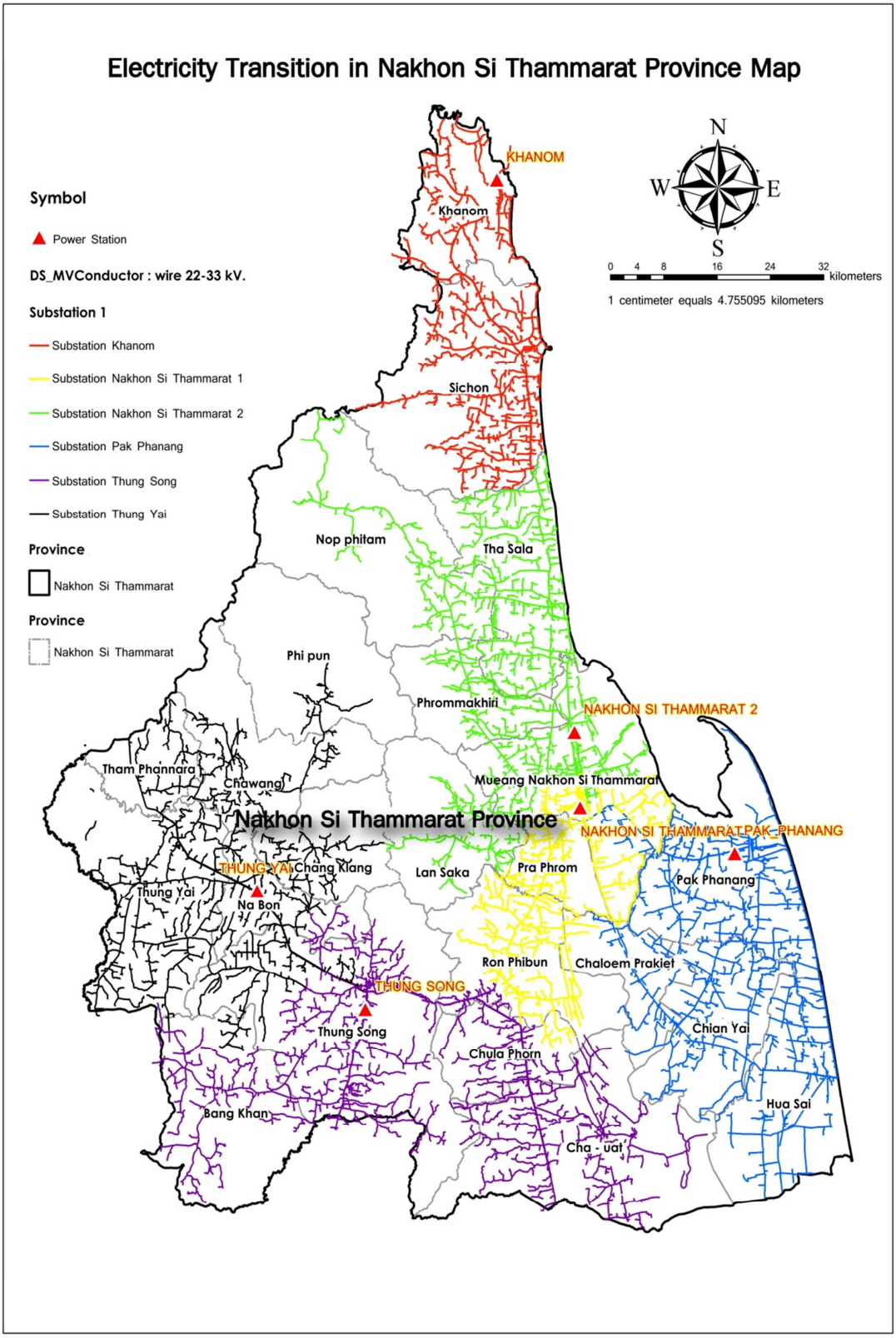


Figure 5: Electricity Substation in Nakhon Si Thammarat Province
Source: Nakhon Si Thammarat Provincial Electricity Authority, 2011

Since 2008 to 2011, energy demand in Nakhon Si Thammarat had fluctuated at respectively 256.2 MW., 262.3MW., 263.9 MW., and 210.2 MW; whereas the future energy forecast was mostly increasing every year. The average energy demand prediction was raising about 21 MW annually and would reached to 647 MW in the next 20 years which was concordant with the percentage of GPP booming in the future. The energy forecast of province presented in figure 6 with detailed load forecast in electricity substation transit, was accounted by working together with Nakhon Si Thammarat Provincial Electricity Authority, National Committee of Energy Forecast which was responsible for National Power Development Plan and National Grid implementation. In fact, it had never corrected figure for planning in the future in term of unstable and risk assessment which was difficult to cover over it. It was fundamentally important process before the Power Development Plan endorsement.

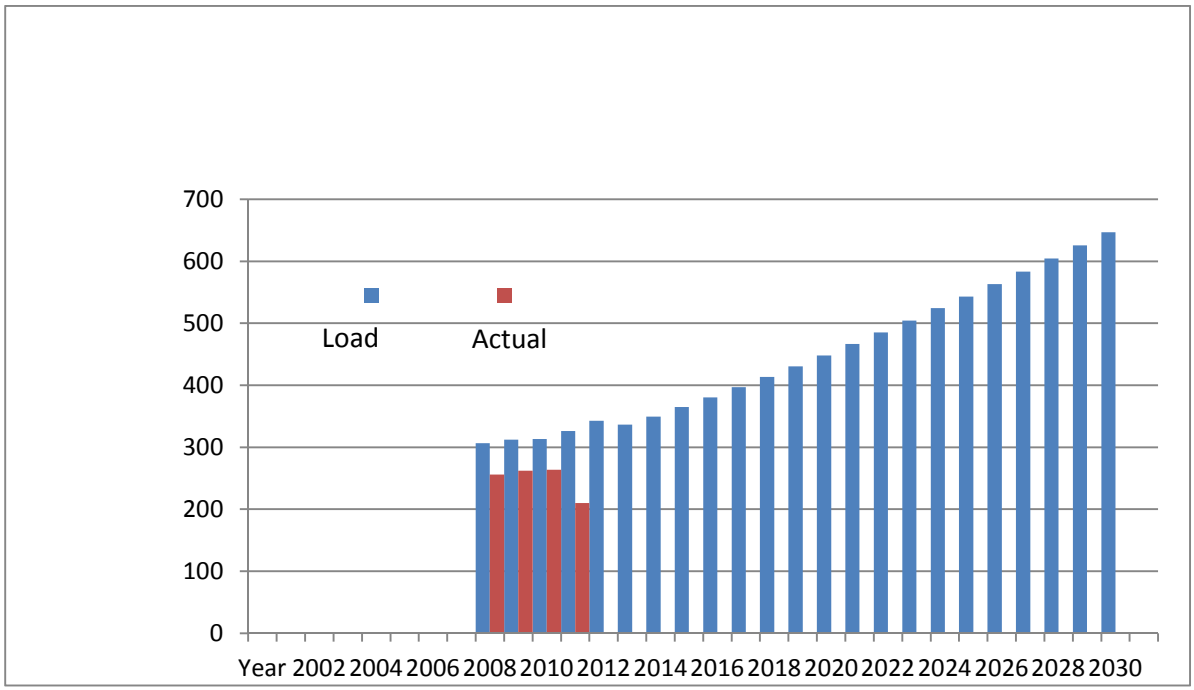


Figure 6: Energy Forecast at Electricity of Nakhon Si Thammarat Province
Source: Nakhon Si Thammarat Provincial Electricity Authority, 2012

Considering provincial energy consumption, in figure 6 shown that its huge proportion was industrial, residential, government and non-government sector respectively; whereas the agricultural pumping was the least amount of energy demand in every year and the temporary electricity unit was the second of the last list. In contrast, if considering in separated sector, the ultimate energy demand came from households level obviously identify in residential energy consumption more than 50 kWh. For small business, it referred to applying energy for running the business and /or having a business with the household was gradually rise and then down to the

lowest point in 2011. The medium business sector was the second key player behind the highest residential which used electricity more than 50 kWh each year. The third of group was belong to a large business sector in province which was the group of agricultural and construction industry process. In December 2011, the top ten of highest energy consumption in province was directly connected to rubber industry, construction industry, cement industry, university, department store, seafood and aquatic animals export, plastic industry and hospital. Service business, government and non-government, temporary electricity unit were the energy consumption group from the last one shown in figures 7 and 8.

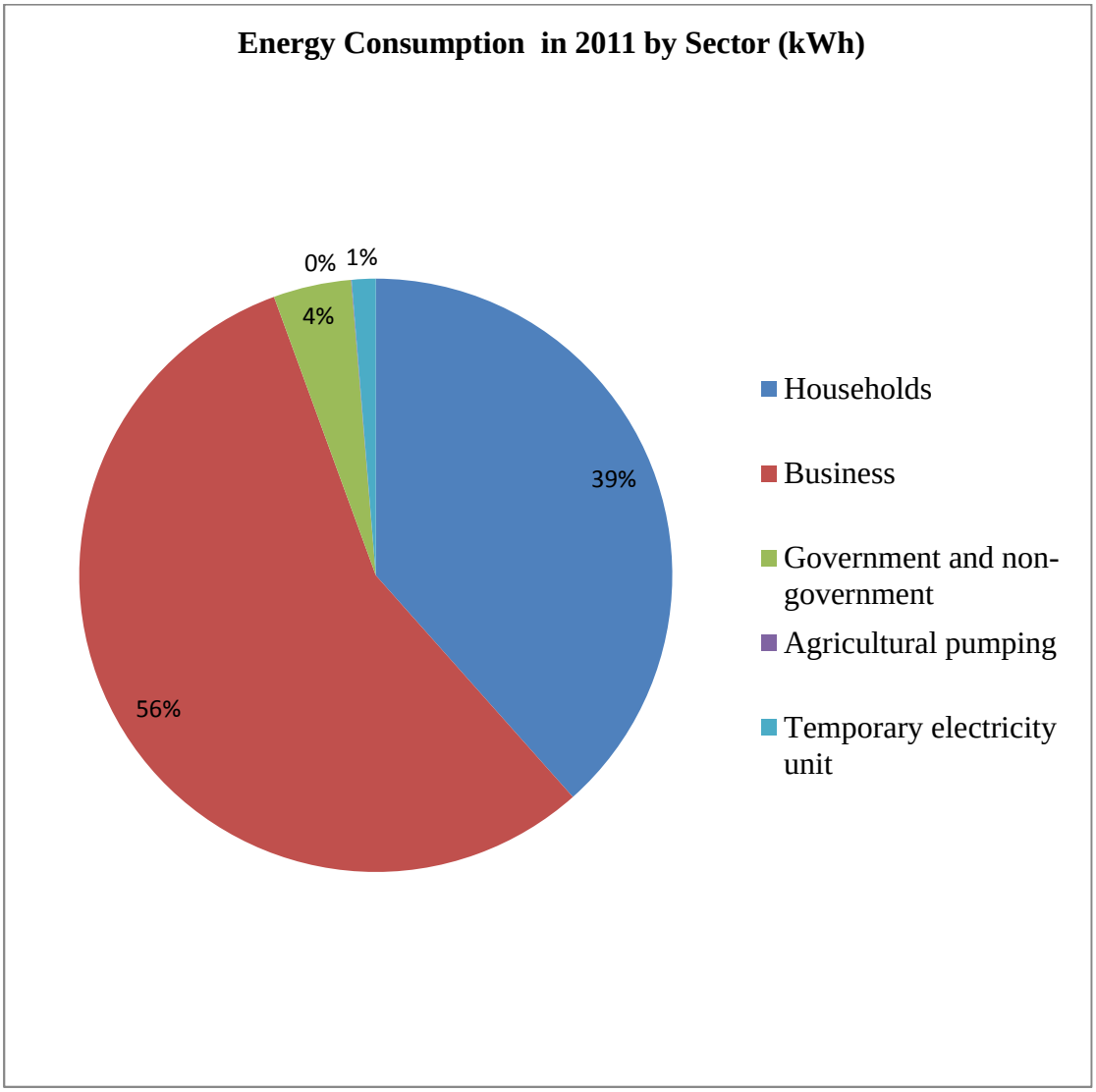


Figure 7: Energy Consumption by Sector at Nakhon Si Thammarat in 2011
Source: Modified from Nakhon Si Thammarat Provincial Electricity Authority, 2012

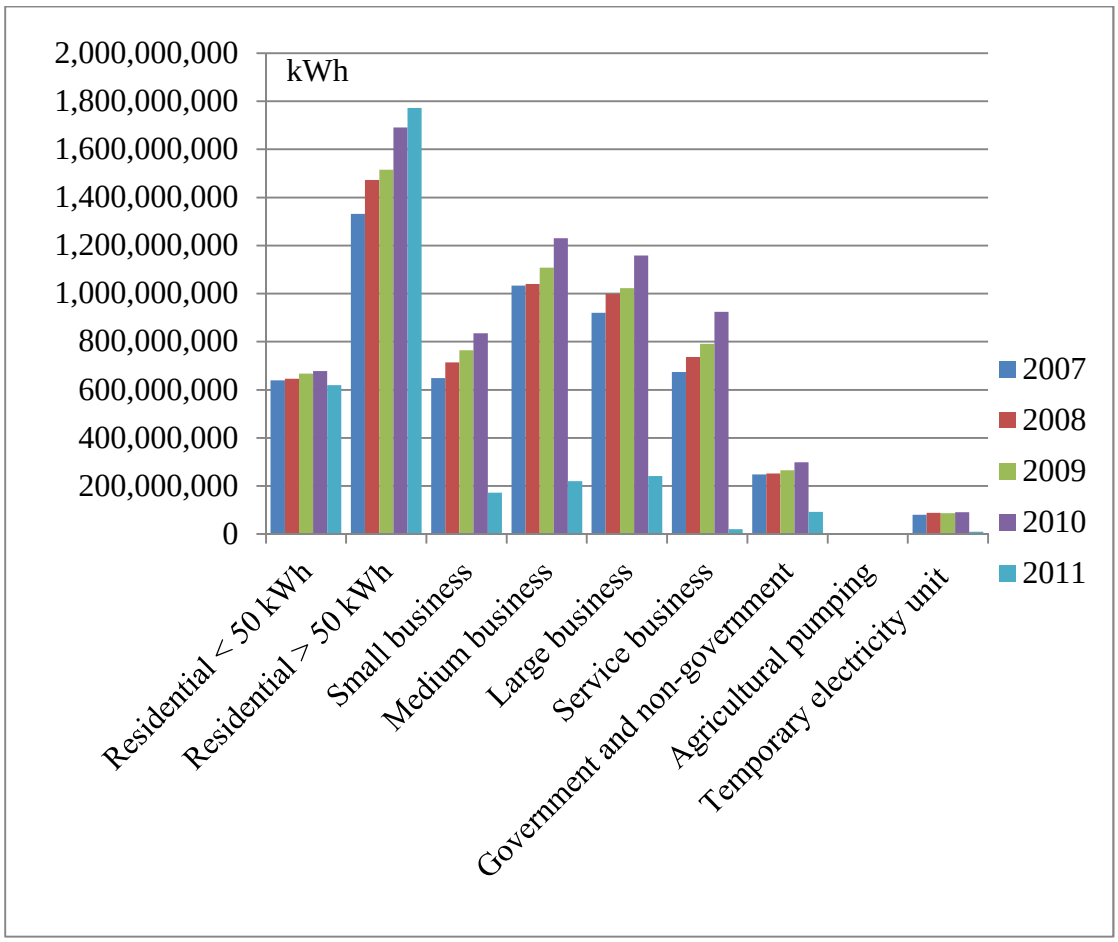


Figure 8: Energy Consumption by Sector at Nakhon Si Thammarat in 2007-2011
Source: Modified from Nakhon Si Thammarat Provincial Electricity Authority, 2012

Considering description, the peaking night load of provincial energy consumption shown that during 7-8 pm. people had been plugged in electricity at the same time running the highest energy demand in totally six electricity substations. However, peak day load reflected electricity consumption behavior in the different period; where Nakhon Si Thammarat 2 electricity substation had peak energy supply in the afternoon between 1.30 -3.30 pm. and Pak Phanang electricity substation peaked in the morning at 8.30-9.30 am. However, Thung Yai had diversified peak time compared to others. Peak load was an important data for provincial energy planning especially for the reason of energy security avoiding power failure which took multiplied of cost damage than usual (Provincial Electricity Authority, 2012).

2.4.1 Power producer of Nakhon Si Thammarat Province

The energy industrial structure in Thailand was an Enhanced Single Buyer Model by government supporting with IPPs, SPPs and VSPPs taking part in energy producer system according to the government quota under EGAT, MEA and PEA agreement. For SPPs purchasing, there was either Firm or Non-Firm contracts with different conditions. The firm contract, having project time covered up to 20-25 years, would receive Energy Payment (EP) and Availability Payment (AP); where the power plant would gain if the plant generated electricity according to EGAT orders; however, EP was the payment by private electricity producer purpose which reflected the market price of producer, maintenance depended on the agreement's condition. Meanwhile, the non-firm contract had a contract for 5 years and continually only EP benefit with calculation by the electricity purchasing without EGAT ordered to generate. So SPPs investors' analyzed that the factor and investment theory based on Net Present Value, Pay Back Period, and Internal Rate of Return (Kunteera et al., 2011)

Considering the electricity generating projects of Nakhon Si Thamarat province in Table 4 the high figure stood at 860.353 MW which was excessive compared to the provincial energy demands. Nonetheless, the national centralization system forced the electricity generating in province transit electricity to national grid so as to support others provinces. So the electricity produced here was not supplied for only Nakhon Si Thammarat boundary the invisible electricity flowed to feed other communities so far. Therefore, in 2011, the capacity of provincial electricity generating of renewable energy would be actually projected at 42.253 MW when excluded the natural gas power plants supply form Palit Fai Fa Khanom Co., Ltd. account to 818.1 MW. Increasing renewable energy utilization was a key point to reduce national and provincial energy supply energy regulatory permission needed to be applied and approved as a quick procedure with high standard. The awareness of barriers of renewable energy produces in the province such as apparently policy support, financial support and other logistics. And one important thing was to raise people awareness of energy efficiency and educated the potential of provincial renewable energy which powered and impelled to self-reliance of energy supply in the future.

Table 4: IPP, SPP, VSPP Purchasing Status at Nakhon Si Thammarat Province in 2011

No.	Company	Site <District>	Plant	Fuel	Installation Capacity (MW)	Load Capacity (MW)	Substation and Grid	Quota Approval	PPA	SCOD	COD
1	Power Electrical Co.,Ltd.	Hua Sai	Wind Turbine	Wind	0.05	0.05	Pak Phanang F4				
2	Burtan Technical Solution Co.,Ltd.	Pak Phanang	Wind Turbine	Wind	0.048	0.048	Pak Phanang F4				
3	For Life Tech Co.,Ltd.	Pak Phanang	Wind Turbine	Wind	1.05	1.05	No More Grid Quota				
4	Kaset Loomnam Co.,Ltd.	Pra Phrom	Gas Engine	Biogas	1	0.99	Nakhon Si Thammarat1 -F3				
5	SCG Windenergy Co.,Ltd.	Hua Sai	Wind Turbine	Wind	9	8.965	Pak Phanang F4				
6	Tung Sung Green Co.,Ltd.	Thung Yai	Steam Turbine	Palm Empty Bunches	9.5	9.2	Thung Yai F8				
7	Palang Ngan Todtan Thung Song Co.,Ltd.	Thung Song	Gasification	Solid Waste	0.3	0.3	Thung Song F9				19/2/10
8	Palit Fai Fa Khanom Co.,Ltd.	Khanom		Natural Gas		678	Khanom				6/19/96
9	Department of Alternative Energy	Hua Sai	Wind Turbine	Wind	0.25	0.25	Pak Phanang F4	3/31/08	6/17/08		
	Development and Efficiency										
10	Master Power Co.,Ltd.	Hua Sai	Wind Turbine	Wind	0.8	0.8	Pak Phanang F4	12/20/07	2/29/08		12/15/08
11	Ka Ne Ya Co.,Ltd.	Hua Sai	Wind Turbine	Wind	1	1	Pak Phanang F8	4/26/10			
12	Palit Fai Fa Se Kleaw Co.,Ltd.	Muaeng	Stream Turbine	Solid Waste	9.6	8.4	Nakhon Si Thammarat	2/1/08	4/10/08	1/31/10	
13	Power Electrical 2 Co.,Ltd	Hua Sai	Wind Turbine	Wind	1	1	Pak Phanang F8	4/26/10			
14	Power Electrical 1 Co.,Ltd.	Hua Sai	Wind Turbine	Wind	1	1	Pak Phanang F8	4/26/10			
15	PakPlaning Development Consultant Co.,Ltd.	Hua Sai	Wind Turbine	Wind	1	1	Pak Phanang F4	5/6/10			
16	Rong Fai Fa Chevamoul Thung Song Co.,Ltd.	Thung Song	Gas Engine	Solid Waste	0.32	0.3	Thung Song F9	12/7/07			4/9/10
17	S.P.O Agro Industry Co.,Ltd.	Sichon	Steam Turbine	Agri Empty Bunches	8.4	6.9					
18	I.Q.D Engineering Group, Ltd.	Pak Phanang	Wind Turbine	Wind	1	1	Pak Phanang F8	12/11/08			
19	Palit Fai Fa Khanom Co.,Ltd. < Plant1>	Khanom		Natural Gas		69.9	Khanom				6/19/96
20	Palit Fai Fa Khanom Co.,Ltd. <Plant2>	Khanom		Natural Gas Crude Oil		70.2	Khanom				6/19/96
	Total					**860.353**					

Sources: Modified from Energy Regulatory Commission (ERC), 2012

2.4.2 Potential of Renewable Energy of Nakhon Si Thammarat Province

Nakhon Si Thammarat province had employed renewable energy database of the Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy and a study of the potential of renewable energy by academic universities in Southern. However, its information from both sides was not exactly the same figure which leaded province's need to conduct the fundamental energy database exploring to the future Provincial Power Development Plan. The renewable energy database which had been conducted from the central energy officers was update reported in 2010. In Thailand's Alternative Energy Situation reported the potential of renewable energy in the province which continually increased in each source. However, this research reviewed the other potential of provincial renewable energy which was linked to lead the further Provincial Power Development Plan. Besides the governmental energy officer's report, it needed to find out the various studies of energy raw materials in province which reflected to how much the potential of renewable was.

2.4.2.1 Biomass

Although Nakhon Si Thammarat mainly relied on agriculture sector to enhance provincial economic growth, the proportion of agricultural residues used for electricity generation was small scales both community and private investor. For example, 9.5 MW of biomass power plant at Thung Yai district and 8.4 MW at Sichon district, both of which used palm empty bunch as main fuels. Some local companies also employed part of rubber tree to generate electricity at Tung Sung district. However, potential of biomass agricultural wastes in the south of Thailand were less than other regions, and nearly all had been used (Thaneat et al., 2007). Biomass energy in the province depends mainly on the plentiful production of rice, palm, and rubber tree; whereas coconut and groundnut were not much abundant to supply for electricity generation. The barrier of biomass supply in province that was needed to be considered was how to manage risk and impact of raw materials insufficiency supply. First, flooding crisis exhibits impacted in the province every year. It was reported in 2011 by Nakhon Si Thammarat Disaster Prevention and Mitigation that its damage cost up to 4,446,647,911 million baht between 2007 and 2011. The statistic shown that flooding crisis during the period had happened more frequently than the past and also influenced to planting and harvesting season crops which consequently impacted on either food security or energy security in case of using biomass raw materials.

Price in market also shared influence on the trend of agricultural raw materials availability. The higher price of the crop residues tended to be more available for electricity generation. Paddy residues, for instance, had become more popular for biomass power plants and the price had been continuously increasing. Therefore, market mechanism and penetration was the main factors for biomass growing in the province (Provincial Agriculture Office, 2012).

In case of palm residues, using frond, fiber, shell, and especially empty bunches as fuels for power generation had been increasing whereas it was previously used as palm fertilizer. Yearly agricultural production in the province as showed in Tables 5-7 indicated staple of rubber tree, rice, and palm, respectively.

Table 5: Rice Planting Production between 2007 and 2011 (kg)

District	2007	2008	2009	2010	2011	Total (kg)
Mueang	16,298,250	32,198,325	18,721,790	27,281,913	23,589,870	118,090,148
Cha - uat	32,753,100	29,093,750	24,625,650	7,419,969	14,819,980	108,712,449
Chawang	3,436,560	6,510,000	563,068	915,765	1,688,610	13,114,003
Chian Yai	45,268,650	42,340,000	57,794,940	48,657,324	43,188,350	237,249,264
Hua Sai	83,565,339	78,478,920	65,917,165	73,088,876	53,533,460	354,583,760
Lan Saka	1,020,000	1,656,330	1,085,934	560,847	718,050	5,041,161
Ron Phibun	21,051,100	18,340,875	8,922,750	5,843,763	4,922,340	59,080,828
Sichon	10,960,875	11,832,240	9,710,820	2,580,376	2,490,250	37,574,561
Tha Sala	13,797,915	15,081,975	12,987,636	7,361,898	5,790,600	55,020,024
Thung Song	3,590,800	3,549,910	1,208,900	1,108,000	792,880	10,250,490
Thung Yai	89,375	161,700	94,916	526,110	1,909,040	2,781,141
Phi pun	646,000	704,255	285,912	397,160	192,880	2,226,207
Phrommakhiri	6,436,000	6,690,600	5,426,960	2,367,993	2,785,950	23,707,503
Phrommakhiri	6,436,000	6,690,600	5,426,960	2,367,993	2,785,950	23,707,503
Na Bon	7,433,250	2,307,750		80,351	130,530	9,951,881
Bang Khan	-	-	-	-	13,980	13,980
Pak Phanang	16,270,100	33,925,000	37,204,650	44,266,277	26,775,430	158,441,457
Tham Phannara	3,276,000	3,126,310	777,896	223,001	317,640	7,720,847

Table 5: Rice Planting Production between 2007 and 2011 (kg) (Cont.)

District	2007	2008	2009	2010	2011	Total (kg)
Chula Phorn	5,850,000	7,676,250	5,654,880	5,135,032	7,056,220	31,372,382
Pra Phrom	4,536,220	6,525,000	7,621,152	3,735,979	5,379,930	27,798,281
Nop phitam	1,208,250	952,425	255,000	229,558	96,480	2,741,713
Chang Klang	126,000	174,300	84,000	8,100	14,100	406,500
Chaloem Prakiet	21,275,260	24,658,920	25,641,220	21,810,058	18,639,520	112,024,978

Source: Provincial Agriculture Office, 2012.

Table 6: Palm Planting Production between 2007 and 2011 (kg)

District	2007	2008	2009	2010	2011	Total (kg)
Mueang	1,238,000	1,912,000	16,656,900	20,613,845	12,247,494	52,668,239
Cha - uat	1,368,375	3,442,775	5,322,225	12,969,660	28,283,250	51,386,285
Chawang	770,990	770,990	1,141,450	1,196,240	1,378,860	5,258,530
Chian Yai	1,946,835	9,501,300	12,358,500	19,070,790	22,111,368	64,988,793
Hua Sai	165,585	9,148,250	4,655,055	5,424,650	33,950,634	53,344,174
Lan Saka	-	-	30,900	40,050	295,665	366,615
Ron Phibun	1,830,122	9,377,768	10,532,845	13,176,105	71,973,055	106,889,895
Sichon	48,987,935	50,120,100	56,130,600	74,228,250	68,547,808	298,014,693
Tha Sala	4,967,400	4,967,400	10,653,900	10,969,250	9,095,681	40,653,631
Thung Song	26,362,600	26,362,600	4,362,600	6,013,550	9,032,460	72,133,810
Thung Yai	26,359,320	26,425,800	31,117,320	32,554,275	34,734,252	151,190,967
Phi pun	910,800	910,800	85,050	881,125	642,664	3,430,439
Phrommakhiri	-	-	115,500	137,190	2,278,584	2,531,274
Na Bon	3,847,800	4,894,550	3,656,250	1,279,660	4,757,600	18,435,860

Table 6: Palm Planting Production between 2007 and 2011 (kg) (Cont.)

District	2007	2008	2009	2010	2011	Total(kg)
Bang Khan	12,992,000	12,992,000	13,537,685	14,643,530	11,903,549	66,068,764
Pak Phanang	373,635	3,478,000	5,865,200	7,293,900	12,145,023	29,155,758
Khanom	3,673,600	6,896,750	7,094,640	14,193,615	15,500,124	47,358,729
Tham Phannara	2,835,000	2,572,500	3,307,500	3,633,400	5,614,035	17,962,435
Chula Phorn	110,000	170,000	436,800	937,400	505,250	2,159,450
Pra Phrom	1,555,500	5,082,750	8,035,050	8,484,750	9,055,758	32,213,808
Nop phitam	225,000	225,000	699,750	942,900	586,002	2,678,652
Chang Klang	1,100,000	1,100,000	1,291,400	1,636,740	1,966,104	7,094,244
Chaloem Prakiet	3,587,920	14,131,260	23,227,312	14,270,685	12,135,993	67,353,170

Source: Provincial Agriculture Office, 2012

Table 7: Rubber Planting Production between 2007 and 2011 (kg)

District	2007	2008	2009	2010	2011	Total (kg)
Mueang	2,233,730	1,837,175	2,584,680	2,105,250	3,593,574	12,354,409
Cha - uat	19,203,500	17,401,725	23,435,550	17,401,725	17,669,696	95,112,196
Chawang	48,166,485	34,791,960	38,299,525	27,595,575	21,151,230	170,004,775
Chian Yai	172,830	161,500	213,750	190,950	525	739,555
Hua Sai	210,240	229,140	299,155	229,140	1,047,816	2,015,491
Lan Saka	7,383,348	5,613,060	5,420,025	4,612,695	6,299,168	29,328,296
Ron Phibun	5,191,390	4,920,240	6,860,250	5,587,725	5,758,675	28,318,280
Sichon	8,277,776	8,865,150	12,302,025	9,284,730	12,112,260	50,841,941
Tha Sala	15,867,945	11,755,920	13,292,125	11,773,440	10,999,680	63,689,110
Thung Song	36,787,565	28,231,000	43,169,670	33,814,795	76,169,215	218,172,245

Table 7: Rubber Planting Production between 2007 and 2011 (kg) (Cont.)

District	2007	2008	2009	2010	2011	Total (kg.
Thung Yai	74,925,080	45,533,125	69,662,775	50,676,000	31,869,735	272,666,715
Phi pun	6,141,000	7,296,100	10,775,280	10,791,090	11,273,350	46,276,820
Phrommakhiri	2,308,425	2,740,440	3,361,890	2,868,770	5,514,432	16,793,957
Na Bon	22,089,375	16,157,475	15,979,950	15,803,100	9,255,375	79,285,275
Bang Khan	39,136,275	37,491,055	46,688,985	30,715,545	33,080,594	187,112,454
Pak Phanang	-	-	-	-		-
Khanom	5,429,340	5,500,140	6,256,800	5,946,000	1,102,656	24,234,936
Tham Phannara	18,056,265	13,467,570	12,833,385	12,433,750	10,465,227	67,256,197
Chula Phorn	13,097,750	11,383,175	12,559,190	10,586,170	7,448,060	55,074,345
Pra Phrom	1,200,042	1,057,275	1,623,920	1,448,550	970,875	6,300,662
Nop phitam	14,260,260	12,781,000	12,506,500	11,694,960	21,028,056	72,270,776
Chang Klang	9,694,850	8,181,225	11,071,395	8,330,625	19,313,802	56,591,897
Chaloem Prakiet	-	-	-	-	163,540	163,540

Source: Provincial Agriculture Office, 2012.

2.4.2.2 Biogas

Biogas can be produced from various sources of organic compounds like agricultural wastes, animal farm waste water, and organic industrial waste water. Number of industries in the province as shown in Table 8 indicated only potential in 3 industries, i.e. agricultural industry, food industry, and rubber industry. Regarding to biogas from animal farm waste water, was indicated the much lower potential than agricultural wastes in the province.

Table 8: Number of Animals for Biogas Evaluation

Year	Buffalo	Swine	Cattle	Chicken	Duck	Biogas Capacity
2009	5,798	695,945	161,560	4,237,370	375,559	11.22
2010	3,052	187,361	136,655	3,324,258	683,014	7.64
2011	3,475	261,412	161,232	5,271,111	1,043,706	9.58

Source: Nakhon Si Thammarat Livestock Office and Nakhon Si Thammarat Power Office, 2012

Table 9: Potential of Biogas from animal wastes (ktoe)

Year	2003	2004	2005	2006	2007	2008
Cattle	2.37	1.82	3.34	3.49	3.91	3.29
Buffalo	0.14	0.06	0.11	0.23	0.25	0.41
Swine	1.74	0.78	1.46	1.01	1.91	1.57
Chicken	0.53	0.2	0.36	0.1	0.46	0.29
Duck	0.04	0.02	0.03	0.03	0.04	0.03
Total	4.82	2.88	5.3	4.86	6.57	5.59

Source: Nakhon Si Thammarat Power Office, 2012

2.4.2.3 Municipal Solid Waste (MSW)

MSW generated in Nakhon Si Thammarat province has become the 12th of national waste capacity, which accounted to more than 100 tons per day (DEDE, 2004). Waste generation in the province was increasing up to nearly 300 tons per day as shown in Table 10. However, it needed to be excluded 32,687,391 kg during January - August 2011 and 44,552,060 kg in 2010 with contracts Surat Thani to dump waste in Nakhon Si Thammarat province. The contract had been canceled since September 2011 when Nakhon Si Thammarat Municipality had a new lord mayor. Waste management in the province is to collect and landfill, while some sub-district municipality manages by opens dumping. In fact, Municipality takes responsibility for provincial waste management with capacity more than 100 thousand tons annually in the last 3 years statistic with the methods of landfills and open dumping. However, it was under the Municipality planning for Refuse Derived Fuel (RDF) project by separating combustible wastes and used to generate heat or electricity.

MSW in the province exhibited a huge problem to health and environmental impact due to lacking public awareness to separate waste before dumping. It was the burden of Nakhon Si Thammarat municipality and local government, especially sub-district level which spent the budget for dumping solid waste at open land areas at 0.25 baht per kilogram. The solid waste was generally composed of organic wastes higher than 50 percent, and left with recyclable wastes and non-organic wastes. Refuse Derived Fuel (RDF) technology can produce identified solid fuel with high heating value, convenient transportation, and compound with other fuel sources to supply power plants and factories. However, the province needs to make people aware on energy waste management, technology development acceptance, integrated local and provincial authority office working together with the long term planning, the central and provincial policy to have a strengthen waste energy producer and financial support apart from adder. The final thing is unofficial waste from some local communities and some sub-districts do not carry the wastes to municipal authority to dump it all. Therefore, there is no certainly figure about the amount of each kind of wastes. If solid

waste from all households, communities, and local governments had a same pattern of management, it would create values to save the provincial budget for waste management, increasing renewable energy resources, while reducing environmental and health impacts.

Table 10: The Amount of Municipal Solid Waste in Nakhon Si Thammarat Province during 2005 - 2011 (kg.)

Year	2005	2006	2007	2008	2009	2010	2011
January	4,186,605	4,150,470	6,349,130	5,651,355	6,450,564	9,154,470	9,154,470
February	3,253,340	3,723,625	5,246,840	5,308,420	5,416,410	8,378,645	8,378,645
March	3,489,125	3,913,085	5,592,117	5,660,890	6,523,675	8,824,330	8,824,330
April	3,344,045	3,971,615	5,542,475	5,708,335	6,156,897	8,934,077	11,095,900
May	3,698,430	4,857,698	6,721,700	5,928,145	8,717,345	9,573,720	10,458,505
June	3,913,645	4,941,530	6,081,150	5,533,802	8,903,925	9,598,145	10,311,785
July	4,607,075	5,082,745	6,487,047	6,053,330	10,399,870	10,785,855	11,240,125
August	4,083,245	4,911,305	7,618,410	6,059,373	10,437,210	11,247,365	10,826,050
September	3,637,970	4,571,430	6,276,411	5,520,955	9,523,125	10,554,910	5,302,499
October	3,982,595	5,438,005	6,360,590	5,879,590	9,506,570	10,801,160	6,444,874
November	4,163,250	5,613,890	6,141,564	6,234,185	9,369,155	10,690,705	6,639,787
December	4,207,395	5,871,505	5,910,340	7,321,138	9,886,835	10,849,740	7,028,644
Total (kg)	**46,566,720**	**57,046,903**	**74,327,774**	**70,859,518**	**101,291,581**	**119,393,122**	**105,705,614**
Monthly average (kg)	3,880,560	4,753,909	6,193,981	5,904,960	8,440,965	9,949,427	8,808,801
Daily average(kg)	127,580	156,293	203,638	194,136	277,511	327,104	289,604

Source: Nakhon Si Thammarat Municipality, 2012

2.4.2.4 Micro-hydropower

Micro-hydro power was one of potential renewable energy in Nakhon Si Thammarat province with total capacity accounted to 32,839.62 kW. The potential of mini-hydro power in the southern and significantly shown the high capacity of energy producer province from 46 water falls attracting tourism with abundant forest biodiversity; however, a small hydro project had not been developed much (Payom, R. 2010). There is one demonstrated community project constructed at Khiriwong community living at Khaoluang Mountain and some more extending in other districts.

Using water for electricity generation in the province has been started obviously at Khiriwong village with small hydro power innovation adapting from bicycle wheel and can as local technology innovation for agriculture employing and then in 1998 the first water turbine was started for electricity generation which is familiar with villager lifestyle for using electricity and watering their plants on the hills. In 2011, the village got a fund from Thai Health Foundation and King Mongkut's University of Technology Thonburi (KMUTT) to improve an effective water turbine and now local people can develop their technology, distributed and sold innovative water turbine technology to others.

In 2012, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy funded approximately 14 million baht to construct a micro hydro-power project to generate electricity supply to community and the left was sold to national grid relied on the power producer agreement as a buying contract with Provincial Electricity Authority (PEA). The income of electricity selling would be transferred to local government as sub-district to distribute the budget developing community apart from local government authority inadequate budget. Notwithstanding, community power plant concept had been developing together with local people, local authority, provincial and national energy authority work on developing the effective energy power plant model beneficial to provincial economic, energy, and environment. The province can learn from this developed project as a community model and expand to other appropriate models as sustainable energy planning for other areas in the future as shown the plentiful potential of micro-hydro power.

2.4.2.5 Wind

In 2001, Department of Alternative Energy Development and Efficiency (DEDE) presented the first Thailand wind map showing the potential of wind farm installation capacity of Nakhon Si Thammarat at 179 MW. Furthermore, Worrapong et al. (2008) researched an assessment of wind energy and feasibility of installing 0.225-0.75 MW wind farm along the coast of Nakhon Si Thammarat with 10 wind monitoring stations at Khanom, Sichon, Tha Sala, Pak Phanang from January to December 2008 at the height of 20, 30 and 40 meters above the ground and wind turbine size of 0.225 MW., 0.3 MW., 0.5 MW., and 0.75 MW. The consequence of the study illustrated that Nakhon Si Thammarat had high potential wind energy to be developed along the coastline at Pak Phanang, Hua Sai, Tha Sala, Khanom districts, accounted to 0.03-2.07 GWh / year and 0.9-51.5 percent of energy effective annually energy production.

Then, the study showed wind speed by applying RAMS to calculate wind flowing from January 2005 to June 2007 with the height of 50 and 100 metres (Radklao et al, 2008). Later, it was developed and analyzed wind sources between 2004 and 2008 and applied the database in 2006 with the height of 20 and 100 metres. The result of all wind studies showed that Nakhon Si Thammarat province had high potential of wind power (Kasenson et al., 2010). A Feasibility Study of Wind Farm Power Plants along the Coastal of Southern Thailand had been studied during October 2008 - September 2009, in the pilot areas of five districts in Nakhon Si Thammarat province under collaboration of Taksin University, Prince of Songkla University, Walailak University, DEDE, and PEA Provincial Electricity Authority with financial support from the Office of the National Research Council of Thailand. The research indicated that five coastline districts of the province had a potential of wind energy totally 1,150 MW, 1,227 MW and 1,166 MW with the speed of wind turbine at 1 MW, 1.5 MW and 2 MW consequently. The average wind speed of Khanom, Sichon, Tha Sala, Pak Phanang and Hua Sai districts accounted to 6.5-8.5 m/s with the height wind substation 80-100 meters with actually the potential wind speed as Cut-In Wind Speed for huge wind turbine capacity needed fundamentally wind speed more than 3.5-4 m/s. The research suggested that Nakhon Si Thammarat province was appropriate for wind farm development in term of the potential of annual average wind speed and bared area which renewable energy development could grow parallel with agriculture and the most important things was PEA grid connection and logistic system served for wind energy development. The plant load factor valued at 17-48 percent of 1-1.5 MW and 22-56 percent of 2 MW with the energy cost per kWh is at 0.6-3.2 baht, 0.6-3.1 baht and 0.6-2.4 baht respectively. The research assured that the cost of wind energy was less than 7 cents per kWh having ability to complete with fossil fuel and takes 3-14 years payback period depending on wind speed and project investment (Jompob et al., 2008).

However, getting overall wind energy database according to Thailand wind statistic, it recommended studying wind capacity in the longer period (Serm J.et al., 2010). In 2010, it was reviewed wind database to advocate the potential of wind utilization for electricity generation and water pumping. Its capacity showed the average wind speed in monthly and annually at 10 m/s, 40 m/s, 70 m/s, 90 m/s and 110 m/s. DEDE developed the first wind project of 250 kW and 1.5 MW with 80 meters height as wind turbine research center at Nakhon Si Thammarat province, the generated electricity had been purchased by EGAT since December 15, 2008 and June 2009 respectively. Then in April 2010, it was initiated five new projects with 18 meters height wind turbine at the same area (DEDE, 2010). Wind scenario excluded community, transportation line, archaeological site, conservative forest and watershed 1A 1B, dam and water reservoir, with the height of 90 meters and the distance of 10 meters, 20 meters and 40 meters from electricity substation with wind speed 6 m/s. shown installation capacity of wind energy in Nakhon Si Thammarat province accounted at 399 MW of Substation Distance 20 Km. and 981 MW. of Substation Distance 40 Km. (Serm J et al., 2010)

2.4.2.6 Solar Energy

The intensity of solar radiation mapping from 1993 to 1998 indicated that intensity spread of solar radiation in monthly was influent with Northeast and Southwest monsoon at the peak during in April and May taking into account at 20 - 24 MJ/m2 –day cover 14.3 percent of country area and inclusively 18-19 MJ/m2 –day of 50.2 percent of total national area, so its intensity annual average with the value at 18.2MJ/m2 –day (Faculty of Science, Silpakorn University, 2012). Nakhon Si Thammarat province has intensity of solar radiation at 18.1 with illustrated the potential of the province at 507,796.21 ktoe to develop solar energy although the highest capacity was considerably in some provinces in the Northeast and Central. For that reason, these regions had been soared investment more than Nakhon Si Thammarat province which had no solar power plant project, and even in the southern. However, the first commercial solar power plant in the Southern had invested in Songkla province, stood at 50 MW, electricity generation would be transferred on-grid afterwards.

CHAPTER III
RESEARCH METHODOLOGY

The research aimed to study potential renewable energy resources for electricity generation in Nakhon Si Thammarat province with electricity demand forecast and also to develop a Provincial Power Development Plan process. It determined how to manage energy security by applying the priority energy fuel in the province to produce energy supply in the context of Nakhon Si Thammarat province. Provincial Power Development Plan referred to the provincial renewable energy management. The research methodology designed to response the suitable for research objectives and questions by including research samplings, research design, method of data collection, method of data analysis, research process and research outcome.

The study started with collecting and reviewing information and academic researches related to statistics of the provincial energy consumption, national energy plan as well as Alternative Energy Development Plan (AEDP), and also Power Development Plan 2010 including the database of provincial energy research. Then, an interview part was carried out with local government agency, provincial energy authority, the renewable energy power producers, Member of the Parliament of Nakhon Si Thammarat Province, local community and the renewable energy project's community leaders, the renewable energy project's community leaders, civil network and local community as representative group of province on sustainable Provincial Power Development Plan, and with energy policy makers in national energy policy, provincial energy policy, and local energy policy levels to find out such sustainable energy development plan in Nakhon Si Thammarat province. Finally a process and model for sustainable Provincial Power Development Plan was drafted and presented in this study.

3.1 Research Type

Practical research was to gather information and content analysis from the secondary data and on field interviews by studying the potential of alternative energy in the province and how to utilize its capacity with sustainable Provincial Power Development Plan.

3.2 Research Samplings

Samples Size:

- Potential of renewable energy resources for electricity generation: totally 23 districts of Nakhon Si Thammarat province, the researcher reviewed energy document, relevant energy research and gathering information from Energy Research

Institution Library, Environmental Research Institute Library, Thailand Information Center, Center of Academic Resources, Chulalongkorn University, National Center of Excellence for Environmental and Hazardous Waste Management Library to develop the thesis subject, the study objective, research methodology and reviewing the linked theory and concept to collecting information and data analysis. The potential of renewable energy sourced from three academic inputs: (Suwit P. et al., 2010, Payom, R., 2010, Jompob et al., 2008) and also applied from secondary data and the Ministry of Energy's reference in case of the potential of biogas, biomass, and solid waste.

- The study of electricity demand forecast: totally the statistic of energy consumption during 2001-2030 of the province illustrated by the Nakhon Si Thammarat Provincial Electricity Authority database
- Government support needs for promoting renewable energy in the province: gathering the budget of provincial strategic development of the province and identify energy financial support to renewable energy project development to Provincial Energy Officer of Nakhon Si Thammarat province and community.

Samples of Participants:

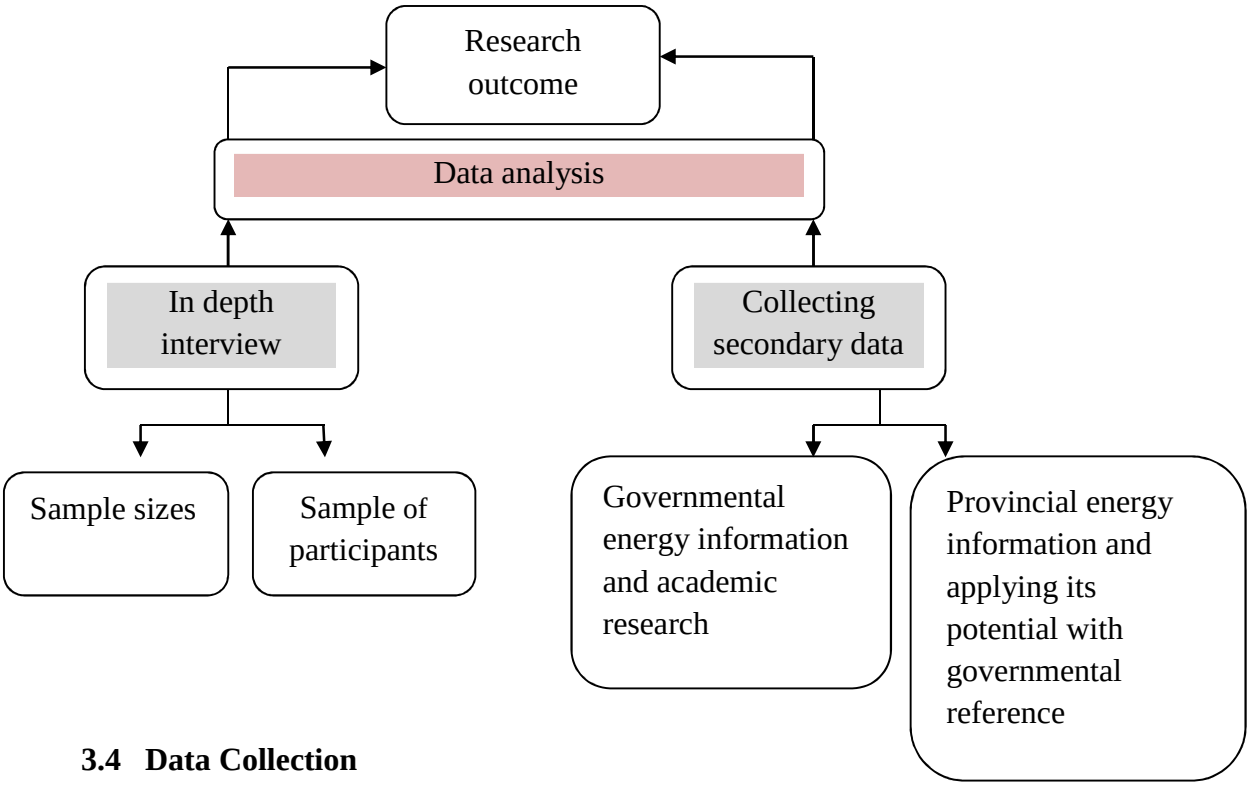
- The development of Provincial Power Development Plan: fifthteen individuals were formally in depth-interviewed with the diversity of energy responsibilities and connected energy development in Nakhon Si Thammarat province.

The interviewees were not selected bases on age, sex and professions. The important rules to explore the model of Provincial Power Development Plan was that the people willing to open their mind for answer the question about energy development and energy secure in the province. The researcher asked and encouraged answer in depth in case they have little ability to answer it directly; however, the interviewees could answer the question clearly if their officially work relates on energy fuel source and energy management as provincial administrative organization. In addition, the researcher interviewed local government of Tambon administrative and local community both renewable energy development and external renewable energy investors and Member of the Parliament of Nakhon Si Thammarat Province.

Two representatives from provincial energy administrative, seven representatives from provincial energy planning and management, two representatives from local administrative at Hua Sai and Tha Sa La districts. Furthermore, the secretariat of Kiriwong village was the one of strengthen community of local renewable energy technology developing and selling to other network and also at here it was the first village as community energy management would be selling electricity on grid under the Ministry of Energy financial support. The local people who were working a civil network to reform energy management calling on energy self-reliance in the province was one of interviewee giving opinion on the secure of Provincial Power Development Plan.

3.3 Research Design

The research was designed based on research questions which aimed to study the situation and outlook of electricity generation and consumption in Nakhon Si Thammarat province, the potential of renewable energy resources for electricity generation, the renewable energy policy and studied to develop sustainable Provincial Power Development Plan.



3.4 Data Collection

The research conducted on secondary data analysis and interview method as qualitative research with the length of each interviewees were 1.5-2.0 hours cover the open questions according to research questions. During interview, the researcher listened to the interviewees closely and gave an explanation to make them clearly understand on the energy situation and referred to energy database of the province. All interview were conducted in formal conservation giving their opinions and the researcher took note of the answers. In this process, the researcher had no sound record on that the comfortable tool for the interviewees explode was conducted by researcher taking note and typing it as evidence.

In addition to the interview, there are other methods applied for the data collection such as document (including the province mapping, energy transition report, news about energy projects), attending provincial energy meeting (including civil network meeting and provincial renewable energy conference), past records (including literature review documents, academic paper and energy management and renewable energy research)

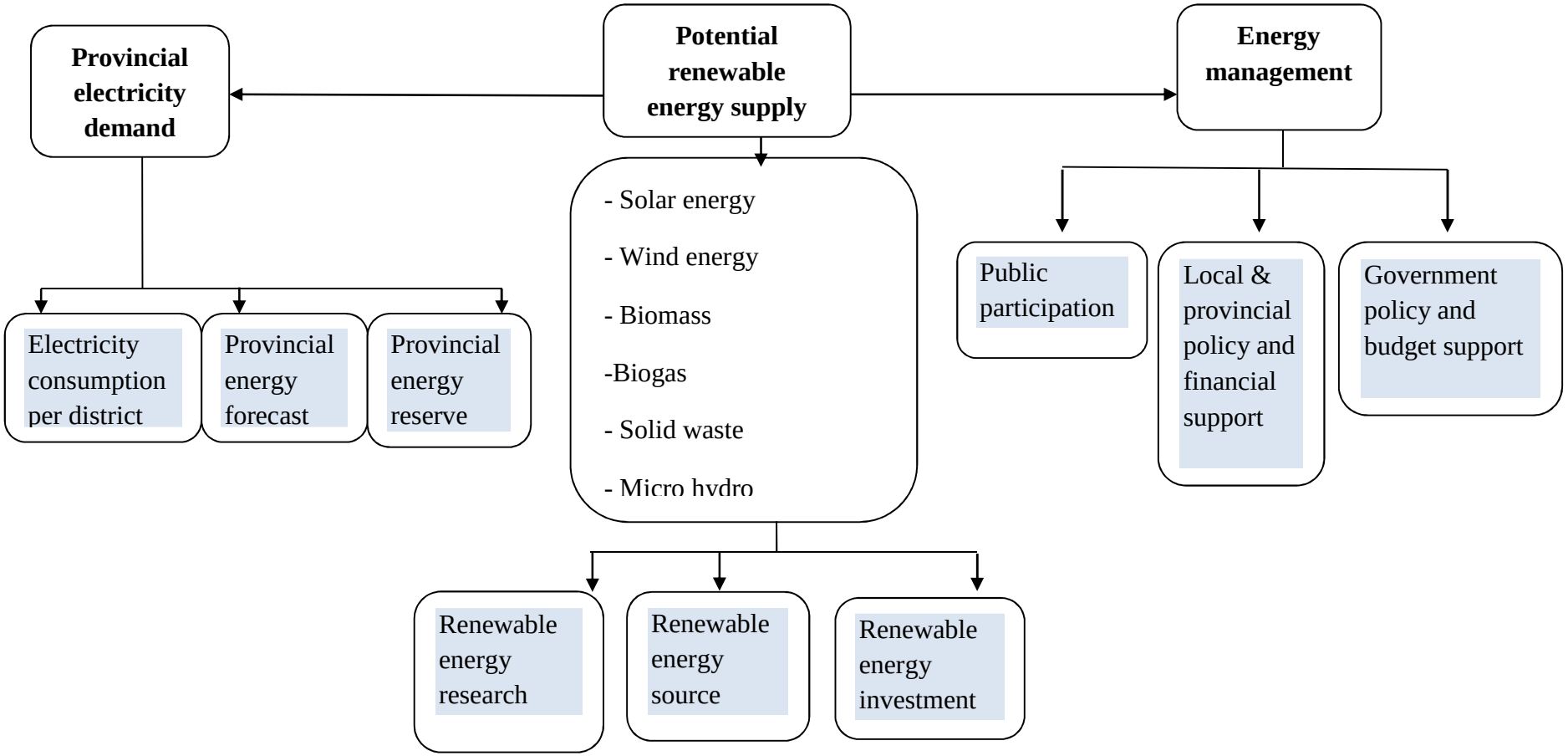
3.5 Data Analysis

The research was applied the component of Energy Sustainability Indicators for Local Energy Planning consisting of electricity demand, the potential of renewable energy supply and energy management presented by Ana et al., 2010 as the following framework. The sustainable for energy planning indicated demand side factor on energy consumption, energy forecast and energy reserve and in term of supply side, it required to take account of the potential of renewable energy. Certainly, energy management implementation was the process of government, provincial and national financial support and public participation.

Analyzing the data of Provincial Power Development Plan needed to consider both electricity demand and supply sides to go for secure energy in the province by utilizing the priority of the potential of renewable energy. For provincial electricity demand, it needed the electricity consumption database in all districts, provincial energy forecast and the standard of provincial energy research. And the potential of renewable energy supply fundamentally relied on its research, fuel sources and project investment. Integration of sustainable renewable energy planning requires public participation, local and provincial financial support and government policy and budget support.

This data analysis based on the research objectives and research questions. It was adapted from energy sustainability indicators for local energy planning by Ana et al., 2010 which mentioned on good governance, local authority available on finance for renewable energy and awareness rising on energy issue. However, this research model went through the factor of the elements of provincial electricity management which differed in some key performance indicators identifying the sustainable provincial energy planning. Some of them explored from literature review in Chapter 2 which referred to the energy demand, supply and management in the policy level of the country. This research also adapted the macro energy model development to provincial scale development.

Factors of the Element of Provincial Electricity Management



3.6 Research Process

The research process was divided in three parts as below:

The first part was the preparation stage with data gathering by reviewing the previous energy documentation and academic researches, consulting with my thesis advisors to frame the issue and pre-research fieldwork including thesis proposal and selected interviewees as influential person on energy issue in the province.

The second part was the research fieldwork. The researcher stayed in the province and participated in provincial energy movement in the province, especially at Khanom, Tha Sa La, Sichon, Hua Sai and Pak Phanang districts to study the local people movement on energy policy. The formal face-to-face interview with local community and local administrative with all data recorded in taking note and filed typing. This part included the process of searching secondary data both governmental and provincial energy information. Some central database was linked to energy policy level whereas the in-depth energy statistic especially the energy demand, the potential of renewable energy and financial support in the province needed to search at the fieldwork. For academic energy researches had been conducted by the southern universities at Songkla, Pattalung provinces as academic paper by Suwit P. et al., (2010), Payom, R., 2010, Jompob et al., 2008 as the area of the capacity of southern energy.

The third part was formulation of a model for Provincial Power Development Plan by integrated analysis of the secondary data and interview part as the qualitative result.

3.7 Research Outcome

After data analysis and interview as mentioned above, the last process of the research was research conclusion and the analysis result had been identified by applying the concept of provincial energy management and relevant researches including the suggestion of the research. The expectation of the research was presented the development of provincial energy management plan, including preliminary of provincial power development plan coped with energy, environment, economic, and social security and this energy management would help Nakhon Si Thammarat province enhance its effective renewable energy planning in term of sustainability.

CHAPTER IV
THE RESULT AND DISCUSSION

The study was a qualitative research explaining through the energy sustainability indicators for local energy planning suggested by Ana et al., 2010 including the factors of the elements of provincial electricity management in the field work and literature reviews which consisted of provincial electricity demand, the potential of renewable energy supply and energy management and Provincial Power Development Plan. This chapter presented energy outlook with demand and supply sides, energy management to develop a sustainable Power Development Plan for energy, economic and environment security.

After the study presented potential of renewable energy in the province and further sustainable of Provincial Power Development Plan, there were some essential criteria to be achieved in term of energy management including the prospective and vision of people in the province, the integration of National Power Development Plan and Provincial Power Development Plan and the restrict of sustainable Provincial Power Development Plan. This study had a part of in-depth interview with local government agency, provincial energy authority, the renewable energy power producers, Member of the Parliament of Nakhon Si Thammarat Province, and the renewable energy project's community leaders, as representative group of province on sustainable Provincial Power Development Plan and energy policy makers in national energy policy, provincial energy policy and local energy policy levels to find out the sustainable power energy development plan in Nakhon Si Thammarat province. For this study, there were totally 15 interviewees from various provincial energy sectors and relevant renewable energy development.

4.1 Provincial Electricity Demand

Provincial electricity demand composed of electricity consumption, provincial energy forecast and energy reserve. The trend of energy supply of Nakhon Si Thammarat province relied on fossil fuel afford with more than 95 percent of 860 megawatt to feed the provincial energy demand of 647 megawatt in 2030. In fact, the potential of renewable energy soared at 1,613.24 megawatt ;whereas the renewable energy supply on grid was just 42 megawatt. Figure 12 evidenced that the province existing energy supply was over the provincial energy demand. According to centralization energy system and the Power Development Plan, Nakhon Si Thammarat province was a target of electricity supply for the country instead of natural gas supply, how to convert the capacity of renewable energy to replace the limited conditions in the province including policy and implementation levels.

Result of the interview and secondary data of the capacity of renewable energy in the province had been identified to wind energy, biomass, solar cell, micro-hydro power, biomass, and waste energy. The dependent energy supply of the province relying on energy supply from centralized Southern energy grid relied on 77 percent of natural gas power plant at Khanom district, 12 percent of Ratchaprapa dam at Surat Thani province, Banglang dam at Yala province, and 11 percent of Malaysia natural gas transmission.

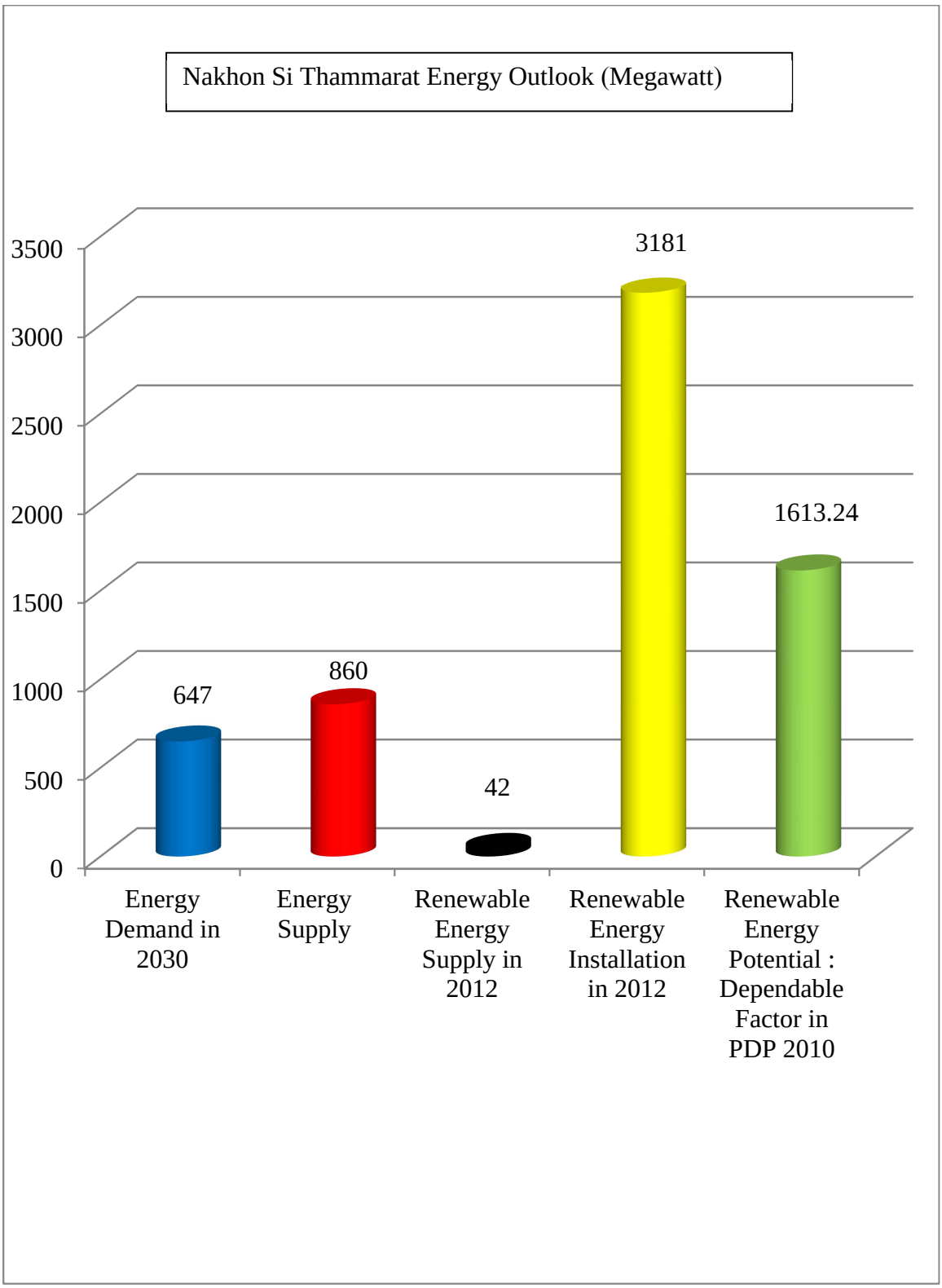


Figure 9: Demand and Supply Sides of Nakhon Si Thammarat Province
Source: Modified from secondary data

Renewable energy source in the province has been generated for energy supply especially in industrial group with biomass and biogas mainly in households sector or local community projects which supported by energy offices in national and provincial levels including wind energy. Some industries generated renewable energy to reduce cost and greenhouse gas emission. Even small scale, renewable energy investment could be developed as a model of decentralization. Energy security is a key performance for electricity sufficiency to respond Nakhon Si Thammarat's citizen consumption.

4.2 Potential of Renewable Energy Supply

Regarding to the information from academic and secondary data of provincial database it explored that the potential of renewable energy of Nakhon Si Thammarat province significantly wind energy was a key figure to develop power planning for sustainability energy resources, technology innovation and the effective policy development. According to the figure of potential of renewable energy in the province collecting from secondary data and comparing the amount of renewable energy fuel capacity it significantly presented that the potential of renewable energy of the province to generate electricity was at 1,613.24 MW and the potential of biogas and solar energy stood at 106,639.17ktoe. However, the feasible installed capacity would be very much lower than the figures due to various limitations like renewable investment and financial support, local people acceptance, environmental related regulations, and so on. Therefore, integrated database of renewable energy sources for electricity generation and policy of relevant governmental agencies becomes very much necessary.

The installation capacity of renewable energy from wind, solid waste and solar power was account to 1,150 and 1,752 MW and 507,805.79 ktoe respectively meanwhile some renewable energy fuel had not been officially developed to take its advantages for instance, solar energy, solid waste and biogas. The clarification of the capacity of renewable energy to supply provincial energy consumption with the annual demand about 250 MW in the previous time and would gradually climbed up to 450 MW of energy demand forecast for the next 10 years where renewable energy become a majority part of electricity generating. The total renewable energy installation capacity was accounted to 3,181.84 MW and 507,805.79 ktoe. of the province; however, the study applied dependable capacity ratios for renewable energy of PDP 2010.

The concept based on system security and adequacy to meet load demand which probabilistic simulation was assumed on long –term statistic transferring renewable energy generating during peak time. EGAT focused on 73 power plants of VSPPs and ended with 38 power plant profiles to be practicable dependable capacity assessment (Titiporn S.et al, 2010).

The number of renewable energy dependable factor depended on the amount of renewable energy power plants on that time; however, it was very low and gave a suggestion on further studies on effective dependable capacity relationship to the limited conditions of renewable energy development (Chuenchom et al, 2012). Another research on analysis of alternative of Power Development Plan to reduce greenhouse gas emission in energy sector (Decharut S. et al, 2011), support by the Thailand Research Fund presented difference in some dependable factor of renewable energy (see also Table 11). However, this study used the some dependable factors that EGAT used in Power Development Plan.

Table 11: Comparison of Dependable Factor of Renewable Energy

Renewable Energy	Dependable Factor (Percentage)	
	EGAT	**Decharut S. et al.**
Biomass	40	70
Biomass (rice husk)	70	70
Biogas	21	50
Solar	21	40
Wind	5	20
Micro Hydro	40	40
Waste	20	60

Source: Modified from EGAT, 2010 and Decharut S. et al., 2011

The Dependable Factor was calculated with the first renewable energy installation capacity of Nakhon Si Thammarat province which accounted for 3,181.84 MW and 507,805.79 ktoe. Applying EGAT dependable factor in each energy source emerges the potential of renewable energy which was considerable decreasing compared to the figure of Decharut S. et al. with stood at 1,613.24 MW. and 106,630.17 ktoe in Table 12. The percentage of renewable energy is an important factor that reflects the acceptance of renewable energy stability and security to generate electricity to serve the provincial energy demand.

Furthermore, it was showing the proportion of electricity generated from renewable energy the more percentage the further renewable energy utilization and investment which returned benefit back to citizen in the province, of course the province would not lose its chance if the dependable factor based on accurate capacity and percentage.

In term of potential of biomass, solid waste, biogas, micro hydro power and wind energy had been illustrated in detail of each districts of Nakhon Si Thammarat province and the secondary were collected from national energy policy, Provincial Administrative, Local Administrative and academic researches with a conclusion and summary in figure 10-16. The potential of renewable energy mapping was connected to the substation energy transit and electricity distribution system which grid connection by PEA and EGAT and renewable energy supply in districts.

Table 12: Potential of Renewable Energy Source in Nakhon Si Thammarat Province

The reference of the Ministry of Energy				**Nakhon Si Thammarat province**			
Fuel	**Unit**	**Energy source demand for electricity 1 MW generating** (Unit per MW)	**Potential of energy** (ktoe per unit)	**Amount of fuel at Nakhon Si Thammarat** (unit)	**Installation Capacity of energy generating**	**Dependable Capacity of RE as assumed in PDP 2010 (Percent)**	**The Potential of RE**
Electricity (MW)							
Husk	ton	9,656	0.00027	29,733	3	70	2.1
Straw palm	ton	2,935	0.00013	238,668	81	40	32.4
Rubber tree	ton	1,907	0.0002	310,921	163	40	65.2
Solid waste	ton	54		94,316	1,752	20	350.4
Micro-hydro power					32.84	40	13.14
*Wind 1 MW clusters	m/s	>3.5-4 m/s				17-48	1,150
Total							**1,613.24**
Thermal (ktoe)							
Biogas (animal waste)	Mm^3				9.58	21	2.01
Solar energy					507,796.21	21	106,637.16
Total					**507,805.79**		**106,639.17**

Source: Modified from secondary data

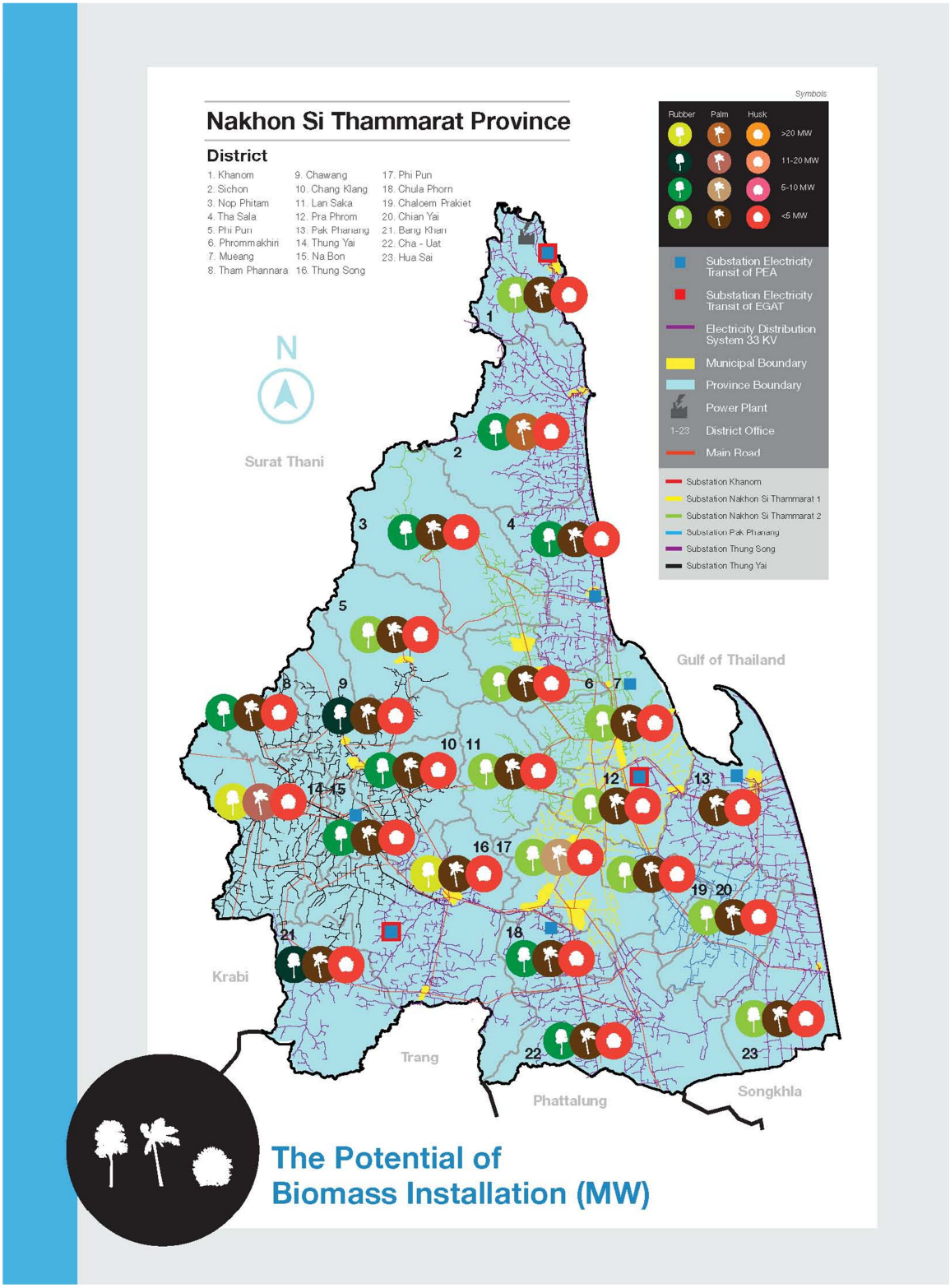


Figure 10: Potential of Biomass Installation (MW)

Source : Modified from Nakhon Si Thammarat Agriculture Office, 2012 and the reference of Ministry of Energy

: Provincial Base Map from Nakhon Si Thammarat Provincial Electricity Authority

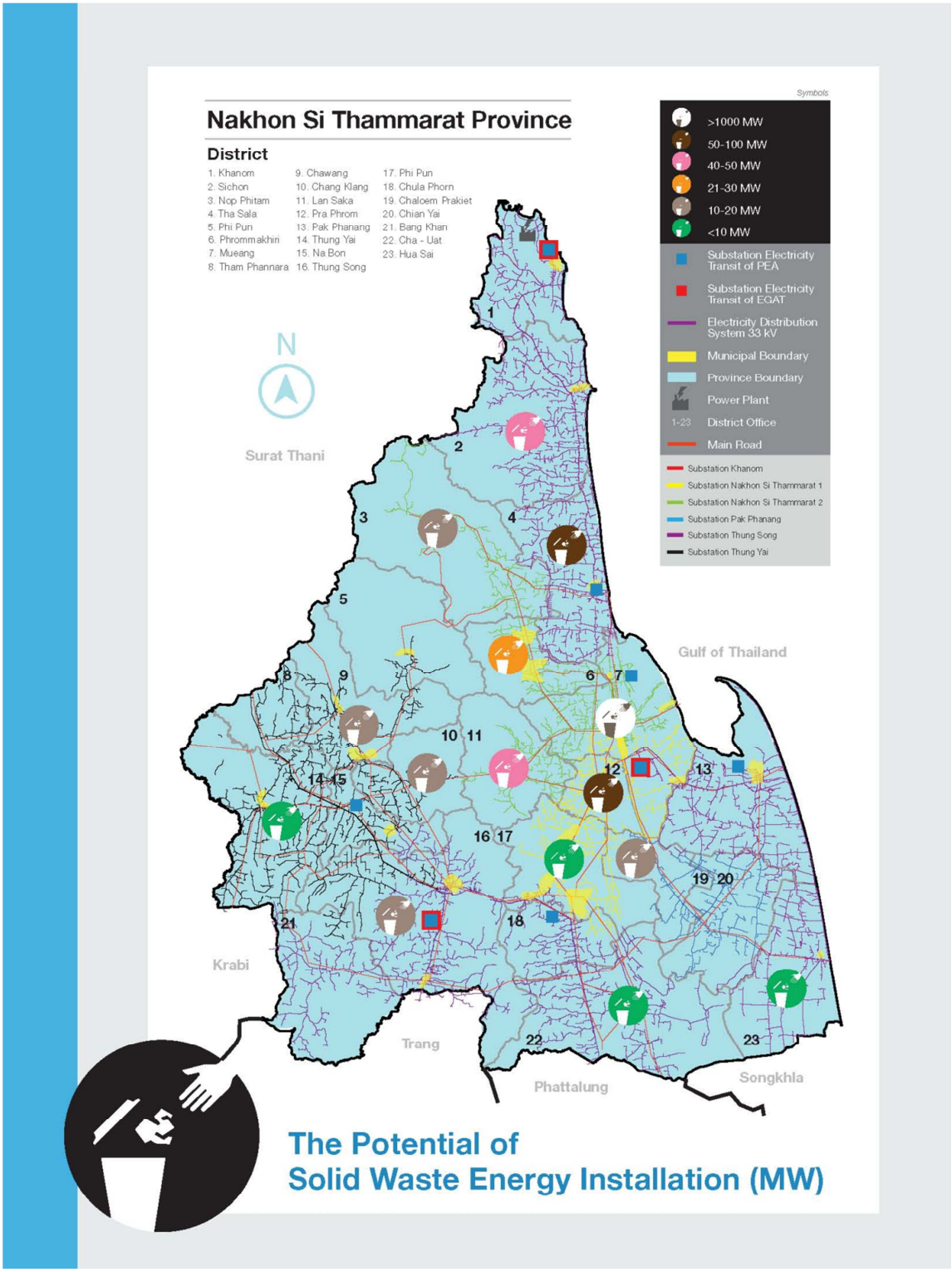


Figure 11: Potential of Solid Waste Energy Installation (**MW**)

Source : Modified from Nakhon Si Thammarat Municipality, 2012 and the reference of Ministry of Energy

: Provincial Base Map from Nakhon Si Thammarat Provincial Electricity Authority

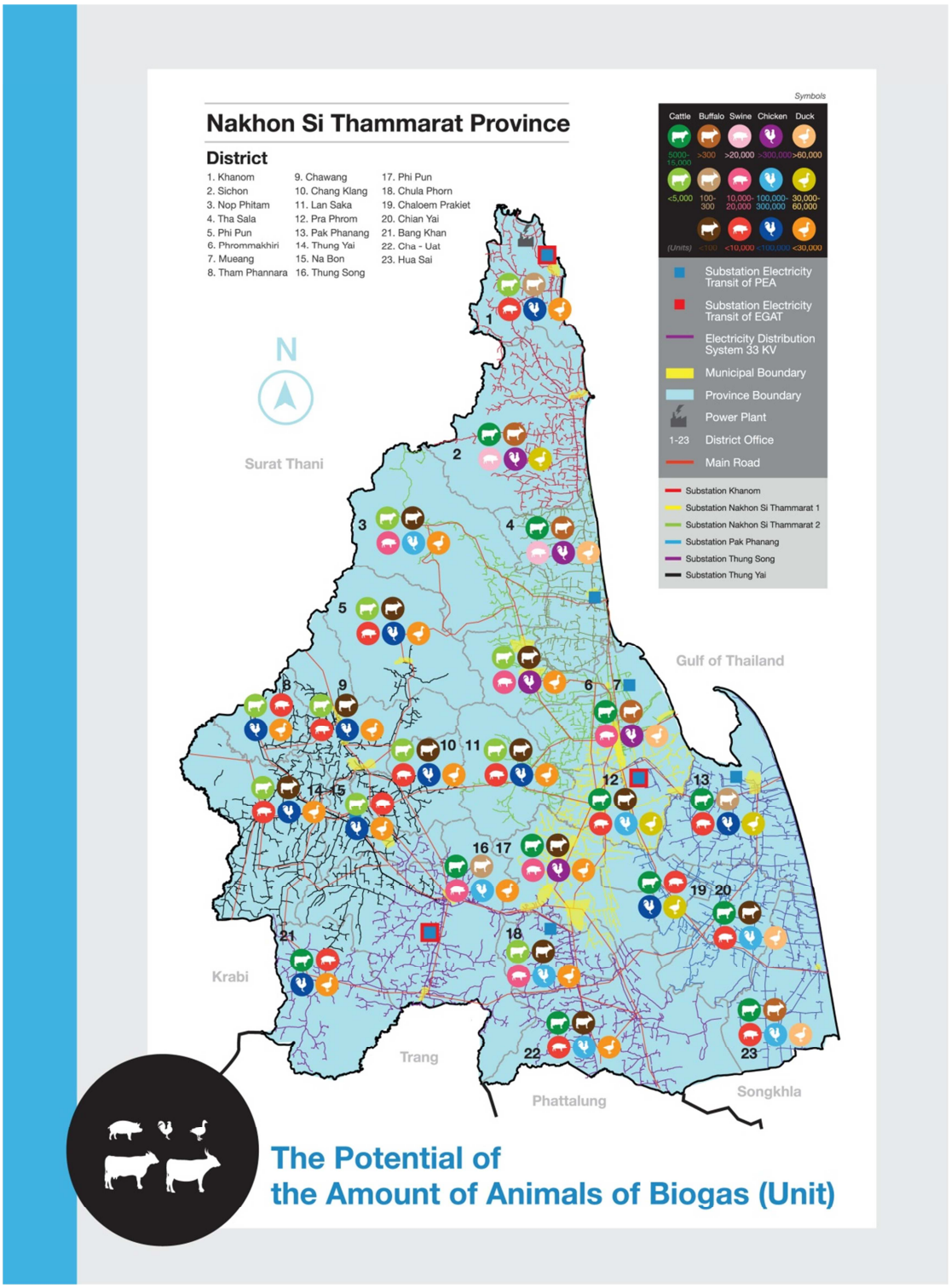


Figure 12: Potential of the Amount of Animals of Biogas (Unit)

Source : Modified from Nakhon Si Thammarat Livestock Office, 2012

: Provincial Base Map from Nakhon Si Thammarat Provincial Electricity Authority

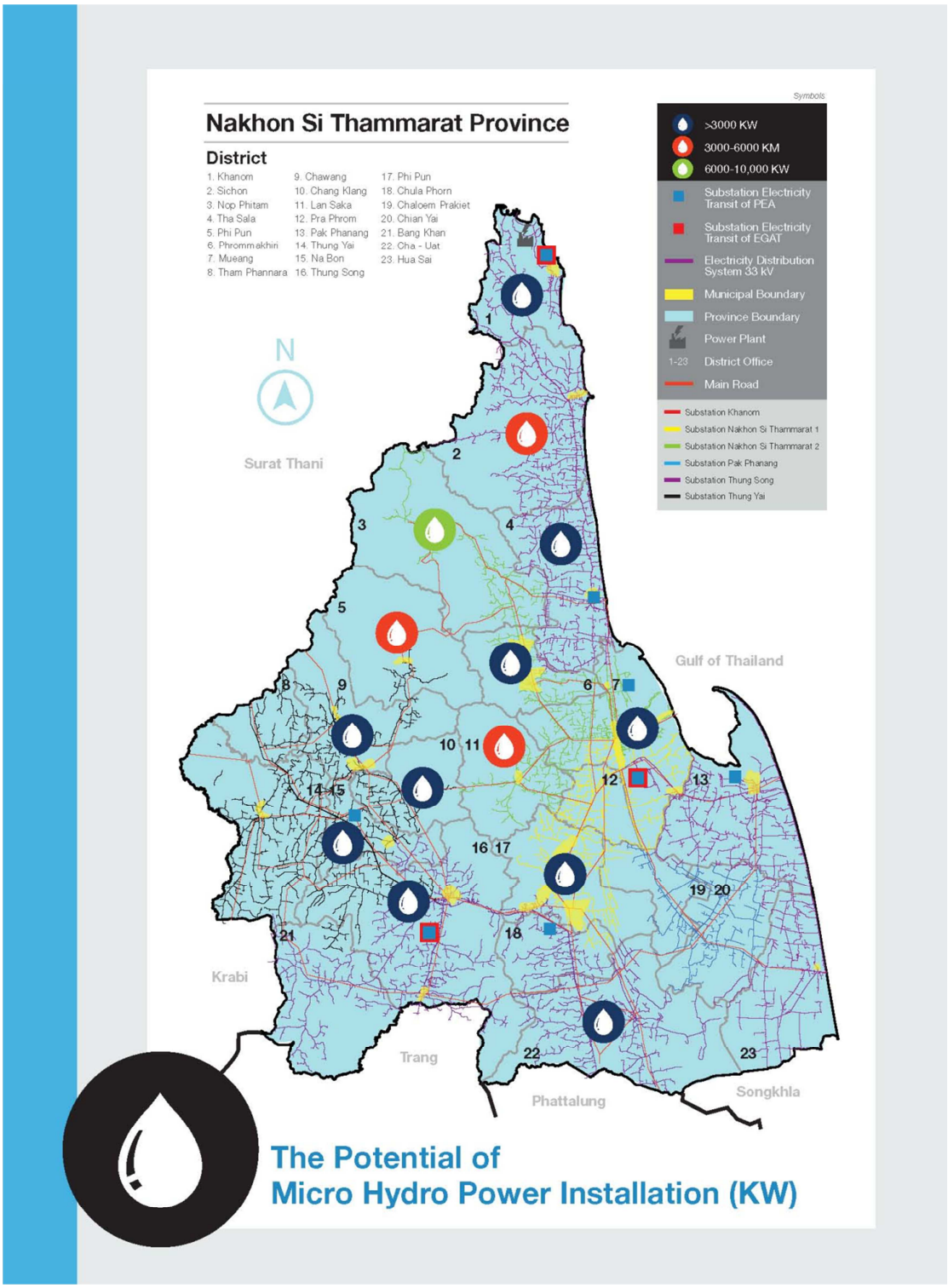


Figure 13: Potential of Micro Hydro Power Installation (KW)

Source : Modified from Payom, R., 2010

: Provincial Base Map from Nakhon Si Thammarat Provincial Electricity Authority

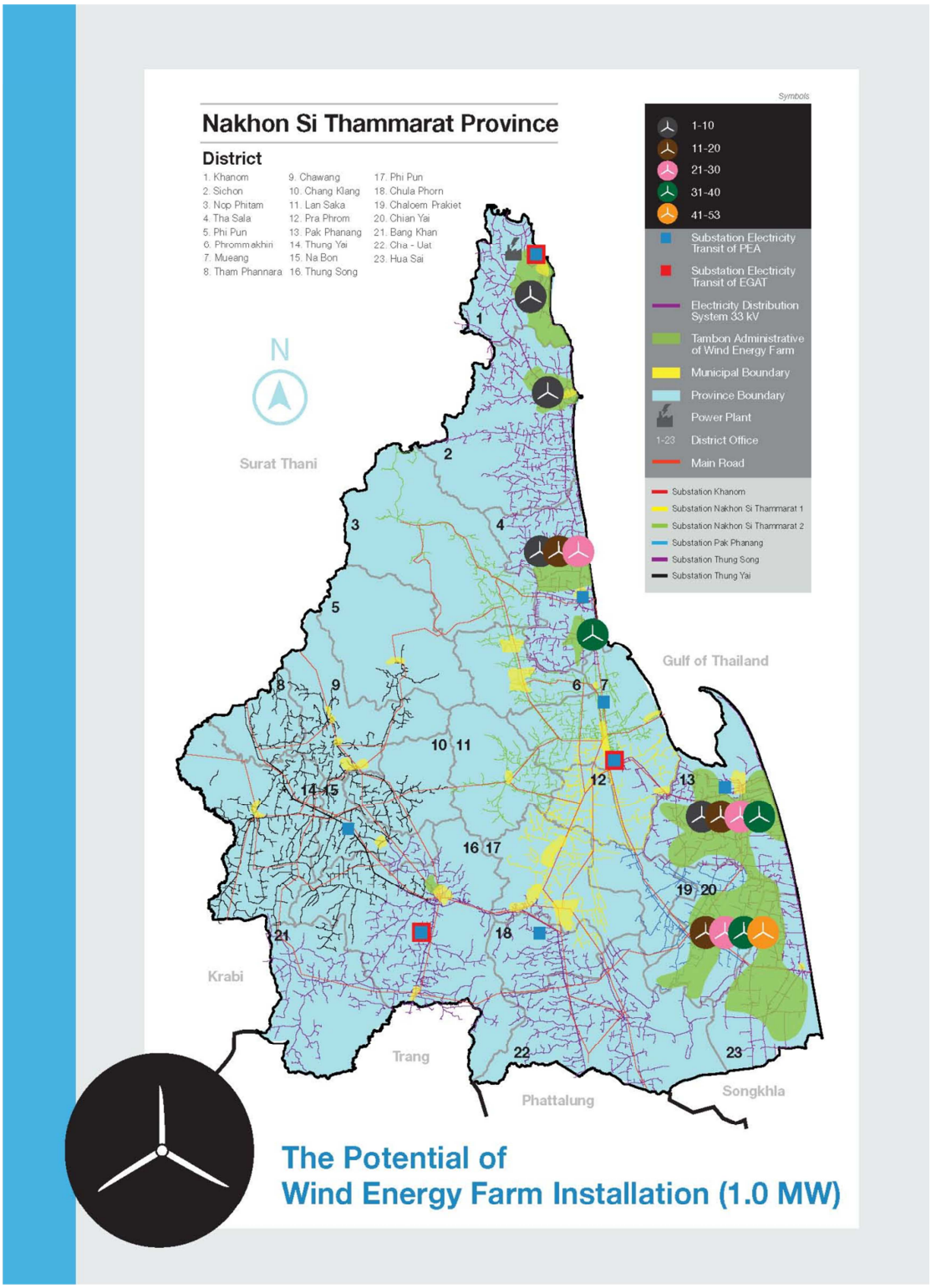


Figure 14: Potential of Wind Energy Farm Installation along the coastline (1MW)

Source : Modified from Jompob, W. et al, 2008.

: Provincial Base Map from Nakhon Si Thammarat Provincial Electricity Authority

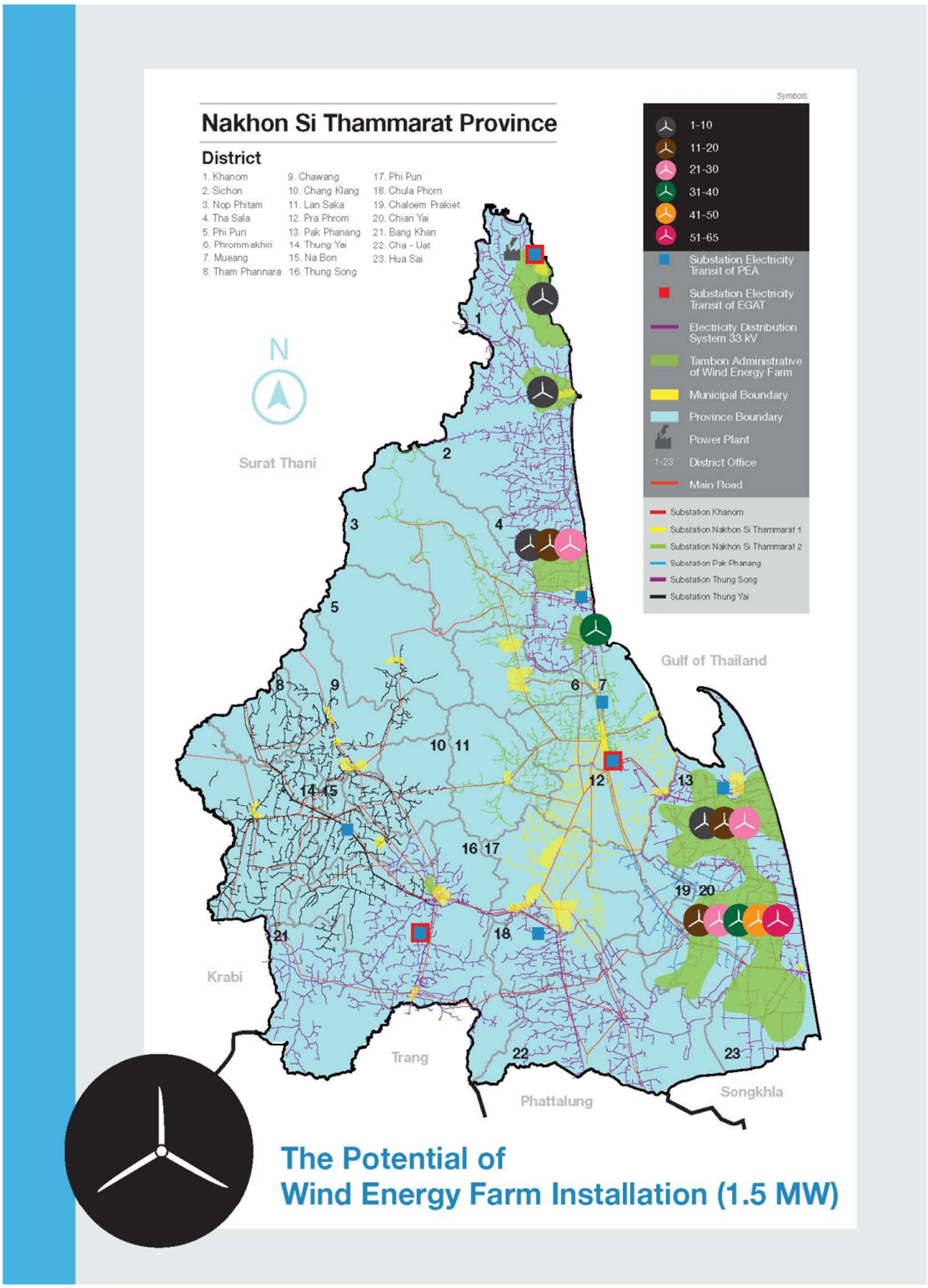


Figure 15: Potential of Wind Energy Farm Installation along the coastline (1.5 MW)

Source : Modified from Jompob, W. et al, 2008.

: Provincial Base Map from Provincial Electricity Authority

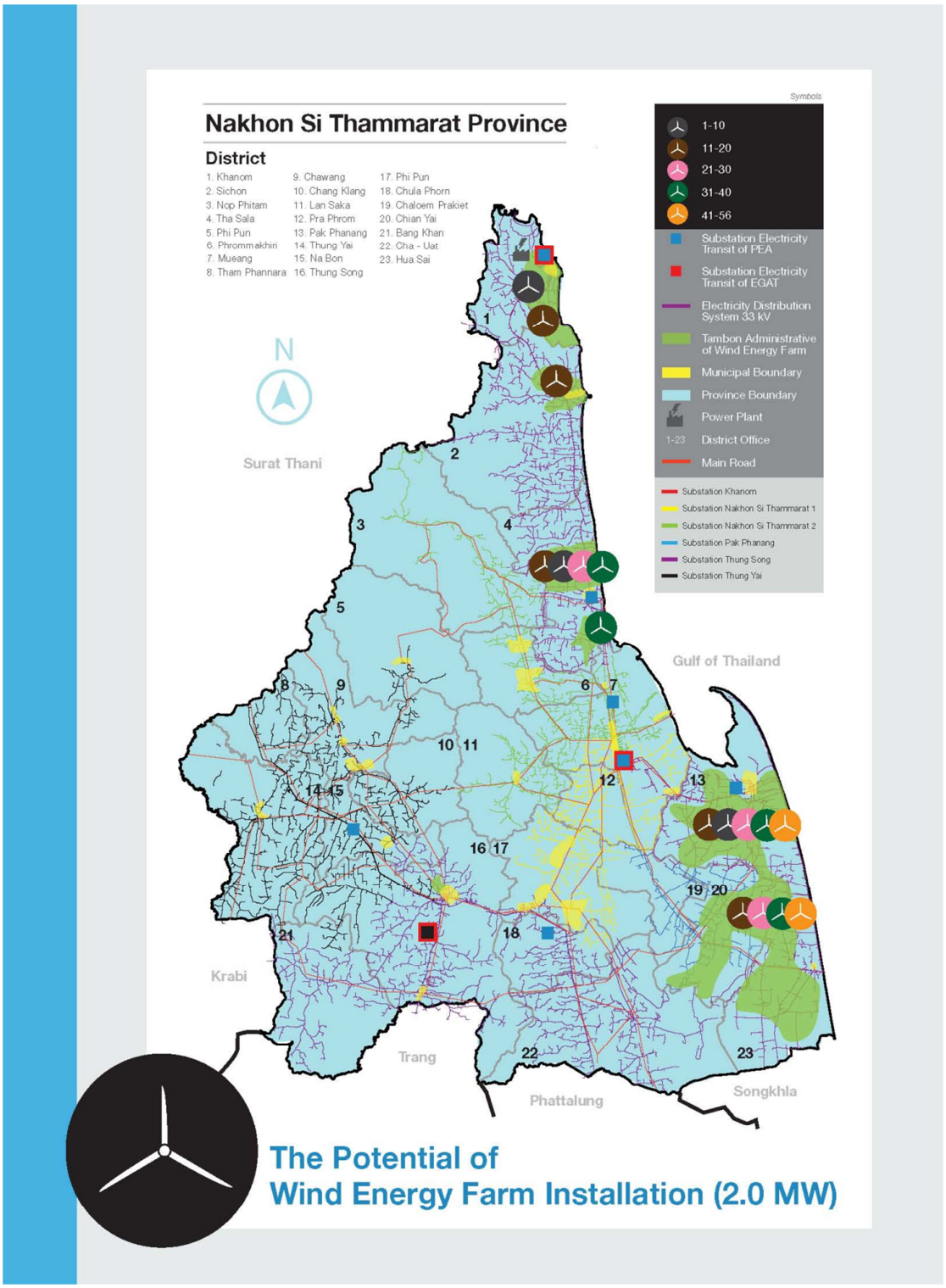


Figure 16: Potential of Wind Energy Farm Installation along the coastline (2 MW)
Source : Modified from Jompob, W. et al, 2008.
: Provincial Base Map from Provincial Electricity Authority

Considering to solar energy, there is no project investment in the province because of different factors, saltiness from the sea impact to technology lasting, huge plain area and the more expensive land than Eastern region. However, it does not mean Nakhon Si Thammarat province has no potential of solar energy. Investors' first neglect with the less profit and business opportunity was compared to other benefit areas. In conclusion, the interviewees knew that the province has the potential of renewable energy; however further research and developments are required. Most renewable energy has not yet researched and communicated broadly to people including the advance study of wave and geothermal energy capacity. The province needs to utilize the internal locally available energy sources to achieve sufficiency, security and sustainability of energy.

Some interviewees critiqued that people need to be built capacity to become energy producer instead of energy buyer as previously. Raising awareness and giving people knowledge would create a good example for community, industry or other sectors as a changing agent. Lean on natural gas energy source could not supply energy to a province in a long term, the province has to develop the local energy plan base on the capacity of energy supply and public participation.

They essentially considered the capacity of energy in the province first to increase the value of provincial economic, energy security, social and environmental impacts. Renewable energy would be the priority of provincial energy supply and diversify energy source for energy security. It is time for searching renewable energy resources, especially mini-hydro power from 46 water falling in the province, and the potential of wind energy they are interested in mini-hydro power because the province has water flow over year, not much expensive investment, internal technology development, no need to buy fuel and water can be feed agriculture sector and others without disappearing quantity. If the province has good water management it would reduce the impact of flooding crisis and take benefit from losing fresh water from the mountain to the sea when it has heavy rain.

All practical renewable energy projects of the province required maintenance and evaluation to improve for the next strategy so it has to be seriously keep on going projects and made it effective. Approving the potential of renewable energy as the image of a new product required good image and demonstrate the useful energy alternative to convince people changing for sustainable and benefit energy directly to the province. Public communication is a key method to raise awareness and believe of people in the province. Not only having a wind turbine demonstrated, but also it would construct more than one for the renewable energy effective system for people perception and acknowledgement. Nowadays, they mentioned that wind farm research center project by DEDE at Hua Sai district was a good case study which reflected to lacking of government seriously to make people clearly understand about its capacity when it has often stopped revolving around which growing distrust the capacity of renewable energy development.

Starting with the several of renewable energy evolution could be adapted from a small and large scale however they agreed to change the pattern of power plant projects which benefited only the investors turning to people in a province as power plant project stake holders. In conclusion, Provincial Power Development Plan was one key factor to utilize renewable energy in province to assure economic, social and environmental aspects with clean energy. However, the study had not presented the cost of renewable energy investment because it needed to be coordinated with the relevant authorities, experts and local people depending on which conclusion from the in-depth interviewees and external and internal factors had been adapted for sustainable Provincial Power Development Plan.

4.3 Energy Management

The adequate electricity supply was to be transferred on grid for energy demand in province however, the achievement of good governance was not only concerned on energy security the elements of economy, society and environment it needed public participation and realized on the internal and external factors of local and provincial policy and financial support. Nakhon Si Thammarat province had high potential of renewable energy and would be taken advantage back to develop the province and citizen in case of renewable power plant projects initiatives. The province had components of electricity development about transmission line with the stable renewable energy system with the future smart grid system, feed-in tariff measurement and the effective renewable energy investment in various stages. According to national renewable policy accelerated its purchase quota but in facts the monopoly of energy system in country depended on EGAT authority. The structural of national energy development was not much support the independent increasing renewable energy unless the country enforced feed-in tariff regulation to encourage the expanding of its investments.

With the in-depth interview process a study found that **the factors directly affected to Sustainable Provincial Power Development Plan** was divided into 3 components:

4.3.1. The initiative vision and prospective was motivating thinking system on self-reliance of energy planning and development. How to encourage people to lead the province on independent fossil fuel supply especially local and provincial energy authority was the full empower of order and budget.

4.3.2. The integration of local, provincial and national energy policy was the top of head on addressing energy policy development in case of centralization energy system.

4.3.3. The implementation of planning was the practical measurement, a first model of Sustainable Provincial Power Development Plan which was advantage on establishing an officially structure of province to implement with a concrete plan to be self-reliance on energy supply and increasing renewable investment in province.5

4.3.1 Initiative vision and prospective

In term of people’s opinions a study found that most of interviewees agreed on reducing fossil fuel dependence and a potential of renewable energy was significantly developed although it had barriers as a new concept and project. And most of them

was assured that large power plant project was opposed by strengthen people in province because they were concerned about its impact. The summarized interviewees' opinion on vision and prospective of provincial energy demand, energy supply and energy management presented as below;

4.3.1.1 Prospective of interviewees on energy management in the province showed that citizen in Nakhon Si Thammarat had not much already to change on energy management. Fundamentally, people needed to understand more since the relationship of energy consumption from their households, workplace, and province level with the end of national energy level. The connection of thinking about energy from micro scale to macro scale was essential. The positive thinking and supporting on renewable energy development concept were enhancing a chance of growing its potential to reduce fossil fuel consumption. Trust was a key word and fundamental thing to make people believe in the security of renewable energy even though renewable energy projects, especially wind project of government investment had not effective enough to communicate with people in the province believe in the potential of renewable energy including other renewable energy projects were supported by government officers and invalid after project ended because the citizen had been lacking capacity building to maintenance it. Renewable technology initiative was developed properly with the condition of community eventually advantage to province. Furthermore, Local Administrative, Provincial Administrative and relevant government offices had not much practiced on renewable energy and energy efficiency campaigning those would happened just for perfunctorily work without strengthen and continual energy planning despite the province consumed energy growing in the 4th of 14 southern provinces.

4.3.1.2 Conducting renewable energy research and information to later was communicated and acknowledged people about the result of potential of renewable energy in province. Changing experience on renewable energy development with other provinces and working closely with energy experts including creating the diverse of renewable energy center developed various kinds of renewable energy fuel and investment under the concept of community possession. The important thing was that developing renewable energy project required quality than quantities to make it effective to expand its projects in the future and intensive province confidently at least. Surveying the potential of renewable energy in the province was to encourage about energy management and energy benefits. Definitely financial support effective and energy management from national, provincial and local offices was in needed.

4.3.1.3 Measurement of environmental and health impact in term of renewable energy management was the interviewees concerned. The lesson learn of energy power plant and energy project accelerated people in some districts opponent to government projects such as coal power plant, nuclear power plant including biomass projects as well. Lacking awareness and being negligently of the owner of energy project management increasing people disagreement on energy projects development in their communities. Even renewable energy was positive attitude for majority of citizen the feasibility and impact assessment required to be implementation and set a standard at all. Increasing renewable energy to reduce Greenhouse emission, dependable fossil fuel supply it significantly needed to

evidence people on the provincial economic with growing job description and income, reducing the impact of environment and preserve community livelihood and local economic.

4.3.1.4 Sustainable city and energy planning became the new concept connection with province landscape management and energy management. Carrying capacity of city and community development were obviously factors facing in the future. In term of renewable energy investment the province demanded on city planning for sustainability and green city concept. It was benefit to reducing cost of energy transportation in case of conveyance raw materials and energy waste during transition. Supposing its concept had been applied the cost of energy decreased because of energy efficiency.

4.3.1.5 Decentralization energy and energy management authority encouraged changing in local and provincial policy level. The concept of decentralization emerged with small scales spreading however; the concept could not achieve if the authority of energy management had settle in the central. The limitation of renewable energy growing came from the monopoly of energy management and decision. The Process of Power Development Plan implementation had been addressed and accredited the committee and working group at central which in history Thailand had no officially provincial or regional Power Development Plan to sustainable energy management and solving energy management in country leading to the expanding of conflict on energy management.

4.3.1.6 Willing of electricity payment if renewable energy was expensive became to be concern. Price of generating renewable energy for electricity in unit required energy scenario to be proposed. Citizen in Nakhon si Thammarat would have a chance to choose what energy they preferred to utilize. The price of electricity unit would not impact to economic growing in the province and certainly people acceptance on paying that price. The decline of renewable energy technology price and the ability of renewable energy technology innovation in country could continually reduce its price eventually with the effective market mechanism and fuel price management. The significantly energy information had to illustrate both dependable fossil fuel and increasing renewable energy supply in the province for energy planning implementation in the short-term, medium team and long-term including public participation on self-reliance energy management.

4.3.1.7 Changing provincial energy policy influenced national energy policy hence, public participation was essential for Nakhon Si Thammarat province's energy revolution. In term of lacking the leaders' vision and relevant energy offices' effectiveness, enthusiastic people was concretely condition on the success of energy movement and changing to increasing renewable energy. Exporting energy would be the next possible plan when energy supply and demand had been sufficiency to be distributed for the province consumption. The previous energy projects development less public participation since the beginning of project development which of course, was different from intensive public participation in the province began with energy planning, energy implementation and energy benefit distribution. Moreover, public participation could reduce environmental impact of energy developed project in the province because people could be reported and closely observed project process and implementation.

4.3.2 Integration of local, provincial and national energy policy

As we known that Nakhon Si Thammarat province had a potential of renewable energy and people in province agreed to develop it to support energy demand. The study considered a solution of energy planning in province and found that a character and occupation of people based on agriculture, fishery and small industry changing into a large scale of power development like Khanom district on natural gas power plant was not their destinations. They learned to develop effective renewable energy implementation avoiding a concept of disaster first compensate later, power producer registration in local and power plant possession. When a study analyzed through interviewees' opinion it was shown that renewable energy could be a province solution in condition with a capability and good governance. The limitation of national energy policy had been presented as a priority obstacle renewable energy growing was reflected to asking government sectors to responsibility on supporting renewable energy policy, finance and maintenance.

In fact, Thailand needed to increase renewable energy but it was monopoly system of electricity purchasing which unbalanced in hand and conflicts of interest. Shifting a circumstance with from buyer to seller need time to encourage people. According to interviewees information a study showed that people were thinking of benefit and income from renewable energy plan in term of power development plan which was different from the previous time that they received only a compensate money without income, their livelihood maintenance and benefits. The integration of local, provincial and national energy policy to increasing a percentage of renewable energy had been emerged. This was four group of interviewers had been presented a solution of provincial energy integration.

4.3.2.1 Local people group was a group of strengthen energy movement in a province and played a main role on renewable energy development as a small scale including a change maker from payer to power producer in future. They mentioned on the concept of renewable energy development that it was small scales distributed to household, village and community. Micro management was a future of energy management and each part was essential to create a half of energy supply to feed its consumption. Renewable energy was an answer to community, provincial and policy whereas a study could not be exposed to pressure disagree parties such as politician and fossil fuel supporters. It had just started whereas fossil fuel investment was all the time. Trend was cheap in the long term with figure showing because people believed in numbers and statistics. This was the responsible of academic, government sector, independent institution and local and provincial administrative to go to national resolution changing. It was possible to every province starting their Provincial Power Development Plan and pushed forwards to changing energy policy.

Cooperate Social Responsibility (CSR) could be a role to support renewable energy growing. And also a support of university and academic in province was a main of research part about the potential of renewable energy. Growing renewable energy projects would be included local and provincial budget and external financial support however; self-reliance was a key success of independent energy supply and increasing human capacity building. It could be started in community level by household's sharing for instance, ten households together loaned money from

community fund to invest renewable energy project instead of just paying electricity bill every month. Growing renewable energy needed private sector inside and outside Nakhon Si Thammarat province whereas people in province were still less awareness about self-reliance energy planning. Community, business and commercial association created local or province and medium enterprise with opening external investment and set a system of power balancing with stakeholder sharing and board election. It would be started from small scale which was better than Sub-district or district level because it had lot of benefits and conflicts. Fuel sources management was an essential tool to sharing sufficient renewable energy resources. Provincial, local and representative politician would base on creating more energy projects.

Renewable energy investment needed a commercial mechanism to move forwards and public acceptance. In term of cooperative model or public organization to manage renewable energy whoever could invest in this. Stakeholder was not monopoly and local administrative sector could get taxes and land renting to support local people livelihood without environmental impact. Moreover, government sector had to support a province on increasing a capacity of energy crop planting and production. Achieving renewable energy development government sector would address its provincial strategy and gave a chance to other investors. Government had not to invest because it could not make a profit and overwhelming corruption. A wording of investment could show us in case of social investment meaning to a kind of renewable energy.

4.3.2.2 Relevant power and investment group was authority as local energy policy maker directly to energy planning and database including influential capital related to a measurement of local government in term of research, development and investment renewable energy in province. The suggestion concentrated on local ability was that local and provincial administrative had a capacity together with their citizen, local politician and relevant beneficiary working for people and province. It would be a model of local investment, local administrative joint venture with private company etc. PEA could support on a process of planning with electricity planning at legally permission at 1-8 megawatt. Not only concerned they about renewable energy supply but also energy efficiency in each household and institution. At the same time PEA could support provincial energy development in term of potential of renewable energy, energy demand and supply, renewable energy research, renewable energy study and smart grid communication. And academic institution would acknowledge student especially university and vocation collages. It had institution in province already to push forwards energy development plan but it had been lacking of integration. PEA and municipal could be a stakeholder of renewable energy investment. Local government budget could come after a clarified vision.

Renewable energy could reduce electricity bill so government would support by decreasing loans' interest to power producer and market mechanism of technology price, fuel and electricity cost. Government had to conduct renewable energy database as a menu and then charged private sector back with fee or special tax. Energy planning implementation consisted of budget, human resource from provincial and local administrative sector, experts and people. Budget would come from Provincial and Local Administrative Offices with about 20-30 percent government sector could

be a supporter if budget was not enough. A model of Nakhon Si Thammarat province would be established a learning center for adjusting appropriate model in each scale.

They agreed with small cooperative model which invested in community with sum money. Government could train people about technology management if a project had been started first by government sector support. Government could invest for one community as model or center in province and if other areas were interested in that how to further develop similar to be expanding. Provincial energy management would be set up a board with committee working in period time and reported back to province and people. The quality of board consisted of professional and expert with relevant authorities ‘control. The benefit needed to be directly transferred to people in province without limited external investment. Furthermore, electricity generating investment would be an income distribution to people in province it could be gradually growing from local community scale to district and finally at province.

Implementation energy plan would evaluate a potential of renewable energy in each district with an assumption if EGAT had not supply electricity how we could self-reliance. We needed to increase our capacity building since small institution to province to make its energy development achieve in economic, society and environmental securities. The population and economic growing was a factor of energy plan in rural and urban areas. It was not just local administrative to conduct provincial energy planning because it had no vision and budget to change it. A leader could walk to a target not just standing with a holding target. It was the same with community which needed to develop its energy strategy to propose to local administrative.

4.3.2.3 Provincial government sector was a policy maker centralized provincial budget and policy of renewable energy development harmonizes with central energy policy makers as top-down and bottom-up planning. They recommended about policy level support was that the initiative investment could be run with budget of government sector, municipal and a large local administrative. Energy development project in province was not much created because it took time more than road construction and facility projects which of course politician needed an objective thing to reserve him or her election votes. In fact, business sector in province had little capability to invest in a small scale of renewable energy. Renewable energy investment was definitely happened because its project in local area was cheap investment cost with resources, transportation and good environment with public participation. The budget would come from Ministry of Energy, Provincial and Local Administrative and advantage sharing without monopoly was a hard work to deal with. Renewable energy was not easy to be developed in district or province because it needed strengthen community and various experts. How to manage with energy of natural resources in local and return to nature was an important fundamental preparation.

Electricity power plant investment would origin of people in province under decentralization concept and small scale to overcome the barrier of local investment capacity. Its development would depend on a part of government support. Energy planning model could be mixed with people possession by sharing a stock with a different benefit zoning such as renewable energy plant was shared more for everyone

in communities which had project development and further. Withoutstanding cooperative model limited a working group in a long term with less effective and private investment needed to turn the most target of profit to support each other on energy development and survivor. Government sector could support project loaning with low interests because the more people invest the less exported fossil fuel and transfer that budget to renewable energy investment instead.

Academic side and university network would be gathering with government, business and public acknowledge and encouraged people to achieve a plan with a district concept leading to provincial energy development. Local and Provincial Administrative were key office to solve energy management problem in province. Problem of biomass management was forest restoration to plant energy crop with good price and income. Public participation in every project with transparency and fairness people could be a part of environmental control and stakeholders as beneficiary. Energy crops were needed a tool of area zoning to manage agricultural planning, energy and food security.

Energy management would be integrated budget from each part of Provincial and Local Administrative to uptake community scale to district and provincial one. Private sector of Nakhon Si Thammarat had restricted to invest renewable energy project and much relied on outside. It could be adapted from cooperative, small and medium enterprise (SME) to be like stakeholder or joint venture with mainly government support. The provincial budget had small grants to develop green energy for small industry and household project annually. Even a province had not enough budgets to invest renewable energy it could be joint venture with big company or Oil Corporation supporting according to a plan. Law was not specifying a percentage of each budget it depended on budget allocation in each administrative.

Nakhon Si Thammarat province had a capability of rubber tree and fishery so model of energy development would be a small scale for community and financial support by government including academic support on information and knowledge. Making people awareness on population increasing and growing energy demand was a way to seek a proportion of renewable energy support. Whoever could be renewable energy producer and investor and benefit was belonging to people and province. Corporative model would elect a board to manage electricity generating, member benefit and distribute on grid connecting with pay back income to community and holders. And stakeholder model was a long term paying back working though selected committee and then they chose an expert management team. Community in which renewable energy had been developed was a priority of benefit sharing with a management concept of transparency, participation and fairness.

4.3.2.4 Local government sector was a group of directly authorities of local energy policy and local renewable energy investment and development. They proposed that a province was lacking of integrated energy policy, public acknowledge and public participation. Provincial energy development had to address a mission, implementation and evaluation. Government was a main leader to innovate renewable energy in province. Renewable energy power plant scale would be started with the effective provincial office support. Municipal was one office with strengthen ability to start it and of course, Provincial Administrative Office had more budget and authority to experience province or supported local administrative which

depending on the vision of leaders. Cooperative model of renewable energy investment would be great because of people's owners, public participation and acceptation to reduce conflict of interest and sharing benefit with transparency, accountability and fairness. However, stakeholder model was hard to access in term of people had no experience and knowledge about stock market which was inevitable to overcome monopoly system.

Energy management in province was new idea of people and government offices. The advantage of power plant ownership was that people had a right to investigate power plant process with a reason on environment and investment balance. If government had policy support renewable energy with subsidy, feed-in tariff which grew its investment at local investors and people would like to invest when government declared a concrete energy plan and future which became a main function to push provincial energy revolution. Increasing renewable energy in Nakhon Si Thammarat province needed a concrete plan to be achieved. Provincial Power Office had no vision of conduction Provincial Power Development Plan because its project development had just occurred in a small scale according to Ministry of Energy concept. A Head of Province and Provincial Power Office had to address self-reliance provincial energy policy considering a cost of energy development and added values in a long term the cheaper electricity cost. And a key player of energy planning was Provincial Administrative Office which was independent, flexible, continual office, and covered areas with a large budget about 800-1000 million baht a year to be financial support of provincial project development whereas municipal had a capacity with limited areas in Mueang district and local administrative with just covered sub-district. The important thing was that the mission of energy planning was a connection. A province needed to address a figure of renewable energy target which significantly evaluated each year and encouraged people to achieve it together.

4.3.3. Implementation of planning

Regarding to Anna et al., 2010 the elements of provincial electricity management composed of electricity demand, the supply side on renewable energy and energy management which was a core of sustainable energy planning. The implementation of planning was the practical measurement, a first model of Sustainable Provincial Power Development Plan which was advantage on establishing an officially structure of province to implement with a concrete plan to be self-reliance on energy supply and increasing renewable energy investment in province. Provincial Power Development Plan strengthen the future plan to produce energy in the province priority basing on internal renewable energy potential and others if it needed to be supported provincial energy demand growing. The pathway to develop Provincial Power Development Plan based on public acceptance and appropriate to province development vision its decision should be integrated. Public participation is essential factors together with provincial strategy and national energy planning to be success. Movement to develop energy plan required good mechanism and the long

term planning to uptake national policy even it already had achieved in provincial energy plan within the province.

Provincial Power Development Plan for other provinces was the interesting models progress depending on the sustainable energy indicators and the reviewed provincial strategic plan with public participation and transparency. Power planning in a province would be difficult to move forwards even a solution policy because of lacking human resources, budget and continuity and relying on central energy policy. Some interviewees mentioned that although local government namely Provincial Organization, Municipality and large Sub-district had some budget to create and develop renewable energy project in fact, it would concern on politic benefit and some local government corruption by gain benefit from investor or project in province. The provincial energy planning needed to communicate and gave knowledge to Nakhon Si Thammarat citizen in every beginning level start with household, school, community, religion and other institutions understand renewable energy and development plan in province. They agreed that clear and correct information communications were the key factors to input information before making a decision on its plan. At this time Provincial Power Office, Provincial Industrial Office and local government especially local regulator related to energy projects development, had to work together informing the truth of energy project in the province reducing the poor attitude about energy development project and after that searched the way to develop provincial energy planning together with public participation.

Although a province had potential of renewable energy it was essential for people start thinking of provincial energy planning with the easy question was if EGAT did not transit energy to support energy demand in the province afterwards and what the energy plan would be. The province was still need natural gas to maintain energy supply and security and renewable energy plan was the figure to reduce all natural gas supply. Communities would have energy plan growing up to Sub-district level and district and blooming to provincial and national energy planning which needed every small, medium and large energy planning to be developed as its short, midterm and long term planning. The structure of provincial power development plan required the existing organization in a province work completely on their roles without creating new players and committee which was the opinions of the interviewees. For instance, Provincial agriculture was likely the Ministry of Agriculture and compared to all accredit with the center administrative it found that the structure was there but the missing was vision of the leaders, the understanding of their roles to create energy security and sustainable plan for people as alternative plan to see what the future they preferred to be alive. Model of Power Development Plan would be consisted of Provincial Planning Committee and Provincial Renewable Research Committee under public organization structure which was professional, transparency and accountability.

The word of “integration” in province, a key message which mentioned by all interviewees and they agreed on a necessary principal to cross barriers of renewable energy development especially integration among the existence of government offices in a province. Nakhon Si Thammarat needed to implement Provincial Power Development Plan integrated with a group of central academic, local and provincial

administrative sector, energy development office and relevant investment sector. Those coordinated with Provincial Power Office to implement together on producing and distribution planning. People, investor and energy committee could achieve what they planned to move next. How to make people in province awareness on this issue was reflected to a small energy development in province to regional energy development and finally national energy level becoming a model of electricity development. Government needed to be serious on this model because it could be a case study of other provinces experiencing and sharing to move forwards on each province.

Power development planning exposed the potential of renewable energy in province and would be developing to sell other regions to increasing economic income however, people in Nakhon Si Thammarat province had to develop according to the concept of power plant possession. The existing government structure was a good model but it had never applied for the effective energy development. It was a same thing comparing to each Ministry responsibility if provincial and local administrative realized on their duties without setting a new department again and again. It was just hire consultant and expert from other sectors to support about research which was enough on provincial energy development plan.

The important thing was that transparency and accountability of people and relevant offices to work on energy development planning and implementation. The culture of knowledge, awareness and public participation valued to create for energy planning. It was a possible model proposing with a questionnaire to collect people opinion in province about the prospective, investment capability with various models and scenario which people could see and make a decision. Gathering power producer and public investment would be a role of relevant Provincial Commerce Office and in a future Provincial Regulator Committee to consider a kind of power plant. In present it was lacking of integration of energy development.

Implementation Provincial Power Development Plan needed integration with Head of Province, Provincial Administrative Office and Local Administrative Office, energy office, agriculture office to give information to people and then together develop a unit to make it happen. In term of Provincial Power Development Plan implementation could be a kind of a small provincial sub-committee board. Applying an existing government structure and making it better with a main of relevant energy office, local and provincial office, public participation and beneficiary linked to a renewable energy research board, a Head of Province to approve a final energy plan and then it was proposed an original bottom up one to national energy development plan. Provincial Power Development Plan required private sector to study a potential of renewable energy together with beneficiary by PEA financial support or government sector. Public acceptance with a trend of economic growing information was useful to expanded renewable energy investment. The management would be flexible and shared benefit directly to people with external expert board as election or selected process by provincial representative as public organization balancing power.

4.4 Provincial Power Development Plan

The opinion of provincial power development plan illustrated as below which they agreed to apply the public organization concept to conduct and managed Provincial Power Development Plan in consideration of the effective, transparency

and good governance. Nakhon Si Thammarat Power Development Plan model would be an external energy expert board under public participation to link with provincial renewable energy research committee and provincial energy planning committee integrating to conduct the sustainable energy planning as Provincial Power Development Plan with the commitment of public hearing and participation. The candidates needed to manage renewable energy investment; income and distribution for people in the province and finally the advantage directly impacted to reduce the risk of energy insecurity and the effects of provincial economic, social and environment.

A researcher reviewed a process of national Power Development Plan 2010 which had been accredited by Ministry of Energy as a president of Energy Policy Executive Board authorities to address subcommittee of PDP peer review. Deputy Secretary of Ministry of Energy was a present of that, the Director of Office of Policy and Energy Planning as sub-president and working with sub-committee of government, state enterprise, academic, expert and relevant private sector. The process of that remained a concept of public participatory, transparency and accountability through opening public platform after the approval of subcommittee of PDP peer review and then proposing to National Energy Regulatory Commission (NERC) and National Energy Policy Council (NEPC) and finally cabinet approval. The reasons of PDP conducting were to ensure the investment of energy development, growing renewable energy and energy efficiency, reducing Greenhouse gas emission and adjusting PDP conform to economic scenario changing. In Table 28, national Power Development Plan Process presented the process of PDP conducting with a responsibility of Ministry of Energy and accreditation working groups on PDP scenarios submitted to public and relevant energy offices. Considering Anna et al., 2010 a study found that the development of national Power Development Plan covered the element of energy management significantly on demand, supply and management sides (Figure 20). However, details of energy management institution had a different in a province's factors.

4.4.1 Connection of National PDP and Provincial PDP Model

The potential of renewable energy of Nakhon Si Thammarat province in 2012 stood at 1,613.24 MW and 106,640.07 ktoe with recently energy consumption at approximately 250 MW annual. Then the figure of renewable energy in province had served energy consumption adequately but in fact, energy supply theory would base on diversification fuel. Natural Gas power plant at Khanom District could be served as energy security generating and transmitting on grid for all time. However, the renewable energy utilization planning was an essential measurement to reduce energy demand from a large power plant, supplied renewable energy more than just peak time period including starting on community energy management to self-reliance on energy supply. Decreasing fossil fuel energy consumption affected directly to the amount of energy consumption in Southern and country.

Provincial PDP was a tool to significantly propose a renewable energy plan in province to serve 100 percent of energy demand in a long term, increasing Gross Province Product and job creation etc. Provincial PDP model in Figure 21-23 needed tripartite expert of energy management from government, private and public working

under Public Organization concept with a selection or election procedure. The movement of Provincial PDP Committee was to conduct a Provincial PDP working with Provincial Energy Assumption Sub-Committee and Provincial Renewable Energy Research Sub-Committee based on their responsibility. Provincial PDP would reduce a risk assessment of provincial and national energy supply finally. Provincial PDP aimed to increasing community energy with off-grid and on-grid connection to reform the electricity markets by guaranteeing priority access to the grid for renewable power generators, ensured that all citizens had equal rights to access renewable energy source, assured national utilities hold accountable in managing electricity infrastructure, increased research and development budgets for renewable energy and energy efficiency in the provincial level and consumers had a right to buy electricity from renewable energy production. Case study in UK showed the effective of feed in tariff with community generation of self –sufficient in electricity which the excess power had automatically transited into national grid under a grid system's function and permanently monitor (Ducan C., et al., 2011)

The lacking of public participation on National PDP was reduced the gap on that by applying a structure of Provincial PDP Committee with a concept of Public Organization and election or selection process under public acceptance. A permanent structure of Provincial PDP accelerated the effective of energy planning in a long term with different from national PDP which was accredited frequently according to a trend of economic and energy growth. Consequently, national PDP responded directly to supply the increasing of energy demand Provincial PDP was a part of energy generating to support on national grid.

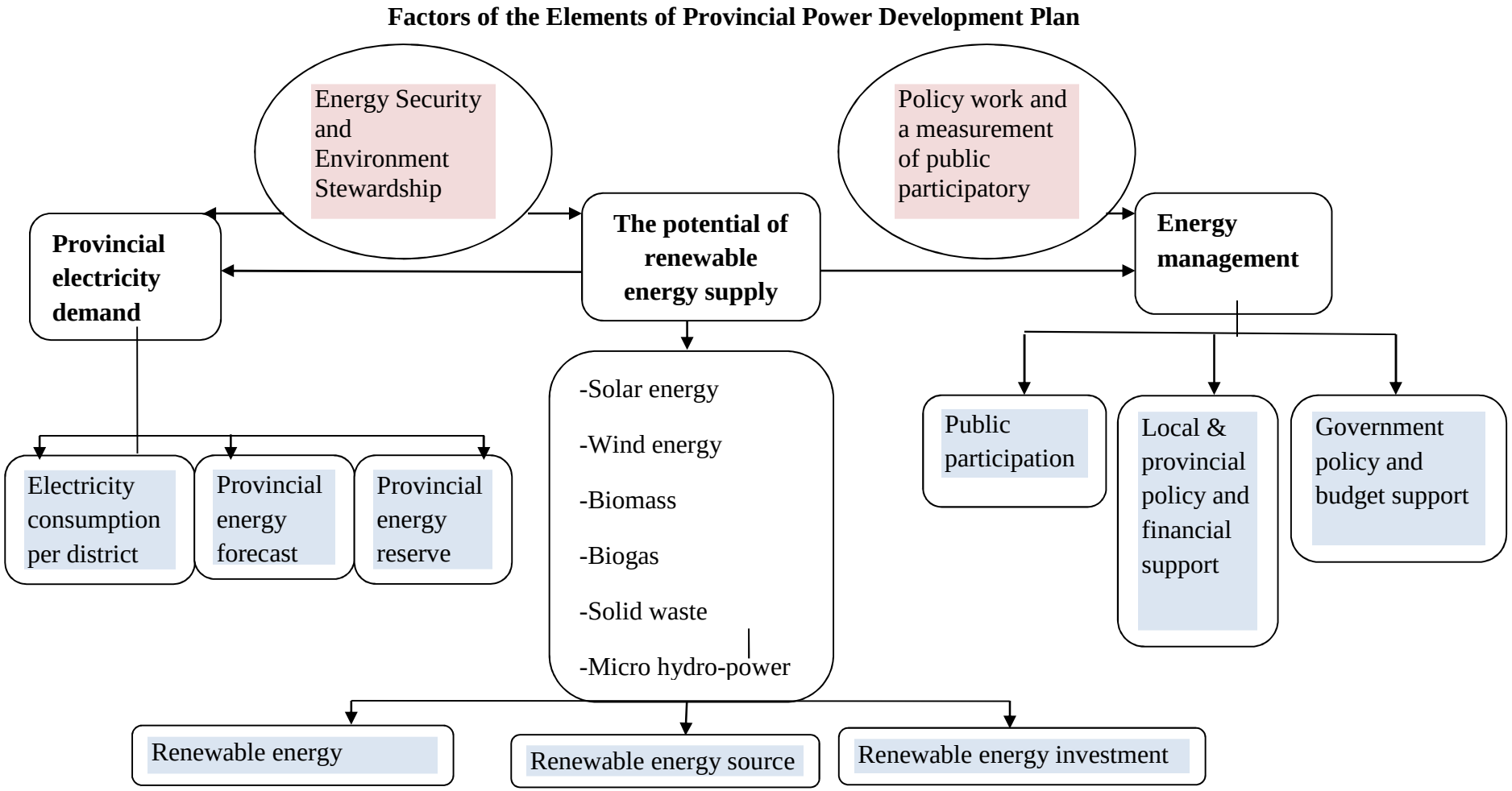


Figure 17: Factors of the Elements of Provincial PDP

Source: Modified from Anna. N., et al., 2010 and PDP concept

Table 13 : National Power Development Plan Process

Principle of PDP conducting	PDP 2010	Subcommittee of PDP Review	Working Group of PDP Assumption Review
1. Policy Work	1.1 Accreditation of Subcommittee of PDP Review by Ministry of Energy as the President of Energy Policy Management Committee	1.Energy Ministry Permanent Secretary	1. Representative of EPPO
		2. Director of EPPO	2. Representative of DEDE
	1.2 Energy Ministry Permanent Secretary as President of Subcommittee of PDP Review accredits of Working Group of PDP Assumption Review compose of a representative of government, state enterprise, experts, academic and power producers.	3. Representative of DEDE	3.Representative of ERC
		4. Representative of NESDB	4. Representative of EGAT
		5.Representative of ERC	5. Representative of MEA
		6. Representative of Federation of Thai Industries	6. Representative of PEA
	1.3 Arrange two small group discussion and public hearing platform	7. Representative of PTT	7. Representative of academic and experts
2. Energy Security and Environment Stewardship	2.1 Energy diversification	8. Representative of EGAT	8. Representative of academic and experts
	2.2 Proper energy reserve not below 15 percent	9.Representative of MEA	9. Representative of EPPO
	2.3 Reducing GHG emission	10. Representative of PEA	10. Representative of EPPO
	2.4 Increasing renewable energy	11. Representative of Private Power Producer	11. Representative of EGAT
	2.5 Promoting energy efficiency with cogeneration system	12. Representative of academic and experts	12. Representative of ONEP

Table 13: National Power Development Plan Process (Cont.)

Principle of PDP Conducting	PDP 2010	Subcommittee of PDP Review	Working Group of PDP Assumption Review
	2.6 Energy imports	13. Representative of academic and experts	13. Representative of Thailand Green House Gas Management Organization
	2.7 Demand Side Management	14. Representative of academic and experts	
	2.8 The portion of EGAT's energy producing	15. Representative of academic and experts	
	2.9 Estimate of fuel cost of electricity generating	16. Representative of EPPO	
	2.10 Considering new power plant installation or repowering	17. Representative of EPPO	
2.1. The Assumption of PDP 2010	2.1.1 Energy Demand Forecast base on long-term economic GDP growth trend by academic research under Energy Policy and Planning Office (EPPO) and Office of the National Economic and Social Development Board (NESDB)		
3. A Measurement of Public Participatory	3.1 A long-term planning 20 years with a review plan according to economic factors		
	3.2 PDP Scenario Plan		

Source: Modified from Energy Policy and Planning Office, 2010

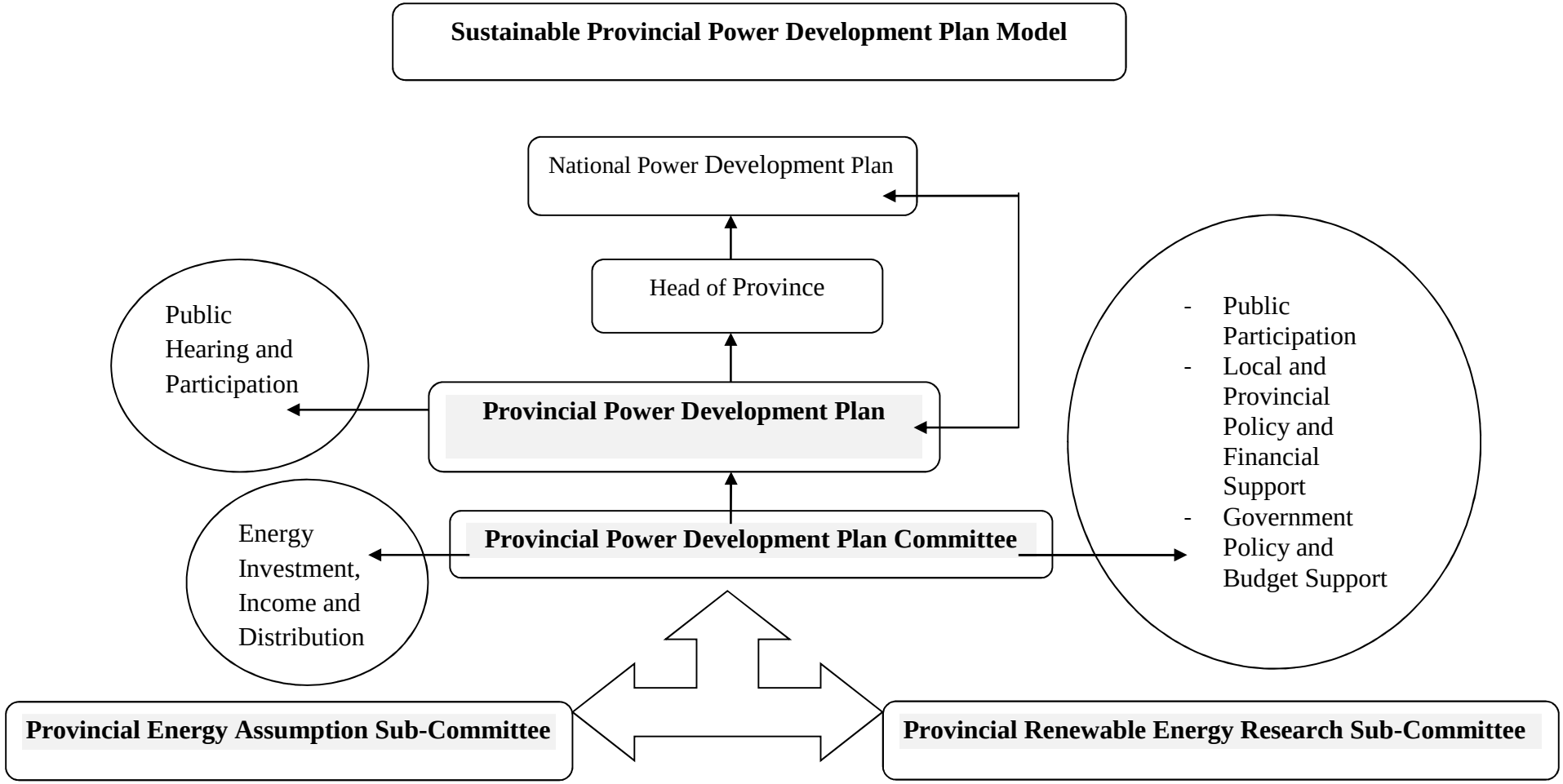


Figure 18: Proposed Sustainable Provincial Power Development Plan Model

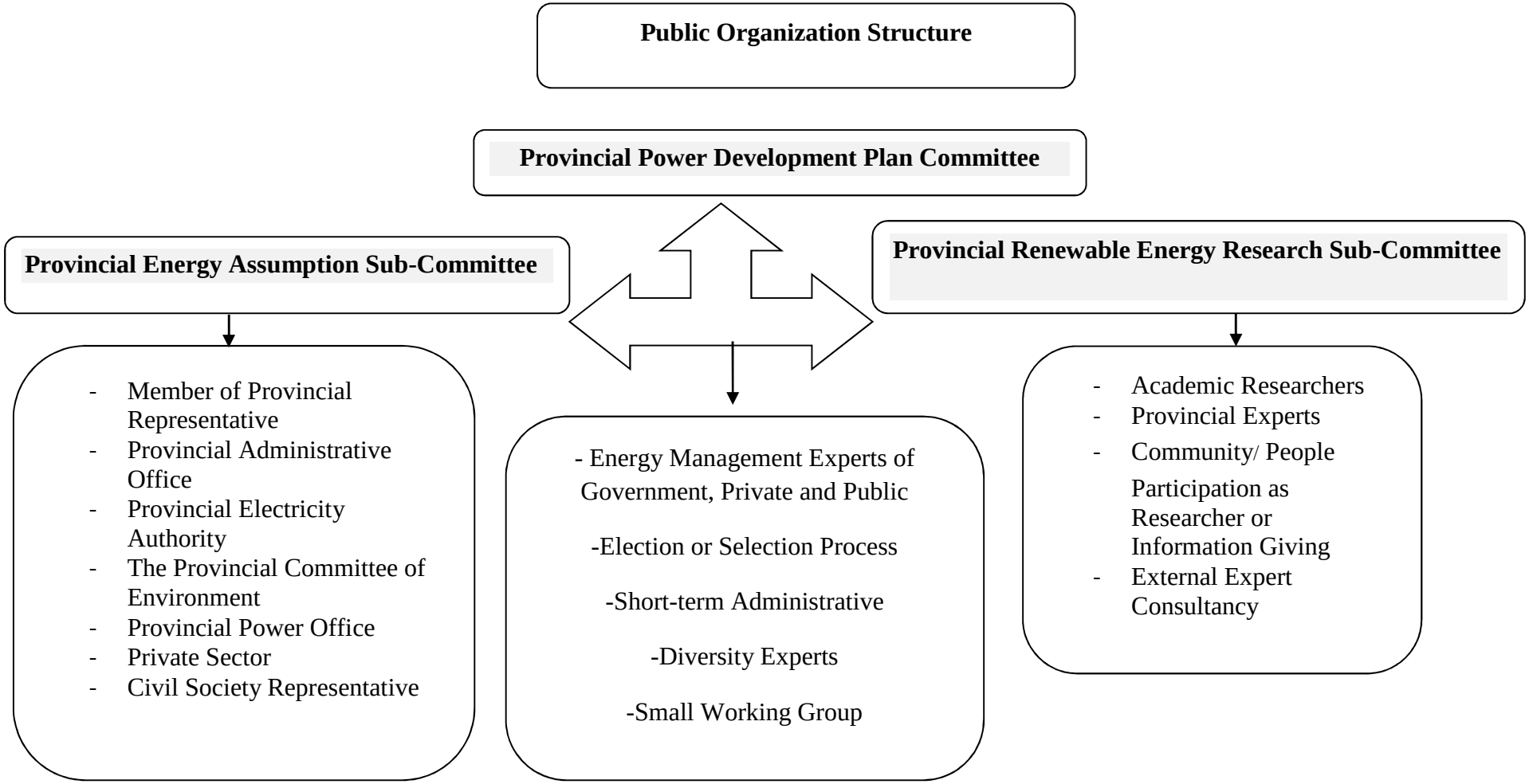


Figure 19: Public Organization Structure

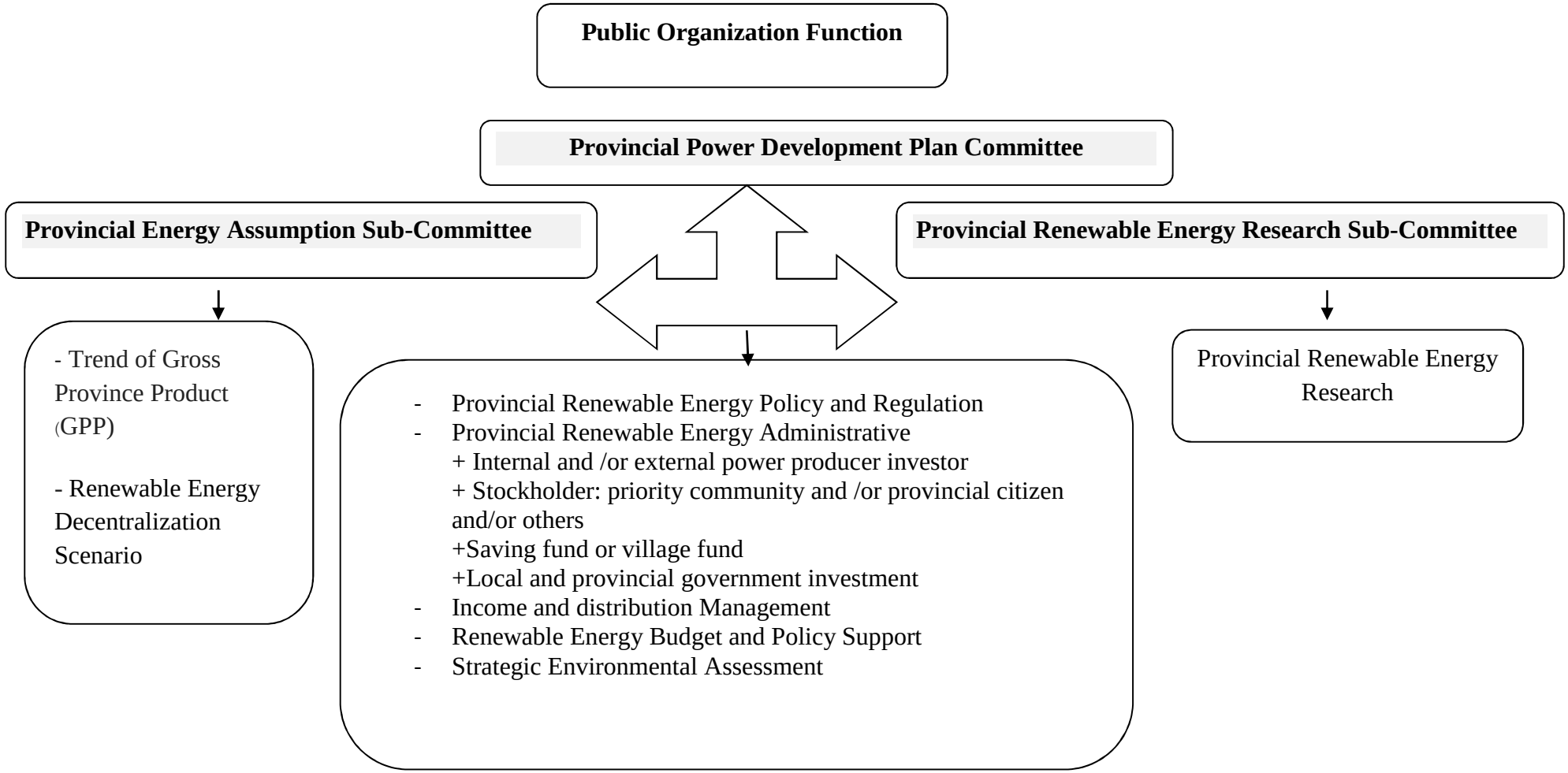


Figure 20: Public Organization Function

4.4.2 Community Grid of Provincial PDP

Considering the sustainable Provincial Power Development Plan, community grid was an access mechanism to renewable energy development as power producer of decentralization system. Community perspective was a social acceptance which affected to renewable energy planning and development to drive decentralized grid system and smart grid control with fit to community (Maarten W., 2012). Implementing Provincial PDP with concentrate on increasing renewable energy utilization the concept of ownership of renewable energy investment linked to community's power plant which was not just mean to the external investor and energy fuel supply it was expanded to energy co-producers.

The study could be summarized the important factor on how citizen in the province had fair and transparency distribution benefits including the right to prevent and manage the effect of economic, social and environment impacts of Provincial PDP, with various opinions of provincial renewable energy investment shown as firstly was Nakhon Si Thammarat province would apply public organization management model to distribute the advantage priority to the provincial citizen by holding stock of renewable energy project and got the income back from electricity selling and tax which the renewable energy investors could be internal or external citizen in the province. Secondly, the province would develop co-operative model which was happening at Kiriwong community in the province and suitable for community or small scales. The support originated from local and governmental administrative to generate electricity from renewable energy and sell it to be a community's income and it supported conservation and energy development in community. Moreover, province would encourage the local government capacity to invest renewable energy for electricity generating. It benefited for people in the province with tax investment, energy selling income and also improving especially environmental impact of energy investment because they could be a part of energy management and province would modify the village fund as government policy to stimulate renewable energy development and increase community enterprise and job creation by utilize renewable energy resources in the community with a finally province would increase the opportunity for internal and external power producer to invest for electricity generating of renewable energy. In addition to, people in project development area and provincial would hold the stock of private power producer ensure public participation in environmental impact and benefits sharing.

4.5 Restricts of Sustainable Provincial Power Development Plan Implementation

Nakhon Si Thammarat province aimed to implementation Sustainable Provincial Power Development Plan considering about provincial electricity supply and demand, the potential of renewable energy supply and energy management. In detail of each needed to be identified situation in province on energy development at present and a pathway of integrated organization and institution in needs. A study determined to 4 points of the limit to conduct Sustainable Provincial Power Development Plan was that information and research, renewable energy budget support, renewable energy policy and regulatory and provincial renewable energy investment.

4.5.1 Provincial renewable energy research

Provincial energy research benefited to know deeply the potential of renewable energy in a province to develop towards investment and clearly people understanding on renewable energy project development including decreasing their worried whether impacted to swallows' nest collects business or fishery etc. Knowledge and research management were key factors to develop further provincial energy plan. Skillshare and model creation could encourage people to learn about renewable energy and had ability to maintain and expand their projects better than just feed them all.

The province had a problem on renewable energy database. The existing from government and academic research was not agreed data hence, provincial policy and public sector was confused to apply its plan. Being overcome problem it was essential that the province had to create provincial budget for renewable energy research center providing by fossil fuel funding. Most of them agreed that fundraising for research center would be government supported like public organization management and people could be shareholders because government sector works for just made it happen, business creates it for profit and local government needed time to be better with vision and policy.

The result of provincial renewable energy research served power producers and investors, decreasing its policy conflict and reducing fuels import, considering a priority of potential of energy sources etc. because its technology price continually decrease and by in opposite direction fossil fuel cost. Not only had renewable energy information been conducted but it illustrated income, job creation and electric price etc. for people decision and more awareness.

They believed that academic expert whether internal or external province was the main responsibility to survey the potential of renewable energy and its advantages which had to communicate widely to uptake people in the same level to further develop for sustainable provincial development plan. However, some had been raised about the renewable energy research intellectual property which barrier further investor who was able to develop the projects for example academic and expert from university had conducted the potential of alternative energy in province or community but people had no right to use the research result or limited application.

The suggestion was that it must be wide-opened for people advantages and further investment. It was lacking of integrated information between academic, community and investors. In fact community was one of research stakeholder they needed to understand the basic of community research. How to increase the opportunity of people to access the information and apply it finally was an urgent improving. Local people would be a representative of a committee of Provincial Strategic Planning and energy research center. Budget supporting was not difficult if it was useful to increasing the capacity of people and potential of renewable energy.

Nakhon Si Thammarat province needed "Wind Energy Center" with conducting research and budget supporting which would be income from natural gas power plant because it used resources from province. It needed young generation who interested in energy issue to advocate renewable energy field. Capacity building under public organization concept as "Provincial Energy Center" or "Nakhon Si Thammarat

Energy Research Institution" was one of further strategic to implement energy planning by citizen's stockholding or created other appropriated model development.

4.5.2 Renewable energy budget supporting

It had no directly authority office to develop the provincial renewable energy and the energy office in a province had less ability and authority to manage it which had been set up in the province just the branch of Ministry of Energy and supported community scale projects.

Renewable energy subsidy from as local government namely Local Administrative, Provincial Administrative and Municipality would support to start technician and technology sides. However, if considering the local government policy it found that they did not deeply have a plan about energy supply because of familiar with buyer roles and no need to think out of conveniently national grid support. Provincial's budget to finance renewable energy of community emphasized just fundamental scale especially biogas in households or community.

An interviewees 'opinion mentioned that "If one talked about budget which office would start first? It would unlock with allow local administrative to buy in renewable energy project. In term of annual budget it had Collective budget with the rest of its spending according to annual budget date after the end of September so local administrative has authority to spend its budget which is a big amount of money of every office according to law enforcement to collect in a pot. In some collect up to million baht it could be taken out to develop energy project for people in future. Nowadays, this budget could not be spent it was just for saving and if it needed to be taken out the Head of Province had authority to approve. So we needed to think more how each local administrative could share xx percentage of its pot for renewable energy development.

Local administrative budget to spend for renewable energy was hard because it had not much budget and different administrative scale. Taking a share in the expenses from every Local Administrative was also difficult because it was various development and exigency and the policy especially government's measurement focused on fossil fuel funding replacing transferring money for renewable energy investment. Most of them agreed that government; provincial and local budget would be integration increasing renewable energy support in the province. And the budget had to cover the maintenance activity which happened in each renewable energy development especially governmental project support after the project completed, local people had less knowledge to fix or maintain its technology. Small scale development project depended on designing and training the trainers in community and how to encourage community for energy development and environment conservation at the same time.

Nakhon Si Thammarat Province Development Plan had 4 main strategies to increase all capacity building becoming a "green city" as the main policy in the long term energy related. Relying on its plan Provincial Power Office, Ministry of Energy responsible for conducting provincial energy planning with the missions to support and develop renewable energy utilization in the province, raising awareness of energy efficiency, provincial energy management and administration. Main of the strategies based on advocates and develops the effective renewable energy technology, public

participation from every sectors including private, business and government stakeholders, the effective provincial energy management and developed the capacity building of Nakhon Si Thammarat Provincial Power Office both acknowledge and technology innovation.

Regarding to Nakhon Si Thammarat Provincial Energy Development Plan from 2009-2012 which had been allocated budget for energy purpose just 4 years and the budget was not enough as the important of budget requirement to apply the utilization renewable energy and develop Provincial Power Development Plan. Comparing to other budgets it found that especially provincial facilities were still important project for provincial policy makers because of touchable project and could finish in a short term.

Although Nakhon Si Thammarat Provincial Power Office had been responsible for Ministry of Energy and connected policy from central to local its authority was account for community power plan as local administration scale and emphasizes distributing renewable energy budget for project development in community and local levels. The scope of work plan pointed to training community leader, collected energy consumption in community, had a field trip study from others, drafting community energy plan and summaries to be a plan for community and innovated small projects like biogas, biomass, mini-hydro power, etc. as community model with public participation for community energy planning. Apart from governmental budget in Table 29, the province together had the budget of increasing renewable energy project by Natural Resource and Environmental Management Plan of the Southern Gulf of Thailand in 2012 composed of Chumphon Power Office, Nakhon Si Thammarat Power Office, Suratthani Power Office and Phatthalung Power Office. In sector 3, natural resources and environmental management on green city strategy had been addressed 22,800,000 baht to achieve the objectives of decreasing the energy expenditure in community, conserving environment by renewable energy promotion and developing energy facilities in communities.

4.5.3 Authority of Local Administrative and Provincial Administrative on Provincial Power Development Plan

Implementation national Power Development Plan was the directly government policy and Ministry of Energy responsibility to accredit committee, experts and public participation process whereas Provincial Power Development whether imperative energy policy from central. The question was that according to the law enforcement it had not directly addressed the authority of Local Administrative and Provincial Administrative to initiate the first Power Development. It seemed to be the Head of Province would have authority to policy on province energy management however, representative bureaucracy in country had to under central and government policy. In consequence, sustainable Provincial Power Development Plan was difficult with

implementation and practice if the top-down policy inarticulate practice. Furthermore, the important reason on that was since energy planning, energy management, energy implementation and energy distribution had never decentralized to local and province. Monopoly and conflict of interest on energy system in country was the last obstacle which essential factor to break it down and strengthen community, local and province to achieve the sustainable Power Development Plan accelerating good governance local and province capacity building and directly advantage to country in term of energy security by decentralization system, economic growing by job creation, well environment and social elements by decreasing Greenhouse gas emission and pollution from fossil fuel energy generating.

Table 14: Provincial Renewable Budget in 2009-2012

Year	Strategy	Project -Budget Holder	Budget (Baht)	Remarks
2009	Section 3: Natural resource and environmental management	The project of renewable energy promotion by Provincial Power Office	2,933,600	approved
2010	Section 3: Natural resource and environmental development	●The project of entire biodiesel production of crude palm oil by Provincial Power Office	2,000,000	approved
2011	Section 1:Ecomomic development	●The project of palm planting promotion by Provincial Agriculture and Provincial Cooperative Office	16,855,000	approved
	Section 3: Natural resource and environmental development	●The project of entire biodiesel production of crude palm oil by Provincial Power Office	2,000,000	approved
		●The project of livestock biogas promotion by Provincial Power Office	1,000,000	approved
		●The project of renewable energy promotion in accordance with His Majesty King's by Na Bon district	500,000	approved
		●The project of biogas promotion by Department of Lan Saka Local Administration	1,692,000	approved

Table 9: Provincial Renewable Budget in 2009-2012 (Cont.)

Year	Strategy	Project -Budget Holder	Budget (Baht)	Remarks
	Section 3 : Natural resources management including energy efficiency promote and renewable energy increasing	●2 projects by provincial officers	45,600,000	on process
		●42 projects of Energy by Ministry and Energy Department	504,306,080	on process
		●2 projects by Department of Local Administration	1,405,000	on process
		●0 projects by community and private joint adventure	0	-
2012	Section 4: Natural resource and environmental development Thai Strengthen Action Plan 2012	●Renewable energy self-reliance by Department of Local Administration	299,000	on process
		●The project of swine farm biogas promotion by Provincial Power Office	461,200	on process
	Total (appropriate budget)		**579,051,880**	

Source: Modified from Provincial Strategic Office, 2011

4.5.4 Renewable energy policy and regulations

The energy policies relate to Nakhon Si Thammarat province consisted of two issues, renewable energy resources management and electricity generating regulations. The one potential of renewable energy was biomass which related high agricultural products and had been provided to small power plant and industrials in a provinces. Managing the future agriculture raw materials to fuel renewable energy generating they mentioned about its sufficiency. The provincial problem was not distinctly target to zoning agriculture for increasing energy producer sector although the basin of the Pak Phanang River, covering 13 districts had been palm planting projects and cultivated lands according to the Royal Development Projects. Land use in the province caused the law enforcement and regulations. The kind of agricultural products in the present had been depended on market price and if the further development of biomass suddenly growing it encroached on forests. The later, bioenergy had a specific planting technic and land quality consequently changing the way of life was complicated and differ from their traditional knowledge.

However, bioenergy zoning needed policy integration in center and local government which was the lasting problem in country. Provincial City Planning, Agricultural and Strategic Offices were required to work together on solving the problem with energy sectors in the province. And the external factor of planting bioenergy crops government sector had to concern about natural disaster which considerably occurred in each year would affect the quality and quantity of bioenergy and cultivated plants.

Therefore, bioenergy cultivate promotion would be initiated from people customary knowledge and valued of the products and then gradually investmented by small one without a huge project from government. And the better solution it would be applied the original knowledge and the former biological species to research the potential of biomass raw materials and improve plant breeding which is appropriate for food and energy. This was mention that zoning energy crop planting required whether regulation or law enforcement and development in private land property with private objectives and relocated habitat. It was not enough on provincial policy and need to uptake on national policy. Linking agriculture industry was a best way of bio-crop development with decreasing capital cost and balancing food security. Agriculture industry zoning depended on a quota of electricity generating and quantity of fuel sources. Government had to invite a private sector to initiate energy crop zoning and present a figure of installation capacity it was government responsibility to stop a loophole of inadequate renewable energy information.

Secondly, energy supply in province was transited to national grid according to the centralization energy system. And in the future the transmission line would be developed as smart grid project to connect energy power producer from households' electricity selling and convenient other energy supply sectors. Smart grid made people think about energy generating and earn money from the buyers. Producing renewable energy the producers and investors in province relied on adder policy support which the quota and permission had been approved by the central energy authority mainly energy regulators.

The situation of renewable energy power plant in some areas had been strongly opposed by local people because of environmental impact issue. Untrustworthy, significant point for people who refused the power plant projects even renewable energy. Government had no distinctly renewable energy policy and its impacts which was the same process of public acceptance in the past. Furthermore, the capacity of renewable energy was at 10 MW towards the regulation forced the investors to conduct Environmental Impact Assessment (EIA) whereas in fact, most of them avoided by developed renewable energy project under 10 MW and some tactics leaded people distrust compounding the failure of environmental management of energy power plant project in the past.

Moreover, the permission and regulation of renewable energy project was under Energy Regulator Committee and linked to National Power Development Plan (PDP). All energy permission was belonged to the center whereas the project development happened in the province although a company submited the proposal asking for power plant construction license to Provincial Industry Office and local government for a public hearing platform. A concept of EGAT choosing fuel sources from was the lowest cost and highest profit factors with less serious about the capacity of renewable energy in the province accompany with the decentralization targets of renewable energy project in province which addressed by Provincial Power Office. The last one was VSPP grid connection support as priority assessment to accelerate renewable energy development.

4.5.5 Provincial renewable energy investment

The agriculture and related agricultural industry had been not integrating to energy planning policy in a province. Renewable energy projects investment were external power producers because of lacking technology and financial support. The concept of 1 community 1 renewable energy initiative could encourage and grow renewable energy in Sub-district, District and Province later.

However, the barrier of renewable energy investment in the province was policy and regulator problem including the process was slowly with about up to a year to get electric generating license. And the first round of quota system at the first period many non-ability electricity producers had taken over and then it was out of renewable energy left project because of people interesting. The problem was presented that a measurement of adder was not effective for renewable energy investors because of slowly payment process. Government sector had to working fast and solving a barrier of its investment such as a quota of renewable energy project and giving money return as adder of renewable energy policy. Renewable energy was a new concept for country so a capacity of paying back was not excellent just in a rate of fair and good.

In the present, industrial sectors, especially agricultural industry sector and non-toxic waste endeavors provided renewable energy to decreasing cost of products and starting carbon credit. However, for some rice mill and icehouse had just been changing their producing time period from during day time to nigh time because of cheaper electricity cost. Renewable energy concept relied on decentralization as small scale to supply energy in each which was not large scale with high investment become community’s investment barriers. People owner the power plant was able to

control the quality and quantity of renewable energy projects in the province. And energy management had to be a local issue and movement.

Regarding to micro-hydro power, Khiriwong community was the first model of provincial renewable energy investment as community scale. Because of the potential of micro-hydro power the project had been continue developing from Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy approximately 14 million baht. The budget administrative was on behalf of Sub-district as local government and would be transferred the budget and benefit to community if it had capacity building. DEDE would take care of the project first until local community would have a strengthen capacity to carry out the financial management, electricity selling, investment strategy and human resources training. This was the process of government investment for community level. And the project success would be demonstrated as energy learning center and tourism center. The income of electricity selling was to develop the community projects needs which was specific on local community had less or no budget to support especially in water management, forest conservation as the essential origin of energy generating.

This problem was an obviously case study linked to government sector on law enforcement and investment which was mentioned that “Although government sector had a limit investment part according to law enforcement it was a one essential of its policy in case of supporting local renewable energy investment and how to manage its benefit directly to community according to legal law enforcement. A small scale of renewable energy development had many processes to access government funding and after selling electricity on grid local government was a representative to manage its income not community because of law enforcement. The solution was that local administrative would deduct a percentage of management and then transferred the left of income to community.

Local Administrative had authority to joint investment but it could not loan to invest any project in province which was different from Municipal and Provincial Administrative Office. How to solve this kind of law enforcement was to open investment market with public participation or shift Corporate Social Responsibility (CSR) objective to increase more renewable energy in province. In policy level, Provincial Administrative Office was high capacity to invest in renewable energy projects all of that depended on vision and implementation plan to make it happen. It needed to come from Provincial Power Development Plan with a good public participation. A project initiation in community was able to response a local need in term of energy supply, reducing fossil fuel depending. It would be sharing a role of energy supply to each office such as Municipal had xx renewable energy power plant or projects and xx projects for Local Administrative etc.

Renewable energy farm was the attractive places for renewable energy development and tourism center in the province and the important thing was people could be energy producer changing from the previous time as only buyer players. The energy development direction in province certainly needed to develop from the grassroots and households sector which needed government support depending on how many percentage. Like solar cell roof top policy development the first cost would be high at first that needed financial and policy support.

Renewable energy generating would be developed as small scale by community or Local Administrative which had their capacity and connected for its network. People did not want huge power plant like government investment and public owner model of its plant had to be practiced to reduce public insistence. Community model was suitable for self- innovation, maintenance and patent. Most of them agreed that Local Administrative had their own capacity and lawful authority to support renewable energy projects which was better than only construct road and facilities every year. However start with new vision and provincial plan changing needed government support because state's concept was not based on break-even point but citizen service was priority, as a result of the reason government had not proposed to grow benefit differently with private investment.

The problem of its investment was that the provincial leaders had no vision to develop as provincial policy level. Even the districts had potential renewable research showing the conflict of policy certainly occur especially the coast line areas both wind and coal projects. Beside of that, in order to develop provincial renewable energy it found some barriers such as land property price increasing by land agency, the different of figure of cost effective, obstructed policy during coordinate with The Board of Investment of Thailand and Ministry of Energy etc.

The majority opinion agreed with encouraging Provincial Organization as the highest capacity and budget to innovate renewable energy utilization. And some people further opinion that the renewable energy investment could come from external private sector with internal public procession to take part in environment controllers. And people required government support to become electrical producers connected to national grid which impact the capacity directly to national Power Development Plan. However, its capacity database needed to be correct from the local information working together since each renewable energy research had been started. Provincial organization and local government had to be much involved because of the income of investment return and local taxes.

The one important thing was that the interviewers who had experiences on renewable energy developing project suggests that if it had been financed by the government sector the income of electricity selling would go for Local Administrative including project possession according to Office of the Prime Minister on Procurement 1992, as amendment (No. 7) Act 2009 addressed. So if the model was government investment for community it needed to be realized on this issue.

CHAPTER V
CONCLUSION AND RECOMMENDATIONS

This chapter covered the conclusion of renewable energy potential in Nakhon Si Thammarat province and the proposed sustainable Provincial Power Development Plan process for the province, and also the direction of further research benefited to overcome the barriers for renewable energy deployment.

5.1 Summary

Electricity outlook of the province indicated that electricity generated in the province exceeds its demand, which implied that the province exported electricity to other provinces in the southern part of Thailand and trended to be one of electricity suppliers for the country. However, the main source of electricity generation in the province was natural gas combine cycle, whereas electricity from renewable source was low proportion (its installation as of 2011 was only 42 MW). Even though the previous study (Suwit P. et al. 2010) reported that Nakhon Si Thammarat province had high potential of renewable energy for electricity generation as much as approximately 3,200 MW (without dependable factor), but only about 1,600 MW if using EGAT's dependable factor.

In order to promote renewable energy development as well as energy security and energy self-reliance, the province should have its own Power Development Plan (PDP) which can be integrated with the national plan. Therefore, the present study has proposed a model for sustainable provincial PDP process, where its path way to develop the plan would consist of accredited committee of provincial PDP together with provincial energy assumption sub-committee and provincial renewable energy research sub-committee to work under public organization structure and function (see also figures 18-20). However, the authority of Local Administrative and Provincial Administrative would be decided by law enforcement and government policy to implementation Provincial PDP for sustainable energy planning.

The essentially fundamental provincial energy management is energy administrative structure and function to be constituted to overcome its obstacles and conflicts. Having an argument on increasing new large power plants according to the national power development plan has forced Nakhon Si Thammarat people to desire about alternative energy which affordable energy fuel in the province and the solution for longer team energy planning. Integrated relevant beneficiary and stakeholder to take participation since the initial engagement in energy planning can assuredly append capacity building in province.

In addition, people can practice further on conducting renewable energy research and technology initiative so that government should provide sufficient budget feed in.

To encourage power producer in the province as well as the country, it needs to increase budgets for research and development on both renewable energy and energy efficiency in the provincial level. Potential of renewable energy database as well as an energy map should be provided for people in the province and also for any interested investments. Concrete energy planning in the long term and accessible energy information should appear attractive to internally and externally provincial power producer investment which depends on the conditional character of investment models.

In case the provincial PDP for Nakhon Si Thammarat province has been preceded, an innovation of provincial energy management and provincial energy investment should be developed and learned further for other provinces and effective national energy planning base on accurate potential renewable energy as a priority to be calculated and public acceptance. The priority of the potential of provincial renewable energy development is the ability of internal energy fuel to generate electricity for demand side. In case of overload on supply side even the high potential of renewable energy and energy efficiency measurement the province can supplementary benefit as energy export in the future depending on provincial energy investment models.

To implement sustainable provincial PDP of Nakhon Si Thammarat province would require budget from relevant energy offices on develop and practice its model and preliminary renewable energy research including studying the capacity of financial support from local administrative, provincial administrative, existing of power plant and projects, fossil fuel subsidy, new power producer group and consumers. The diversity of provincial energy financial support can be continually growing the proportion of renewable energy, provincial energy management processing and undependable government support much. The path way of provincial PDP process can reflect level of provincial capacity and what it actually need to be achieved in term of energy decentralization and decentralized energy management authority which reduces ever monopoly of national energy planning and management. Therefore, the successful provincial PDP of Nakhon Si Thammarat province would rely on the capacity of energy and the capacity of relevant government offices, power producers and people in the province to bridge over barriers and preserve benefits at all.

5.2 Benefits and barriers

Nakhon Si Thammarat province had just started in the period of short-term energy planning which needed further policy and practical implementation and evaluation. First of all, the financial schemes for renewable energy was distributed from the majority central government support; whereas the dedicated local government support had not yet developed because of lacking the leaders' vision and the amount of budget sharing to create facilities building in provincial plan instead.

Campaign on energy issues that stopped large power plant projects in the province certainly resulted from the root problem of inadequate public participation in energy planning process. Normally, the process of energy research, energy planning and energy implementation was likely technical and difficult issue to make people understand at the same level, in consequence growing the gap of public participation gradually. Even the province had less participation in the national energy development planning; the public were also obviously far distance from energy project planning and agreement in the province. They actually knew when it had some representative or researchers passed directly to feasibility of the projects whereas some organization had a main responsibility but ignoring to officially declare to community in priority. And the last one was the local authority support on energy showed that in the province a small scale renewable energy development project had been spread out to other Local administrative as "One Sub-District One Renewable Energy Project" as the model for others sub-districts in the district to learn and exchanged experience each other. The objective was that government aimed to distribute the knowledge and practical to local people as renewable energy learning center.

The study had evidence in some to about the obstacle of sustainable Provincial Power Development Plan as following;

5.2.1 Energy institution structure

It was difficult to evaluate the provincial capability of provincial power development plan with reducing the dependent fossil fuel energy supply in future. The last obstacle of increasing renewable energy in the province was that provincial energy policy under national energy policy in consequence, local and province were lacking of authority to conduct Provincial Power Development Plan and the majority authority of energy project permission. Moreover, even the off-grid transmit had not much problem but the rest of renewable energy generating in the community was unable to connect to the national grid with reason of no grid as well as it could not sell electricity to other surrounding household and community because of illegal. The measurement of the priority of renewable energy producer needed to be considered if the province concentrated to soar its potential including submit the plan to the

relevant center energy officers to agree with provincial power development plan and integrated the plan with local administrative, provincial administrative and national energy planning.

Nakhon Si Thammarat province had huge problem on integrated policy and practices with each government or other relevant authorities. The necessary energy information was disseminated without energy information center. Although the Ministry of Energy had assigned Provincial Power Office as a branch office, the capacity building and the budget were inadequately standard to manage all provincial energy system and also being dependent authority of Ministry of Energy which had authority according to officially regulation and hard to create change of the province.

5.2.2 Access to information and technology

The province had no renewable energy data center even having relevant energy offices in the province. Energy statistics were required at the center officer whereas PEA was the most electricity database for demand and supply side in the province. Energy issues are difficult topics for local people; however, people can understand if the energy authority had a good communication strategy. The issue was not only the technical term at all but it would be related from their daily life of energy consumption, energy planning and energy benefits. The right to know would be empathized and gave an important to local people growing public participation with the final sustainable energy development plan.

Energy potential and energy project would come with more opportunities and priority if all energy projects development are transparently informed in the province and be disclosed before starting public hearing in the province. And technology creative atmosphere would be more co-ordinated with internal or external education sectors including university and vocational education working together to increase job creation.

5.2.3 Investment and financing

Capability of investment and finance were key factors to make the previous factors success. Provincial and local budget were divided considerably to facilities construction projects more than energy development project if compared with the annual provincial strategic plan. Making sustainable energy planning needs to come from the provincial awareness and brainstorm to share the budget to renewable energy sector. However, the leader of provincial and local government’s vision were the turning point to think over renewable energy development because of their authority and budget approval. How to encourage people thinking beyond about provincial energy planning and became a champion of renewable energy as renewable energy exporter because the province had high potential of clean energy compared with provincial energy consumption.

5.2.4 Capacity of people development

Vision of provincial leader and local people were essential factors moving forwards to sustainable provincial power development plan. People in Nakhon Si Thammarat province had life style on traditional people, which are different from some provinces in the south of Thailand relying on what people familiar with. So if the province needed success, the vision of leader could be supported because people usually agreed with the head of community and local politicians which could be both advantaged and disadvantaged points if the leader had a vision. People had few thinking on power producer because they were accustomed to national grid supply feed directly to their business. Creating a choice of alternative energy had been invested by external investors.

The character of non-businessman including local politicians, local authorities and local people were less enthusiastic to initiate alternative energy management if they had not much pressure on unsatisfied energy planning. Just opponent a large power plant project was not strengthen fighting if the province had not create the renewable energy planning by applying its potentials to submit local and central government on changing to the sustainable energy pathway.

5.3 Direction of the further research

This study aimed to evident the potential of renewable energy and to come with sustainable provincial power development plan to utilize renewable energy for priority electricity generating. The limitation of the potential of renewable energy information was gathering from secondary data and some renewable energy had been calculated with government sector reference and not covered every area in province. It was the pathway of the province to come up with the first model of initiative sustainable provincial energy development planning. Therefore, there are further researches required to make it completely for energy planning implementation, the information of all potential of renewable energy as mapping areas, the cost of renewable energy investment, the price of renewable energy electricity scenario and the willing of people payment and the benefit of people in the province were essential points to prove which kind of energy development was appropriate, and the capacity of reducing fossil fuel by increasing renewable energy demand in Nakhon Si Thammarat province

Finally, the possession of renewable energy power plant was the one solution of public participation, governance and transparency to benefit people in the province; however, it would apply experiment and evaluation. The result would be different depending on each community conditions which required to be proved and find the answer for the scale of provincial energy management in the future.

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Appendices

Appendix A

Appendix A: Number of population from registration record, percent change and density by district 2006-2010

District	Number of population					Percent change					Population density
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010	(Per sq. km.)
Total	**1,510,460**	**1,506,997**	**1,513,163**	**1,516,499**	**1,522,561**	**-0.23**	**0.41**	**0.22**	**0.22**	**0.40**	**153.14**
Mueang Nakhon Si Thammarat	266,622	266,668	267,232	266,613	267,440	0.02	0.21	-0.23	-0.23	0.31	433.14
Phrommakhiri	35,741	35,865	36,092	36,227	36,435	0.35	0.63	0.37	0.37	0.57	113.33
Lan Saka	40,297	40,055	40,162	40,209	40,291	-0.60	0.27	0.12	0.12	0.20	117.50
Chawang	65,848	65,629	66,179	66,286	66,491	-0.33	0.84	0.16	0.16	0.31	125.88
Phi pun	27,875	28,160	28,486	28,630	28,781	1.02	1.16	0.51	0.51	0.53	79.12
Chian Yai	45,478	44,048	43,890	43,657	43,571	-3.14	-0.36	-0.53	-0.53	-0.20	187.21
Cha - uat	84,602	84,464	84,851	85,067	85,403	-0.16	0.46	0.25	0.25	0.39	102.52
Tha Sala	107,286	107,537	108,006	108,170	108,834	0.23	0.44	0.15	0.15	0.61	299.08
Thung Song	147,562	148,585	150,122	151,563	152,808	0.69	1.03	0.96	0.96	0.82	146.65
Na Bon	26,461	26,461	26,489	26,504	26,686	0.00	0.11	0.06	0.06	0.69	138.34
Thung Yai	68,154	68,876	69,739	70,386	71,121	1.06	1.25	0.93	0.93	1.04	117.89
Thung Yai	68,154	68,876	69,739	70,386	71,121	1.06	1.25	0.93	0.93	1.04	117.89
Pak Phanang	106,402	104,816	104,011	103,268	102,607	-1.49	-0.77	-0.71	-0.71	-0.64	242.89
Ron Phibun	82,832	80,729	80,893	81,110	81,116	-2.54	0.20	0.27	0.27	0.01	241.76
Sichon	84,255	84,884	85,299	85,719	86,231	0.75	0.49	0.49	0.49	0.60	122.64
Khanom	27,864	28,128	28,397	28,763	29,026	0.95	0.96	1.29	1.29	0.91	66.89
Hua Sai	68,414	67,771	67,434	67,243	67,055	-0.94	-0.50	-0.28	-0.28	-0.28	160.52

Appendix A: Number of population from registration record, percent change and density by district 2006-2010 (Cont.)

District	Number of population					Percent change					Population density
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010	(Per sq. km.)
Sichon	84,255	84,884	85,299	85,719	86,231	0.75	0.49	0.49	0.49	0.60	122.64
Khanom	27,864	28,128	28,397	28,763	29,026	0.95	0.96	1.29	1.29	0.91	66.89
Hua Sai	68,414	67,771	67,434	67,243	67,055	-0.94	-0.50	-0.28	-0.28	-0.28	160.52
Bang Khan	41,354	42,302	42,990	43,467	44,182	2.29	1.63	1.11	1.11	1.64	73.43
Tham Phannara	17,674	17,802	18,051	18,270	18,405	0.72	1.40	1.21	1.21	0.74	108.84
Chula Phorn	30,859	30,446	30,720	30,816	30,935	-1.34	0.90	0.31	0.31	0.39	160.69
Pra Phrom	41,652	41,557	41,516	41,638	41,787	-0.23	-0.10	0.29	0.29	0.36	282.42
Nop phitam	30,016	30,315	30,785	31,125	31,488	1.00	1.55	1.10	1.10	1.17	43.72
Chang Klang	29,836	29,845	29,833	29,914	29,949	0.03	-0.04	0.27	0.27	0.12	128.79
Chaloem Prakiet	33,376	32,054	31,986	31,854	31,919	-3.96	-0.21	-0.41	-0.41	0.20	257.12

Source: Department of Provincial Administration, Ministry of Interior, 2011

Appendix A1

Appendix A1: Gross Provincial Product at current market prices by economic activities: 2006-2010

Economic activities		Year				
		2006	**2007**	**2008**	**2009**	**2010**
Agriculture	**Million Baht**	**33,090.6**	**31,074.8**	**33,673.1**	**31,740.9**	**39,104.6**
	Agriculture, hunting and forestry	2,641.7	25,172.3	28,114.9	2,556.3	32,664.6
	Fishing	7,489.9	5,902.5	5,558.2	6,184.6	6,440.0
	Million Baht	**81,369.8**	**86,459.2**	**91,564.6**	**91,909.9**	**100,801.3**
	Mining and quarrying	14,111.5	15,163.0	17,352.9	17,666.7	20,231.5
	Manufacturing	13,553.3	14,675.3	16,061.9	15,220.7	17,621.4
	Electricity, gas and water supply	7,648.7	8,352.6	8,371.7	7,913.7	8,991.9
	Construction	3,552.9	2,630.4	2,628.0	2,761.7	2,642.9
	Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods	14,663.6	15,065.3	15,380.6	15,097.7	16,193.5
	Hotels and restaurants	5,731.0	720.9	686.6	731.8	837.4
	Transport, storage and communications	2,684.3	2,900.1	3,165.5	3,074.5	2,894.4
	Financial intermediation	2,657.3	2,993.8	3,248.7	3,369.1	3,712.5
	Real estate, renting and business activities	3,677.5	3,736.2	3,706.8	3,890.8	3,933.9
	Public administration and defense ;					
	compulsory social security	6,747.8	7,207.9	7,300.1	7,458.8	8,313.7
Non-Agriculture	Education	8,196.1	9,453.6	9,955.3	10,574.5	11,077.8

Appendix A1: Gross Provincial Product at current market prices by economic activities: 2006-2010 (Cont.)

Economic activities		Year				
		2006	**2007**	**2008**	**2009**	**2010**
Non-Agriculture	Health and social work	2,411.7	2,691.8	285.9	3,245.4	3,412.3
	Other community, social and personal services	835.0	808.0	791.6	837.5	871.1
	Private households with employed persons	57.0	60.0	64.0	67.0	67.0
Gross Provincial Product (GPP)		**115,279.4**	**117,534.0**	**125,237.7**	**123,650.8**	**139,905.0**
Per capita GPP (Baht)		**69,831.0**	**70,323.0**	**74,033.0**	**72,242.0**	**80,816.0**
Population (1,000 persons)		**1,650.0**	**1,671.4**	**1,691.7**	**1,711.6**	**1,731.2**

Source: Office of the National Economic and Social Development Board, 2011

Appendix A2

Appendix A2: Gross Regional and Provincial Product at current market prices by region and province in 2010

Region, province	Gross Domestic Product, Gross Regional Product and Gross Provincial Product (GPP) (Million Baht)	Population (1,000 persons)	Per capita GPP (Baht)	Per capita GPP rankings	
				Of the Region	Of the Country
Southern Region	**982,231**	**9,378**	**104,738**		
Phuket	78,964	301	26,529	1	10
Phangnga	37,546	268	139,878	2	15
Surat Thani	139,410	1,010	138,034	3	16
Krabi	54,663	398	137,497	4	17
Songkhla	174,301	1,464	119,041	5	22
Chumphon	55,421	510	108,589	6	24
Ranong	19,887	190	104,625	7	25
Trang	69,365	689	100,740	8	27
Satun	29,136	292	99,624	9	28
Yala	46,098	487	94,611	10	31
Nakhon Si Thammarat	139,905	1,731	80,816	11	41
Narathiwat	55,841	778	71,786	12	49
Phatthalung	37,230	566	65,750	13	52
Pattani	44,465	693	64,157	14	54

Source: Office of the National Economic and Social Development Board, 2011

Appendix B

Appendix B 1: Electricity supply by consumer types and districts <fiscal 2010>

Electricity Supply in 2010 (kwh.)						
District	**Number of consumers (Persons)**	**Total**	**Residential**	**Business and industry**	**Government office and public utility**	**Others**
Muang Nakhon Si Thammarat	88,831	26,420,418	11,356,850	12,405,094	2,469,053	189,421
Phrommakhiri	10,003	1,348,693	1,036,811	193,103	108,002	10,777
Lan Saka	11,019	1,492,557	1,048,227	346,714	90,960	6,656
Chawang	13,394	1,967,751	1,418,468	382,522	151,918	14,843
Phi pun	9,017	999,887	842,123	89,938	65,961	1,865
Chian Yai	17,812	2,203,237	1,696,632	286,638	185,643	34,324
Cha - uat	21,564	2,700,047	1,844,495	663,061	170,995	21,496
Tha Sala	37,051	7,118,344	3,943,147	2,870,243	281,005	23,949
Thung Song	47,905	18,722,018	5,681,504	11,306,841	1,502,374	231,299
Na Bon	19,861	4,524,045	2,173,314	2,124,449	192,334	33,948
Thung Yai	19,559	4,183,511	2,310,868	1,582,427	271,825	18,391
Pak Phanang	23,613	7,879,066	2,520,718	4,875,155	470,057	13,136
Ron Phibun	20,309	3,262,228	2,208,804	781,421	228,221	43,782
Sichon	24,529	4,941,983	2,642,563	1,977,577	301,740	20,103
Khanom	9,696	3,119,933	1,257,255	1,714,118	115,390	33,170

Appendix B2 : Electricity supply by type consumers and districts <fiscal 2010> (Cont.)

Electricity Supply in 2010 (kwh.)						
District	**Number of consumers (Persons)**	**Total**	**Residential**	**Business and industry**	**Government office and public utility**	**Others**
Hua Sai	17,216	6,567,837	1,723,970	4,671,450	166,613	5,804
Bang Khan	8,840	1,437,884	1,113,242	256,381	63,146	5,115
Tham Phannara	4,996	2,251,791	590,853	1,622,429	36,456	2,053
Chula Phorn	7,343	984,602	733,453	174,522	69,488	7,139

Source: Nakhon Si Thammarat Provincial Electricity Authority, 2011

Appendix B3: Electricity access in Nakhon Si Thammarat Province (as of August 2011)

District	**Total Household**	**Electricity distribution** (Household)		**No electricity** (Household)
		Electricity Line	Solar energy	
Mueang	71,404.00	70,854.00	170.00	380.00
Phrommakhiri	9,592.00	9,504.00	13.00	75.00
Lan Saka	10,672.00	10,509.00	106.00	57.00
Chawang	16,782.00	16,733.00	29.00	20.00
Phi pun	11,013.00	10,639.00	231.00	143.00
Chian Yai	7,597.00	7,410.00	105.00	82.00
Cha - uat	23,409.00	23,100.00	170.00	139.00
Tha Sala	28,589.00	28,228.00	7.00	354.00
Thung Song	44,903.00	44,729.00	174.00	0.00
Na Bon	6,961.00	6,904.00	45.00	12.00
Thung Yai	18,341.00	18,255.00	30.00	56.00
Pak Phanang	23,263.00	23,093.00	44.00	136.00
Ron Phibun	20,041.00	19,801.00	88.00	152.00
Sichon	25,196.00	24,784.00	348.00	64.00

Appendix B3: Electricity access in Nakhon Si Thammarat Province (as of August 2011) (Cont.)

District	Total Household	Electricity distribution (Household)		No electricity (Household)
		Electricity Line	Electricity Line	
Khanom	10,419.00	10,410.00	9.00	0.00
Hua Sai	17,130.00	16,907.00	90.00	133.00
Bang Khan	14,435.00	14,016.00	256.00	163.00
Tham Phannara	5,544.00	5,542.00	0.00	2.00
Chula Phorn	8,097.00	7,919.00	22.00	156.00
Pra Phrom	9,901.00	9,737.00	33.00	131.00
Nop Phitam	7,527.00	6,769.00	217.00	541.00
Chang Klang	8,753.00	8,745.00	8.00	0.00
Chaloem Prakiet	6,780.00	6,633.00	104.00	43.00
Total	406,349.00	401,221.00	2,299.00	2,839.00

Source: Nakhon Si Thammarat Provincial Electricity Authority, 2011

Appendix C

Appendix C1: The List of Interviewees

1. The representative of Provincial Industrial Office
2. The representative of civil network at Tha Sala district
3. The representative of Provincial Commerce Office
4. The representative of renewable energy initiative community
5. The representative of Provincial Natural Resources Office
6. Member of the Parliament of Nakhon Si Thammarat Province
7. The representative of Provincial Electricity Authority
8. The representative of Provincial Agriculture Office
9. The representative of renewable energy company
10. The representative of Provincial Power Office
11. The representative of Provincial Strategic Office
12. The representative of Provincial Administrative Office
13. The representative of Mueang Municipal
14. The representative of Hua Sai Municipal
15. The representative of Klai Local Administrative Office

Appendix C2: Example of Questions of In-Depth Interview

1. In 2011, the energy demand of Nakhon Si Thammarat Province is 210.2 megawatt and load forecast in the next 20 years is 647 megawatt with an average 21.84 megawatt a year. What do you think about a measure of province to reduce fossil fuel dependence?

2. Potential of wind energy of Nakhon Si Thammarat Province has different result on various heights with stand at about 1,150 megawatt. What do you think about wind energy installation? Obstacle and mechanism to reach a target?

3. Potential of wind energy according to the coastline of wind energy and coal power plant target is at Khanom, Sichon, Tha Sala, Pak Phanang and Hua Sai. What is your opinion on energy management of these areas?

4. Nakhon Si Thammarat Province has a high potential of solar cell whereas it has no any its investment. Do you think how is possible to develop its capacity? Obstacle and mechanism to reach a target?

5. Most of renewable energy investment comes from external private sector. Do you think how is possible to support its investment in province? And what kind of investment model is suitable and benefit to people most?

6. In 2008, Nakhon Si Thammarat Province reported occupied agriculture land about 83,554 Rai. Do you think how is possible to start energy crops planting? ? Obstacle and mechanism to reach a target?

7. Within 5 years the production of renewable energy has been continually increasing especially in conservation area. In your opinion how to make it sustainable planting planning and linked to food security? And who/organize should be main responsibility role?

8. According to a research, Nakhon Si Thammarat Province has a capacity of renewable energy development of 2nd of 14 Southern provinces but in fact it has not much on electricity generating. Do you think how is possible to utilize it all? Obstacle and mechanism to reach a target?

9. According to provincial energy strategy, it emphasizes on community scale development. Do you think how is possible to extend a capability to district and provincial scale? Obstacle and mechanism to reach a target?

10. Regarding to provincial energy strategy, Nakhon Si Thammarat Province lacks of its concrete planning, target and a clarify figure of renewable energy. Do you think how important it is and how to implement it? Obstacle and mechanism to reach a target?

11. The top ten of highest energy consumption in province is industry, service and government offices. Do you think how is possible to initiate them on renewable energy investment for their business? Obstacle and mechanism to reach a target?

12. Provincial Renewable energy database needs the budget to support on research and development? Obstacle and mechanism to reach a target? And what is solution?

13. Do you think what kind of decentralization renewable energy investment model of the province? And how is linked to budget and law enforcement? And how to make it success and benefit to people and province?

14. The budget of provincial and local administrative sectors is mainly for facilities. Do you think how to make them share into budget for renewable energy investment? And what is the regulation and law enforcement obstacle? And how to make it success and benefit to people and province?

15. How is possible to implement Sustainable Provincial Power Development Plan? And how to priority renewable energy in a plan? And what kind of its model? Obstacle and mechanism to reach a target?

Appendix C3: Example of Answers of In-Depth Interview

1. **Interviewee A**

"The potential of renewable energy of Nakhon Si Thammarat province should study more on micro-hydro power because there is about 46 water fallings and water sources. The community energy model of mini-hydro power can support energy supply by utilize fuel sourve from river basin and the gulf of Thailand yearly. The valuable energy investment is worthy because it is no need to project coal power plant. The province needs to proposed provincial power development plan to Ministry of Energy and government because just the internal power pushing its plan is not a huge impact. It should push forwards from public to changing governmental policy. The responsibility of initiative renewable energy research could be academic aspect leading by research outcomes. Provincial Power Office and people in Nakhon Si Thammarat province can work together with an excellent strategy with budget support from government or Ministry of Energy and unlock national energy system as the barrier of increasing renewable energy development.

The movement calling on stopping coal power plant project is the empathy of people in spite of scaring of insufficiency electricity support. However, then people know about the potential of renewable energy in province as solution or alternative choice so they agree to say no to coal development including a discussion of job creation, distribution income, environmental issue etc. However, a person in Nakhon Si Thammarat province needs to be alignment with a same page of knowledge and movement.

The concept of renewable energy development is not mega project but small scales distribution to house, village and community. Micro management is a future of energy management and each part is essential to create a half of energy supply to feed its consumption. Renewable energy is an answer to community, provincial and policy whereas a study cannot be exposed to pressure disagree parties such as politician and fossil fuel supporters. Renewable energy project have just started differ from fossil fuel which invest all the time. As we known, the price of renewable energy trend is cheaper in the long term which people can see with clearly figure showing because people believe in numbers and statistics. This is the responsible of academic, government sector, independent institution and local and provincial

administrative to go to national resolution changing. It is possible to every province starting own Provincial Power Development Plan and pushes forwards to change energy policy level including Market mechanism and price are keys of renewable energy development in province.

The possibility of Nakhon Si Thammarat province on energy revolution with public movement and academic support is similar to changing renewable energy development in Yala and Krabi provinces with awareness group of people. It needs to make it happen in practical way with how to create a scenario of renewable energy available and security instead of fossil fuel. Making people understand on renewable energy and move together to change energy policy showing that renewable is not just a small chance or impossible thinking of renewable energy development.

Considering energy policy mechanism, Provincial Power Office have certainly same target with Ministry of Energy as a branch office. If we cannot reform national energy policy parallel with provincial energy policy it cannot impact much about changing energy policy in the province. We need to change and develop renewable energy law and constitution in a section of national resources to include energy section. Provincial Power Development Plan addressing is an important part of renewable energy target specific.

I think it should conduct energy consumption mapping and how to create this group to generate renewable energy for its supply side which encourages each energy consumption sector. Furthermore, provincial research together enhance with public calling on reducing fossil fuel consumption in the province as well. Everyone in province have to start thinking its own solution of renewable energy initiative and it might be come up with a new measurement to manage with a high percentage of energy consumption in the province. How to act together in each person and institution is an aspiration of energy planning development.

According to renewable energy studying the budget should come from university sector or funding in the province including energy expert to study electricity system and energy forecast of Nakhon Si Thammarat province which can be a same working group of a part of Provincial Power Development Plan. However, I agree about setting government office sector as secretariat of power planning it should be effective and a responsibility of expert side with opening 2-3 energy platforms making people awareness on energy issue.”

2. Interviewee B

“Nakhon Si Thammarat province has to campaign renewable energy in community level especially Local Administrative as sub-district. The expanded small scales distribution according to community, sub-district, and district to end up at provincial level. The renewable energy projects connection can be spread out with a few budget and gradually growing and sustainability which different from government planning with mega projects with the conflict in project area. In term of large scale of renewable energy development structure public acceptance, public participation and public possess of projects is concerned. The fundamental analysis bases on the capability of each community or scale, local technology invention and capacity building for local people to maintain its projects including budget supporting by Local Administrative.

Communication is a tool to expand renewable energy model from one local to others and support them to start its project. Local community project is financial supported by Provincial Office which addressed under renewable energy strategy.

Zoning is still a legal and regulation conflict which managed according to market mechanism people and some provincial offices have not been clarified to the impact of a long term of income and livelihood. A good case study is Talumpook Cape, suffered from water sea erosion and high sea level and need to evacuate to live on a land whereas their knowledge rely on sea life. How to acknowledge people with their wisdom to developed and improve local energy crops and planning for energy and food sufficiency.

Kiriwong village is an interesting micro hydro power development in community with a concept of water is remaining after electricity generating. Small scale distribution is better than construct a large scale. The important process is how to design with concerning local people and resources. How to make people concern on public interests together with environment conservation of course, no one knows better than local people whose works for community.

I think Cooperate Social Responsibility (CSR) can be played to support renewable energy growing. And also a support of university and academic in the province which is a main of research part about the potential of renewable energy. The problem which happening is the intellectual property of energy research is not shared with a community or investor to develop projects together for example if university conducts a research it blocks other person or institution to invest after that. It is lacking of integrated information between province, academic, community and investors.

In fact community is one of research stakeholder we need to understand the basic of community research. How to increase the opportunity of people to access the information and apply it finally is an urgent improving. Local people should be a representative of a committee of Provincial Strategic Planning and energy research center. Budget supporting is not difficult because it is useful to increasing the capacity of people and potential of renewable energy. It should not set up institution but in fact is should be flexible with correct information and connecting.

Growing renewable energy projects should be including local and provincial budget and external financial support however, self-reliance is a key success of independent energy supply and increasing human capacity building. It can be started in community level by household’s sharing for instance, 10 households together loan money from community fund to invest renewable energy project instead of just paying electricity bill every month to EGAT however, it should be calculated about paying back as power plant possessor. If wherever has capacity building to stand in their own legs it no needs for government support.

Community, business and commercial association create local or province and medium enterprise with opening external investment and set a system of power balancing with stakeholder sharing and board election. It should be started from small scale which is better than for sub-district or district level because it has lot of benefits and conflicts. Fuel sources management is an essential tool to share sufficient renewable energy resources. Provincial, local and representative politician should plan and increase more energy projects.

Growing renewable energy needs private sector inside and outside Nakhon Si Thammarat province whereas people in province are still less awareness about self-reliance energy plan. In term of some districts of coal and nuclear opponent it should work more about people prospective. And it should be compared a figure of the true cost of renewable energy investment and what kind of model is suitable for each. Furthermore, renewable energy is not just construct only one wind turbine and then left it which is contrast with a real concept and impact to perspective of renewable energy development in the province.

The potential of renewable energy needs continually and effectively projects like a quality of product which is essential to make people understand and believe in it. Prospective of Local and Provincial Administrative including central relevant energy offices affects to increasing renewable energy and knowledge management in the province. However, people who insist coal and nuclear power plants need to realize a capacity of people in the province and have to develop renewable energy instead by themselves such as people do not accept coal and nuke projects so local people together in village able to initiate micro-hydro power and distribute to community utilization."

3. Interviewee C

"Natural gas power plant in Nakhon Si Thammarat province has supplied to national grid it is not only response for province energy consumption. I think wind and micro hydro power from water falling cannot support economic growing in the province. However, a potential of renewable energy is a responsibility of relevant electricity offices to apply a small scale of community as decentralization to support energy consumption in the province. Wind energy project is developed by Ministry of Energy at Hua Sai district presenting ineffective wind speed with operate by whirling and stopping in some day which linked to people perspective of a potential of wind energy development.

Wind energy cannot be invested by people because of high cost investment. Renewable energy development should be investing and purchasing process by PEA. Market mechanism and a period of return payment back are key factors to increase interesting investors. Nowadays, it has an investment barrier affect to inside and outside of renewable energy investors. Nakhon Si Thammarat also has both capacity of renewable energy development and coal power plant projects especially along coast line areas. However, problem is how to make people understand and accept coal power plant.

Renewable energy investment needs a commercial mechanism to move forwards and public acceptance. In term of cooperative model or public organization to manage renewable energy whoever can invest in this. A profit of renewable energy development is assured by Ministry of Energy information and no need for profit sharing. Stakeholder is not monopoly and local administrative sector can get taxes and land renting to support local people livelihood with no environmental impact. Moreover, government sector must support a province on increasing a capacity of energy crop planting and production. To achieve renewable energy development

government sector should address its provincial strategy and give a chance to other investors. Government should not invest because it has never get profit and lot of corruption.

Campaigning on renewable energy and energy efficiency needs to begin with children and schools because everyone needs to know before teaching others. People need to do because we consume electricity and government needs to invest for people. People in Nakhon Si Thammarat province know potential of renewable energy however; its database center implementation is in needs and exposed to open a forum for beneficiaries, Local and Provincial administrative sectors and public. I am not sure about a capability of university and academic side in the province on research development. Furthermore, renewable energy development can be identify in each scale such as biogas is for household scale, micro hydro power is for community scale and wind farm is for district scale etc. Its network can be linked to strengthen community and parallel with sub-district, district and provincial movement.

In term of renewable energy database is essential to every province and Head of Province must have it as well. I do not know that whether within 10 years its commercial investment system can be achieved. Government sector has relevant offices in hands so just make them work effective on this issue including integrated Local and Provincial administrative, government sector, academic and public to conduct Provincial Power Development Plan. And member of a parliament in province can propose its budget to parliament members 'meeting. A capacity of its technology development is a part of investment condition and up to now is not much progress.

The important things are that government policy must clarify on energy agenda, increasing an effective energy database system, strengthen community and support them on energy development, benefit and sharing on electricity generating, growing public participation with social movement."

4. Interviewee D

"Nakhon Si Thammarat province is relied on national grid system including fossil fuel supply side. I agree with renewable energy development because smart grid system will be a fundamental plan of Provincial Electricity Authority (PEA) to support its stable. If the smart grid system is success in 2020 the small power producers will be growing to subtend renewable energy purchasing system. When smart grid is worked nuclear power plant project is abolished. Renewable energy can grow parallel with tourism attractive. The potential of renewable energy has been supported from the government sector so the increasing of its proportion is dependent on government policy including provincial and local energy development plan.

Therefore, renewable energy investment needs government sectors support. The present problem is that controlling the standard of renewable energy purchasing is difficult. The accountability of controlling the macro of its purchasing is held by Energy Regulatory Commission. The permission is central authority whereas PEA not to do so. And renewable energy is non-firm causing energy security and hard to control power system.

Nakhon Si Thammarat Municipal has tons of solid waste yearly and local administrative has enough capacity and legal support to be power producer in the province which is better than spend lot of money for road construction and facilities. Government has to uptake president of the Provincial Administration and Head of Nakhon Si Thammarat Municipal. The governmental investment is not essential on making high profit the concept bases on policy support.

We need to make people understanding about energy solution in term of EGAT targets to a large scale of power plant reducing a scale of renewable energy to be decentralization model. And unstable renewable energy should be back up with battery storages and connected to national grid. However, the benefit of renewable energy especially wind farm is offered for tourism attractive and should be started.

Although Nakhon Si Thammarat has high potential of renewable energy it get struck with technology development and policy support such as solar energy including adder policy which should be concerned on the economy security of state policy.

I think Local and Provincial Administrative have a capacity together with their citizen, local politician and relevant beneficiary working for people and province. It should be a model of local investment, local administrative joint venture with private company etc. PEA can support on a process of planning with electricity planning at legally permission at 1-8 megawatt. Not only concern we about renewable energy supply but also energy efficiency in each households and institution.

At the same time PEA can support provincial energy development in term of potential of renewable energy, energy demand and supply, renewable energy research, renewable energy study and smart grid connection and communication. And academic institution should acknowledge student especially university and vocation collages. It has institution in the province already to push forwards energy development plan but it has been lacking of integration. PEA and municipal can be a stakeholder of renewable energy investment. Local government budget should come after a clarified vision.

Raising people awareness is a tuff work because people at present grow with convenient facilities and ignoring to be changed. How to be a change agent is a question including encourage people in the province to practice with learning by doing.

Developing Provincial Power Development Plan, PEA is a forecast office working with planning offices composing of Provincial Administrative Office, Local Administrative Office, academic, energy regulator of district or region, Municipal of Nakhon Si Thammarat province. The important thing is who will be proposing this concept to Provincial Administrative Office to reduce fossil fuel consumption and apply a capacity of province and people with public possess. Southern people believe in local representative but it needs to push forward more vision of politicians.”

5. Interviewee E

"Nakhon Si Thammarat province has a project on offshore wind energy research cover coast line districts which having an oppose coal power plant project network. Renewable energy development requires people understanding and accepting from bottom up. Nakhon Si Thammarat province has a potential of renewable energy why it has not much developed yet, is a range of attractive area investment and a credit of bank support. Although province has potential of wind but government sector uses it as a case study with not making a profit and this is a reason of unattractive investors. Moreover, wind project is still new when asking for credit and bank cancel to approve a credit because investors have no experience.

We are still lacking experience on technology development and user in our country to develop a training model or coordinate with seller. A measure of adder is not effective for renewable energy investors because of slow payment process. Government sector must working fast and solving a barrier of its investment such as a quota of renewable energy project and selling their rights to others later.

Renewable energy is a new concept for country so a capacity of paying back is not excellent just in a rate of fair and good. However decreasing of technology price is obviously especially solar cell which is much than wind technology. In province we need to make people awareness on two things of energy project development one is that nothing is all good and second is nothing is all bad. Although coal is negative impact it is secure.

And we cannot rely on 100 percent of renewable energy because of natural sources. Balancing a proportion of renewable energy and fossil fuel both need to control impact of natural disaster. Furthermore, a small renewable energy project has not much obstacle with Local Administrative which different from a large one however, it is easy for investor than coal power plant development because of high politic negotiation.

A character of people in province indicates a kind of energy development for example their occupations are fishery, small industry with agriculture so their citizen is lacking of commercial and macro relevant project development. How to work on capacity building is public participation. People should begin with finding a place of renewable energy development project as community proposing and next to sharing a holder on power plant as community possession or public owner and setting up selected community representative working as a committee of renewable energy power plant. However, when become a stakeholder of government investment it might be getting stuck of legal enforcement which is not allowed public sharing. In term of cooperative is easy than because of local people ever experience.

Zoning energy crop planting requires whether regulation or law enforcement and development in private land property with private objectives and relocated habitat. It is not enough on provincial policy need to uptake on national policy. Linking agriculture industry is a best way of bio-crop development with decreasing capital cost and balancing food security. Agriculture industry zoning depends on a quota of electricity generating and quantity of fuel sources. Government must invite a private sector to initiate energy crop

zoning and present a figure of installation capacity it is government responsibility to stop a loophole of inadequate renewable energy information.

Government has to invest renewable energy through Fuel Adjustment Charge (at the given time) to reduce fossil fuel dependence which is further in-depth studied a burden of state and people. Coal technology cannot proof at present on a condition of area development and opportunity as well. People in the province have a right of information access before making a decision on energy choice. Power Development Plan implementation requires expert because government officers lacks of experience. It might be consultant team, academic together establish strategy, integrated sub-district and district level up to provincial policy and governmental policy proposing in term of a study of renewable energy database. Politician in the province is not intelligent but people need to propose it as win-win situation. Politicians need achievement for next election which is benefit of people to encourage them.

Renewable energy can reduce electricity bill so government should support by decreasing loan's interest to power producers and market mechanism of technology price, fuel and electricity cost. Government should do renewable energy database as a menu and then charge private sector back with fee or special tax. It implementation consists of budget, human resource from Provincial and Local Administrative sector, experts and people. Budget should come from Provincial and Local Administrative Offices with about 20-30 percent government sector might be a supporter if budget is not enough.

A model of Nakhon Si Thammarat province should be established a learning center for adjusting appropriate model in each scale. Power Development Plan board consists of relevant energy sector in the province, Provincial and Local Administrative, experts, politicians and public. Key success factors are local and provincial politicians, local and provincial government sectors and public participation will come up with alternative model presenting provincial energy policy, a proportion of renewable energy and its factors of fuel source, finance and technical and management experts.**"**

6. Interviewee F

"Industrial sector in the province finds out the way to reduce carbon emission with renewable energy and carbon credit strategy especially palm and rubber industry. The natural gas reduction of electricity generating is measure with not much clearance implementation whereas renewable energy development in the province is uncertain in case of public understanding on impacts to swallow birds and local fishery. Furthermore industrial sector in the province has been complained about biomass project in consequence, the government should have a standard on its environment impact. People in Nakhon Si Thammarat province has opposed to coal power plant project because of the environmental disaster like Mae Moh district at Lampang province case studies however, its severely impact has been alleviated.

The important thing is that when coal power plant project is addressed in national energy policy assure that its plan will be practiced with local people and create problems and conflict in community including non-government organization. The problem of

energy development in province is mainly on permission process, law enforcement, energy regulator and relevant energy office as central authority although they submitted document directly to Provincial and Local administrative. It is hard to increasing renewable energy without parallel with government and private sectors support.

Renewable energy utilized in some areas as local community level with less governmental advocated campaign so it should produce and information about households and public in the province about energy demand and supply sides together reducing fossil fuel consumption by increasing renewable energy utilization. More than information toolkits, people feel cannot trust Local and Provincial Administrative and local politician is like taking benefit from people on politician game. And the one important thing is power plant owner concept and its benefits.

I agree with small cooperative model which invests in community with sum money. Government should train people about technology management if a project has been started first by government sector support. I think government should invest for one community as model or center in the province and if other areas interested in that how to further develop will be similar to mushroom blooming. Without a renewable energy policy center certainly, it has no movement in province level. In term of local factor we need to concern that it is unstable of local politic level making renewable energy development getting stuck including how to uptake renewable energy as majority of provincial milestones and intensive plan on local administrative.

Provincial Energy Management should be set up a board with committee working in period time and report back to province and people. The quality of board consists of professional and experts with relevant authorities controls. The benefit needs to be directly transferred to people in province without limited external investment. Furthermore, electricity generating investment will be an income distribution to people in province it should be gradually growing from local community scale to district and finally at province.

Nakhon Si Thammarat province should be zoning energy crop however, law enforcement of land use and city planning is a key essential factor push forwards from micro to macro scenario. We work like just “burning rice straw” means to arrange one activity and then move to other issue which reflects uncertain and not continuous political policy.

Energy management should be communicated since community, district and provincial levels to make them understand its pathway. Thais like knowledge feeding without thinking by themselves some gets stuck of policy, governmental process. So if we would like to push forwards Nakhon Si Thammarat province it needs a leader to encourage people with knowledge gathering with government policy, local administrative policy to increase renewable energy. It should have a questionnaire of PEA to find out a way of idea and how to work together on energy planning. Conducting Power Development Plan with budget support depends on benefit of each office as well wherever having advantage the politic is a majority.

Renewable energy development is a one of benefit sharing so it is seriously to make people understanding and return it back to people fairly. Renewable energy database in the province should be set up like committee because it is very benefit to province. People in Nakhon Si Thammarat province is much comfortable and ignoring to find out an alternative even campaigning, evaluating an effect of

energy supply and demand. It needs a volunteer working on this issue and a leader community to create a pathway of sustainable energy planning.

In a part of provincial budget it has about 30 percent of Local Administrative budget whereas local energy project come from Provincial Power Office which is little one. I think afterwards business sector or Local Administrative should search a potential of renewable energy and start to develop from bottom up. Sharing budget is not be restricted by law so it depends on a leader's vision.

Nakhon Si Thammarat needs to implement Provincial Power Development Plan integrated with a group of central academic, local and provincial administrative sector, energy development office and relevant investment sector. Those coordinate with Provincial Power Office to implement together on producing and distribution planning. I believe that people, investor and energy committee can achieve what we want to move next it is time to start.

How to make people in the province awareness on this issue is reflected to a small energy development in the province to regional energy development and finally national energy level becoming a model of electricity development. Government needs to be serious on this model because it can be a case study of other provinces experiencing and sharing to move forwards on each energy revolution. Government must give an important on this issue due to development and natural resources exploit is destroying a balance of environment."

7. Interviewee G

"Potential of renewable energy means wind, wave, sun and hydropower because of Nakhon Si Thammarat's geography along with coastline and rivers. Coastline erosion is significantly problem happens in the province and severely impact communities along the beach it leads to turn disaster climate change to renewable energy development with gradual wave level increasing annually. However, solar energy development is not enough attracted project of power producers because of more rain season. The status of renewable energy investment sources from outside province in term of lacking of internal budget and financial support and its technology invention. Furthermore, the leaders of province are not working to growing economic which obviously evident a quality of politicians in the province.

International renewable energy investors who get support from government policy might faces some problem during preparing period as case study of wind energy development such as increasing price of land use, different figures on potential of wind installation capacity database of government and investor, policy barrier with contrast on EGAT promoting coal power plant in area and offshore wind energy is expensive. The problem is renewable energy which conducted by government is not showing the same figure compared with private sector database and research.

Nakhon Si Thammarat province needs “Wind Energy Center” with conducting research and budget supporting which should be contributed from natural gas power plant because it uses resources from province. We need young generation who interested in energy issue to advocate renewable energy field. Capacity building under public organization concept as “Provincial Energy Center” or “Nakhon Si Thammarat Energy Research Institution” is one of further strategic to implement energy planning by citizen’s stake holding or others appropriated model development.

I think Khanom and Sichon districts are for tourism landmark whereas EGAT is continually develop coal power plant, deep sea port to import coal imported from Indonesia and Australia at Hua Sai district.

Nowadays, government has ineffective linked energy and land use reform how to develop agriculture zoning to planning sources, transportation, and technology to add value of product and energy in future with relevant good governance and taking advantage from unoccupied mining, land use to develop energy project instead.

We have no idea of green world and we need to take a root of EGAT out electricity purchasing system. Having EGAT, PEA in every province is much taking advantage from people. EGAT and PEA are responsible for selling electricity to consumers so how to transfer it to “Electricity Control and Distribution Institution” from municipal and/or local government and to response renewable energy development from household, industry with cheaper electricity cost.

Motivating renewable energy through supporting some elements and selling for people benefit in province can be welfare system. Whereas energy investment of EGAT bring the profit to investment making people weaken because of international investment flowing. Taking over of EGAT on electricity monopoly and then replaces with public stakeholders and manage provincial energy system including researching, power producing, electricity distribution, self-energy management and government guarantee with provincial investment and a part of government support.

Implementation energy plan should evaluate potential of renewable energy in each district with an assumption is that if EGAT has not supply electricity how we can self-reliance. We need to increase our capacity building since small institution to province to enhance energy development achieve in economic, society and environmental securities. The population and economic growing are factors of energy plan in rural and urban areas.

I think it is not just Local Administrative to conduct provincial energy planning because it still has no vision and budget to change it. A leader must walk to a target not just standing with a holding target. It is the same with community which needs to develop its energy strategy to propose to Local Administrative. Nakhon Si Thammarat province is a center of Southern Seaboard so we should not thinking of conservative side.

Power development planning exposes the potential of renewable energy in province and might be develop to sell other regions to increasing economic income however, people in Nakhon Si Thammarat province must be a power plant possession. In the past we are taken advantage from one side. The existing government structure is a good model but it has never applied for the effective energy

development. It is a same thing comparing to each Ministry responsibility if Provincial and Local administrative realize on their duties without setting a new department again and again. It is just hire consultant and expert from other sectors to support about research which is enough on provincial energy development plan.

The important thing is that transparency and accountability of people and relevant offices to work on energy development planning and implantation. The culture of knowledge, awareness and public participation is value to create for energy planning. It is a possible model with a questionnaire of people in province about the prospective, investment capability with various models and scenario which people can see and making a decision together.

Provincial Power Development Plan needs database to develop and campaign. At present energy management is a project of center and connects to private benefit for some people including Ministry of Energy and Provincial Power Office without transparency. Gathering power producers and public investment should be a role of relevant Provincial Commerce Office and in a future Provincial Regulator Committee to consider a kind of power plant. In present it is lacking of integration of energy development."

8. Interviewee H

"I do disagree with coal project in the province causes climate change and the impact of global warming. The abundant natural resources are essential of stopping the impact of fossil fuel. Definitely, the province needs electricity supply and natural gas is still important to feed energy consumption at present and the true cost of fossil fuel has been subsidized. In the future it is hard to evitable renewable energy development although renewable energy research has been ignored and concealed. Basically, I think wind energy is expensive to investment whereas renewable energy research is concealed.

Furthermore fossil fuel has subsidized by government covertly applying budget to research and support the potential of alternative energy. The responsibility of my office is not much directly on energy development practically. Without cooperating across the offices and informing after the project has been constructed already with polluted causes my office has no law enforcement to stop energy project in the province just finished with official report submit to pollution watching organizations.

The situation of opposing coal power plant project impacts to insist other renewable energy power plant in some districts because people do not well understanding of renewable energy and a key word of 'power plant' which memorized on a negative project development. In term of this situation Provincial Power Office should have a responsibility with industrial sector about a standard of environmental control and public participation. Every Local Administrative regulation needs to be address to standards renewable energy project in their authorities including a list of severely projects, health impact, taxes payment and permission process.

Sometime people think that every provincial knows all projects but in fact there are lacking of integrated information in each office for example, an office knows when it has public hearing in local because the majority of energy authority is belonging to central government authorities. And also Nakhon Si Thammarat province has not yet officially declaration on "Environmental Protection Area"

which affects to even small project development and needs to be approved on at least Environmental Impact Assessment (EIA) if it is impact to abundant areas.

Renewable energy investment is definitely happened because its project in local area is cheap investment cost with resources, transportation and good environment with public participation. The budget should come from Ministry of Energy, Provincial and local Administrative. And advantage sharing without monopoly is a tuff work to deal with creating fairness.

In term of energy crop planting is self-restrict because we cannot cultivate just only for it and will increasing a problem of forest restoration and invasive land use. Balancing energy and food concept can push an effective energy planning in the province.

Strengthen community, local wisdom; characterized area and continually government support are factors of local energy planning with clearly renewable energy target. Furthermore, industry sector has been generating electricity using in their business.

In term of renewable energy information should conduct by internal or external academic sector because it is believable and trustful. It should be a research group working on renewable energy database in province with government, people academic sectors and other relevant offices on energy plan including Ministry of Energy, provincial and local administrative with sharing budget to develop it.

The initiative investment can be run with budget of government sector, municipal, a large local administrative. Energy development project in the province is not much created because it takes time more than road and facility projects which of course politician needs a subjective thing to maintain him or her election votes. In fact, business sector in the province has little capability to invest in a small scale of renewable energy.

In term of budget the Head of Province has authority to approve renewable energy development budget according to a provincial energy support. Head of province's policy is important to get more energy development budget from central government whereas local budget might be easy than it because the decision is in a head and money is in a hand.

I think Provincial Power Development Plan board composes of public, academic, provincial and local administrative and expert however, I think government system and public company system management is not effective."

9. Interviewee I

"Renewable energy mapping needs local and provincial authority implementation. Nakhon Si Thammarat integrated only provincial strategy whereas energy strategic has not been started. The provincial agriculture narrative determined in production promotion without related to energy supply sector. Rubber tree and palm planting are replacing at uncultivated land.

The project of a large scale of power plant is absolute difficulty whereas the image of wind energy development at Hua Sai district is not success because of having not much wind speeds. In term of renewable energy development is not necessary limited to citizen in province so external company can be a part of that with the essential condition on environmental concern. Moreover, being constructed fossil power plant in the province is considerably difficult because of non-government organization movement as a key factor

which barrier energy development. And becoming the province of exporting energy is still hard in term of the vision of provincial leaders and inadequate skills.

The major responsibility of renewable energy utilization in province is a clear part of Provincial Power Office, PEA and others. It is hard to push burden on just one office. Reducing natural gas consumption in province can be instead with biomass however, its database is in needed. Developing power plant concept relies on public participation it might be stakeholders. In my point of view, corporative model is quite hard to be developed in Southern because character of southern people is hardheaded in general. Furthermore, in kind of Local or Provincial Administrative management is impossible due to the fact that their management in offices is still not good enough in present, are unqualified. The model is optimal for business management style.

The abundant agriculture products including rice, palm and rubble tree is essential to mapping potential and factors in the province. Provincial Office is a first leader of renewable energy development whereas agriculture sector keep on increasing its products without directly and integrate planning to electricity industry.

Renewable energy is not easy to be developed in district or province because it needs strengthen community and various experts. How to manage with energy of natural resources in local and return to nature is an important fundamental preparation.

Self-reliance energy supply needs financial support and knowledge. Furthermore, integrated provincial and local administrative, academic and local people with answering questionnaires participation as fundamental database, opinions are depending on objectives of each office and strategy to create a platform of integrated energy database. Renewable budget needs a kind of continual budget which is different from usual budget used annually.

Implementation Provincial Power Development Plan needs integration with Head of Province, Provincial Administrative Office and Local Administrative Office, energy offices, agriculture office to give information to people and then together develop a unit to make it happen. In my point of view it is hard to uptake Local Administrative to manage renewable energy management and relevant agriculture office should work on food and energy crop planting to research energy crop in the future by integrated database and management system with about 32 relevant agriculture offices at present.”

10. Interviewee J

“Reducing natural gas consumption in the province is trended to be implementation. The capacity of province has both fossil fuel from the Gulf of Thailand and renewable energy support. Energy development needs appropriate area and public acceptance with advantage and disadvantage sides to go for public making decision without absolutely decision from government sector. Government should improve the ineffectively organizational structure especially Provincial Power Office. They should take accountability directly to provincial energy development however; government officer revolution must take time and depend on many factors.

Nakhon Si Thammarat province must study the internal potential of renewable energy in case of insufficient supply, research together and make a decision in province and national levels. Increasing small power producer proportion as the previous absolutely power buyer to go for investors and producers should be advocated by government with the fundamental capital investment. The process of knowledge distribution and renewable energy model development is responsible by local people more than government officers, to reduce external interfere.

Reducing imported renewable energy technology is the key factor of effective alternative energy growing in province which supporting university and vocational education. National grid is able to connect electricity generating as centralization system however in the future in case of renewable energy development should be planning for smart grid system to increasing its investment. The different opinion about coal and nuclear power plant in province however, energy database must come from provincial sources with integrated working by Ministry of Energy, EGAT and Nakhon Si Thammarat province to get involve in Provincial Power Development Plan.

The problem is that there are no database of renewable energy in all province areas which needs to conduct for reviewing provincial energy strategy and planning. Pushing each government sector in province to share database planning at local, sub-district, district and finally provincial levels local administrative is a key of investment sector because its return directly benefit to province. In the previous times it has been budget supported from Ministry of Energy to start provincial energy strategy but it is failed. Academic side and university network should be gathering with government, business and public acknowledge and encourage people to achieve a plan with a distinct concept leading provincial energy development.

Regarding to renewable energy policy especially “adder” tool needs to reviews a measure on that because joint company adventure and/or transnational corporation get through benefits.

At present renewable energy development is relied on quota system in center. So if it has a conduct of Provincial Power Development Plan we will be on a reforming condition and self-reliance of energy planning, management and maintenance with charges service system.

Electricity power plant investment should origin from people in province under decentralization concept and small scale to overcome the barrier of local investment capacity. Its development should depend on a part of government support. Energy planning model should be mixed with people possession by sharing a stock with a different benefit zoning such as renewable energy plant is shared more for everyone in communities which have projected development and further. Withoutstanding cooperative model limited working group in a long term with less effective and private investment needs to reduce the most target of profit to support each other on energy development and survivor. Government sector should support project loaning with low interests because the more people invest the less exported fossil fuel and swoop budget to renewable energy investment instead.

Local and provincial administrative are key office to solve energy management problem in the province. Problem of biomass management is forest restoration to plant energy crop with good price and income. Public participation in every project with transparency and fairness people can be a part of environmental control and stakeholders as beneficiary. Energy crops are needed a tool of area zoning which unclear at agricultural planning with energy and food security.

I think agricultural zoning is a provincial level problem how to manage land use effectively sharing cultivated products for food and energy and appropriate for surrounding in province.

Developing renewable energy of community scale should be supported by setting a target of 23 districts with choosing just one sub-district. And then develop “One Sub-District One Renewable Energy” is a developed model to other sub-district learning and exchange experience. It should be developed as PDP of community, PDP of District and PDP of province with together supported by Ministry of Energy and local offices.

Regarding to industrial sector, it has raw materials to be generated electricity by reducing cost. Campaigning both government and business sector is to be awareness campaign about decreasing energy consumption which significantly reducing power plant project construction automatically in the province. Although government sector has a limited investment part according to law enforcement it is essential of its policy in case of supporting local renewable energy investment and how to manage its benefit directly to community according to legal law enforcement.

A small scale of renewable energy development has many processes to access government funding and after selling electricity on grid local government is a representative to manage its income not community because of law enforcement. The solution of Local Administrative should deduct a percentage of management and then transferring the left of income to community.

Local Administrative has authority to joint renewable energy investment but it cannot loan to invest any project in the province which is different from Municipal and Provincial Administrative Office. How to solve this kind of law enforcement is to open investment market with public participation or shift CSR objective to increase more renewable energy in the province. In policy level, Provincial Administrative Office is a most potential to invest in renewable energy projects all of that depends on vision and implementation plan to make it happen.

It needs to come from Provincial Power Development Plan with a good public participation. A project initiation in community is able to response a local need in term of energy supply, reducing fossil fuel depending. It should be sharing a role of energy supply to each office policy and evaluation such as Municipal has xxx renewable energy power plant or projects and xxx projects for Local Administrative.

A priority is Nakhon Si Thammarat must produce electricity to be an adequate supply and then linked to national grid. It consists of reducing dependent fossil fuel, renewable energy database, resources management and grid connection. The benefit should realize on owner of fuel source. A Committee of Provincial Administrative Strategy Office should integrate energy policy with relevant provincial

energy offices, local and provincial administrative, academic, experts, private sector and public. Provincial Power Development Plan is for public participation, transparency and accountability. It requires a procedure of implementation, examination and maintenance system."

11. Interviewee K

"Renewable energy plan has an important role on strategic planning however, Nakhon Si Thammarat province is dependent on fossil fuel supply and relies on national grid sharing with Surat Thani province. So Ministry of Energy has a feasibility of coal power plant at Khanom district with coal fuel imported from Indonesia. The provincial budget is small grants to develop green energy for small industry and household project annually.

Wind energy installation has been started at Hua Sai district and Ministry of energy planned to expand its capacity in the long term liked to the Gulf of Thailand development plan. Only financial support from government is insufficient government should give priority on policy level to increase provincial's budget. So if coal power plant is strengthen opposing by local people it needs to range it as last of the list.

I agree with the priority of renewable energy development in province in case of provincial consumption overload should further consider other fuels if it needs. Lacking of understanding and supporting government reflects through solar cell roof top project of Provincial Centre Office has been requested since last year but it still on process.

Private sector of Nakhon Si Thammarat province restricts to invest renewable energy project and relies on outside. It should be adapted from cooperative, small and medium enterprise to be like stakeholder or joint venture with mainly government support.

In general land use in province has been changing from rice paddle fields to palm and rubber tree planting. The factor of energy crop zoning should be concern on soil quality, irrigation system, city planning and also risk assessment on flooding crisis.

Energy management should be integrated budget from each part of Provincial and Local Administrative to uptake community scale to district and provincial one. The strategic target needs to identify the figure of renewable and energy efficiency in each year and create strategic indicators. Industrial sector must campaign renewable energy initiative to promote its potential. Nowadays the portion of renewable energy development is not much be emphasized like energy efficiency so its indicators and figures should be set up.

Renewable Energy Center should be initiated by Provincial Power Office to analysis and research together with relevant local and provincial administrative, university and people.

Nowadays a province has not enough budgets to invest renewable energy it should be joint venture with big company or Oil Corporation supporting according to a plan. Law is not specifying a percentage of each budget it depends on budget allocation in each Administrative.

Nakhon Si Thammarat province has practiced National Power Development Plan to build coal and nuclear power plant project leading to people strongly disagree. So it needs public hearing in every step of Provincial Power Development Plan integrated relevant a group of energy work such as Provincial Power Office, PEA, a group of planning for instance Provincial Strategic Office , private sector and power producer investors including Local and Provincial Administrative Office and people in the province."

12. Interviewee L

"The potential of micro-hydro power and wind energy from mountain and coastline respectively will be a main role of energy in future. In present imported technology is still expensive although its price has been decreasing especially wind turbine. Renewable energy we have in the province lot of but people do not realize about energy security in future and how to be awareness on self –reliance of energy planning. It needs to be addressed as provincial strategic planning and working together on energy issues with local especially Provincial Administrative Office. I think we should think over organization benefit to provincial advantage instead of including energy investment integration in the province.

A strengthen opponent coal network is a conflict situation about energy planning in province because it is a top-down energy policy and lacks of public participant and acceptance. Top down management emphasize on compensate cost cannot solve a root cause. I think people actually know about coal impact and ineffective environmental impact on energy issue. Therefore, renewable energy research and database must be conducted to people before they make a decision and this is a priority towards integration. Research will be an answer to energy development question.

Renewable energy research model is a start point leading to integrated point in future. Academic in the province and/or work with regional university in southern as neutral institution with a budget support from government, local and provincial administrative sector and provincial committee, beneficiary and local people who is in an energy field giving information and public participation process, a group of investors in the province and outside. Public hearing is a process after conducting renewable energy database and officially announcement to use it in the province. Provincial Administrative Office should implement renewable energy plan with Local Administrative Office and then transfers it for sub-district maintenance. It is time to initiate a vision of renewable energy development with a budget support in a sector of public service budget.

Nakhon Si Thammarat province has a capability of rubber tree and fishery product so model of energy development should be a small scale for community and financial support by government including academic support on information and knowledge. Making people awareness on population increasing and growing energy demand is a way to seek a proportion of renewable energy support. Whoever can be renewable energy producer and investor and benefit is belonging to people and province.

Corporative model should elect a board to manage electricity generating, member benefit and distribute on grid connecting with pay income return to community and holders. And stakeholder model is a long term paying back working though selected committee and

then they chose an expert management team. Community in which renewable energy has been developed is a priority of benefit sharing with a management concept of transparency, participation and fairness.

Renewable energy policy is important to develop occupied land property to go for energy crop zoning however, it is depends on each appropriate areas increasing agriculture products for energy generating with market mechanism. Energy strategic planning to integrate relevant energy and planning office can work under one strategic with different actions to achieve same target. In term of energy budget is not a part of little environmental budget so vision of leader is a key on financial support shifting from facility to renewable energy development.

Furthermore, Industry sector is a majority of energy consumption to invest renewable energy in their plants including institutions and service sector and how to push a measurement in the provincial policy to encourage them to accountability of renewable energy development and benefit them.

In term of Provincial Power Development Plan implementation should be a kind of a small provincial sub-committee board. Applying an existing government structure and make it better with a main of relevant energy office, local and provincial offices and public participation and beneficiary with linked to a renewable energy research board and a Head of Province to final approve a final energy plan and propose it as an original energy planning bottom up process to national energy development plan later."

13. Interviewee M

"The alternative energy development should be ruminated the capability in the province leading to energy development planning. The government office is the priority to change the way of energy consumption both increasing renewable energy and energy efficiency measurement because it is the expenditure burden of electricity bill about 5 percent compared to all expenses each month.

In the long term break-even point of renewable energy is a good reason to decreasing fossil fuel utilization. Nakhon Si Thammarat province gives an opportunity to present as renewable energy menu to power producer investors. The leader of Local and Provincial Administrative is ignoring the potential of renewable energy and need to be concentrated as concrete provincial energy plan.

I absolutely agree with wind farm electricity generating from nature and of course, it is one factor of tourism attractive especially the gulf of Thailand research proposing renewable investors. Conflicting of energy policy affects to provincial energy development in province. I agree with a large power plant but fuel source must origin from renewable energy according to the potential of areas. It is not import fuel or trend to have high cost of investment. The future of renewable energy investment in province must consider valuable price because renewable energy might high invest in technology with long term succession covertly trend of fossil fuel will be increasing.

I think the barriers of renewable energy development are directly linked to technology development and its purchasing policy. Government is a main leader to innovate renewable energy in the province. Renewable energy power plant scale should be started with the effective governmental provincial office support. Municipal is one office with strengthen ability to start it and of course, Provincial

Administrative Office has more budget and authority to experience province or support Local Administrative which depending on the vision of leaders. In my opinion, cooperative model of renewable energy investment should be great because of people's owners, public participation and acceptation to reduce conflict of interest and sharing benefit with transparency, accountability and fairness. However, I think stakeholder model is hard to access in term of people has no experience and knowledge about stock market which is inevitable to overcome monopoly system.

Furthermore, developing unoccupied agricultural fields to be a productive cultivation for energy crop linked to illegal land property which having a conflict interest of investor, local politician and local government. The province is lacking of integrated energy policy, public acknowledge and public participation. One key person on provincial energy movement is the Head of Province with identified government policy reflecting applying the different potential of renewable energy in each province. Only provincial office is inevitable government policy because provincial level lacks of human resources, budget and a long-term goal. Although it will start with large budget it is valuable. If it supports strengthen community, investment sector and productivity finally it shows a capacity of province.

Although local community in the province has been supported renewable energy projects development it has to be advocated more in district and provincial levels as "one community one initiative renewable energy" to go for a large project further. Provincial energy development must address a mission, implementation and evaluation. In term of industrial sector it is applying energy efficiency which affects its profits. Whereas government has a vision without profit priority it is essential to set a target and officially declaration by a Head of Province as provincial goal expressing and encouraging public to start.

I think budget and knowledge are key factors to push forwards energy information to go for a macro energy planning. Academic in the province has a potential of studying but it is insufficient in term of budget and encouragement. In provincial administrative it has no barrier about renewable energy investment in a part of law enforcement. The leaders should prepare a province to investor as joint venture, stakeholder, self-investment or sharing fairness benefit. In a present we give less important about energy budget in fact it is main policy leading a province to sustainable energy development in a long term.

However, usually leaders in province are inattentive thinking of long term policy. Provincial Power Development Plan requires private sector to study a potential of renewable energy together with beneficiary by PEA financial support. Public acceptance with a trend of economic growing information is useful to expanded renewable energy investment. Provincial energy management should be flexible like company but give benefit directly to people with external expert board as election or selected process by provincial representative as public organization balancing power."

14. Interviewee N

"Fossil Fuel is conventional source Nakhon Si Thammarat province needs to go beyond with renewable energy. How to encourage citizen participate in provincial energy brainstorming is the step of public participant and make them realize on the choice of energy development. Natural gas power plant at Khanom district in Nakhon Si Thammarat province make fish circumstance is decreasing. The true cost of solar cell is continually decreasing with its effective and qualitative. Furthermore trend of people more interested in renewable energy because of environmental concern, job creation and others. Germany is a good case study with decentralization, increasing green energy jobs. I think Nakhon Si Thammarat has capacity of renewable energy technology initiative. This idea came from the question of people when opposing coal power plant project in districts as insist with solution.

Energy management in province is new idea of people and government offices. The advantage of power plant ownership is that people have a right to investigate power plant process with a reason on environment and investment balance. If government has policy support renewable energy with subsidy, feed-in tariff which grows its investment at local. Investors and people would like to invest when government declared a concrete energy plan and future local people will become a main function to push provincial energy revolution. The market and price mechanism are motivate factor of technology innovation although at present people do not much thinking of its technology development.

In case of agriculture property is belonging to Treasury Department which connected to land use policy of energy crop development planning and zoning. In term of energy planning usually it has implementation planning of sub-district every year with project proposing. If the budget is over and Local Administrative cannot afford it will be proposed to Provincial Office. Increasing renewable energy projects should acknowledge people in each to work together including local people, government, business, academic and experts. Industrial sector should be seriously on renewable energy development for its business with a clear target and controlled by new energy organization in province together reforming renewable energy plan.

According to provincial renewable energy research people must put pressure on government sectors to address a research budget in a plan. It might be sharing by people in province, stakeholders or others. And Provincial Power Development Plan should integrated existing Provincial Administrative structure and conducting public hearing on a process of energy planning of community, district and province."

15. Interviewee O

"A large scale of power plant development by government affects and scared people of renewable energy development power plant which is a mistake of EGAT. So people in province should acknowledge on the true of renewable energy impact. Local Administrative has no vision on renewable energy development to compensate fossil fuel consumption. Purchasing electricity role makes citizen convenience on energy consumption side. Little budget grows up renewable energy projects in community emphasizing root

development cannot make local people understanding and depend on fossil fuel feed. Energy issue takes time to raise people awareness on the impact of environment. In term of local administrative is not enough to initiate the alternative energy projects in the community. In case of local governments contribute their budget in a pot it is difficult to guarantee the effective progress because of the different fundamentally facility development in each administrative. At the same time the budget of the Head of Province is less important clarification on renewable energy development including provincial budget.

The bondage of private investor and EGAT is hard to disengage. The vision of EGAT concentrates on low cost investment with high profit without considering on the provincial capacity. Why people do not realize in developing renewable energy in the province because national energy plan determine coal, dam etc. whereas the opponent needs to propose the solution as well. Information debate between non-government organization and EGAT is not absolutely accurate database. EGAT hires Consultant Company with huge budget to propose power plant project to local people with not much success because of the relationship of conflict interest and corruption at the policy level.

Furthermore, the leaders in the province has not seen scenario of energy outlook in Nakhon Si Thammarat province that why renewable energy project contribute just to household project for example charcoal brazier. The province must seriously self-reliance of energy management by increasing its budget, effective research, participation of local government, private and public sector to set strategic energy as the core of provincial policy. Provincial Administrative is the majority of renewable energy development however, it needs to balance the proportion of stakeholder partner even government, business and private sectors. Increasing renewable energy in Nakhon Si Thammarat province needs a concrete plan to be achieved. Provincial Power Office has no vision of conduction Provincial Power Development Plan because its project development has just occurred in small scale with Ministry of Energy concept. A Head of Province and Provincial Power Office must address self-reliance provincial energy policy.

Considering a cost of energy development and add values in a long term if we think since today the electricity cost might cheaper as quick as we start. And a key player of energy planning is Provincial Administrative Office. It is independent, flexible, continual, and covered areas with a large budget about 800-1000 million baht a year to be financial support of provincial project development. Whereas municipal has a capacity with limited areas in Mueang district and local administrative with just cover sub-district. The important thing is that the mission of energy planning is a connection.

The province needs to address a figure of renewable energy target which significantly evaluate each year and encourage people to achieve it together. According to law enforcement and energy regulator, PEA office in each district has monopoly authority of electricity distribution and purchasing in province so it is a barrier of renewable energy development in future and including relevant central energy office.

If we talk about budget which office should start first? It should unlock with allow Local Administrative to buy in renewable energy project. In term of annual budget it has Collective budget which left from its spending according to annual budget date after the

end of September so local administrative has authority to spend its budget which is a big amount of money of every office according to law enforcement to collect in a pot. In some have up to million baht it can be taken out to develop energy project for people in future. Nowadays, this budget cannot be spent it is just for saving and if it needs to be taken out the Head of Province has authority to approve. So we need to think more how each local administrative can share xx percentage of its pot for renewable energy development.

Provincial Power Development Plan consists of energy database, a potential of renewable energy, short and long term of paying back investment and self-reliance or exported electricity planning. It needs provincial, local administrative, funding, expert and academic studying and public energy network which has not yet done. It should be a small effectively working group. Usually wherever renewable energy is developed the Local Administrative Office gets benefit and compensation. The transparency of future energy industry will be benefit to Local Administrative Office in term of taxes and renewable energy company registration which significantly increase income to province. Board of energy planning must be intelligence, incorruption, non-interfering politic.”

Biography

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Work Experience

April 2010 – Present	Climate & Energy Campaigner, Greenpeace Southeast Asia
April 2006 – October 2007	Officer with the Campaigns and Information Dissemination, WWF Thailand
April 2005 – April 2006	Officer with the Campaigns and Information Dissemination, Community Foundation Project of Thailand
August 2002- April 2005	Officer with the Campaigns and Information Dissemination Department, the Foundation for Child Development
July 2002- August 2002	Legal Assistant, Child Protection Foundation

Some Publications on Thai Media:

1. 6 June 2006: Human in Elephant Track Feature Article on Outlook, The Krungthep Turakit newspaper
2. 29 October 2006: Trap or Answer: The Elephants Feeding on Daily Newspapers
3. February 2007: With Mines, Wildlife Disappear: The Return of Illegal Mines at Tung Yai Wildlife Sanctuary on Feature Magazine
4. April2007: New Homes for Marine Fish on Nature Explorer Magazine
5. July 2007: Forest Restoration to be Real Forest on Feature Magazine
6. September 2007: From Forest to City, Dichan Magazine
7. April 2011: From Chernobyl to Fukushima, Business Plus Magazine
8. October 2011: Interview on 10 Tips to Energy Efficiency, Marie Claire
9. October 2011: Thailand Needs Energy Revolution, Business Plus Magazine
10. November 2011: The Future Path Way on Coal, Business Plus Magazine
11. May 2012: Think Over Than Coal, Business Plus Magazine
12. 6 July 2012: The First Renewable Energy Law in Thailand, Post Today newspaper
13. 7 October 2012: Fish for Life: Food Protection Declaration to Stop Dirty Industrial Development, Thai Post newspaper
14. 14 February 2013: Interview on Green&Good Life, Krungthep Turakij Newspaper