The Kingdom of Thailand
National Economic and Social Development Board (NESDB)
Industrial Estate Authority of Thailand (IEAT)

The Kingdom of Thailand
Preparatory Survey
for
Industrial Estate Smart Community Development Project
(PPP Infrastructure Project)
FINAL REPORT

June, 2016

Japan International Cooperation Agency (JICA)

Fuji Electric Co., Ltd.
InterAct Inc.
Pacific Consultants Co., Ltd.
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Thai Baht 1.00 THB = Japanese Yen 3.34 JPY
(September, 2015)

Summary

■Outline of the Study

The study has examined the feasibility of outsourcing services targeting the Thai industrial estates in Prachinburi Province, Rayong Province, Ayutthaya Province, and Chonburi Province to install, operate and maintain their utility facilities. To this end, it has assessed the existing utility supply systems and related infrastructure, the legal systems applicable to the intended businesses, a market research and demand forecast, detailed designs of the services, viable business schemes, requirements of environmental and social considerations, and potential impacts of the project, while also carrying out the cash flow analysis and risk analysis.

Counterparts of the study are the two Thai governmental organizations: the National Economic and Social Development Board (NESDB) and the Industrial Estate Authority of Thailand (IEAT). The study was implemented from January 2015 to May 2016.

The project initially planned to provide such outsourcing services as the Energy Service, the Energy Conservation and O&M Service, and the Smart Services (transportation, human resource development, environmental monitoring, and local contributions). In the course of its analysis, however, the study has revealed that the Smart Services are less feasible than the Energy Service and the Energy Conservation and O&M Service, and therefore decided to elaborate on the latter 2 services to undertake facilities planning, schematic designs and cost estimation. Specifically, the Energy Service includes the Air Conditioning Service that replaces and maintains air conditioners, and the Factory Equipment Service primarily to allocate compressors in an intensive arrangement. The Energy Conservation and O&M Service is featured by remote monitoring with the Cloud FEMS and scheduled maintenance on site.

■Study for Realizing the Business

The study has examined a business scheme that would establish a SPC in the long run to deliver the Energy Service and the Energy Conservation and O&M Service. As a precondition of establishing the SPC, the project must have potential demands and viable business scale. Under the current circumstances. However, only a small start-up business mainly centering on the Air Conditioning Service and the Factory Equipment Service mainly targeting on Japanese-affiliated small-medium scale factories can be practically implemented, as mentioned in 7.3, due to reduction of large scale projects such as on-site power generation which was led by slowdown in Thailand's economy. Therefore, the study has explored if the Alliance Agreement and the Agency Agreement are feasible to cover the period until the SPC is established. Under the Alliance Agreement, the consortium members of this study will consult together and tap business opportunities wherever possible, taking advantage of their strengths. The Agency Agreement, on the other hand, selects an Agency Company from the said consortium members, which will act as a liaison to lead promotional efforts and a collective cooperation to form a business.

A financing measure depends on the intended business scale and form. Project financing will be required for funding where the planned business has solid actual demand, and is able to maintain a reasonable operating scale. Investment and loan shall be provided approximately at a ratio of 4 to 6 or 3 to 7. Financing terms measure is

studied to be obtained by foreign investments and loans from such entities as companies involved in the project planning (the Local Consortium Members), related Thai companies (including Japanese-affiliated subsidiaries), and JICA. Furthermore, loans are studies to be obtained by Japanese banks operating in Thailand as well as local financial institutions. To meet a financial requirement of about 15 billion JPY for the five years, for instance, a funding model comprises investments of 6 billion JPY, including 4.5 billion JPY from some companies centering the consortium members in Japan and the Local Consortium Members, 1.5 billion JPY from JICA's overseas loan and investment finance program, and the remaining loans from Japanese banks and local Thai banks.

The project implementation is scheduled to start with the Alliance or Agency Agreement for the initial 3 years, followed by the establishment of the SPC possibly in the 4th year. To prepare for the SPC, the project must find client companies, develop a business plan, and pursue preliminary consultations with related government agencies including BOI before entering in the 3rd year. The SPC will be then established in the 4th year, obtaining permits and licenses.

■Impact of the Project and Feasibility Evaluation

Currently under elaboration, the project intends to provide the 4 companies with the Energy Services that include the Air Conditioning Service (intensive allocation of air conditioners and installation of air conditioning inverters) and the Factory Equipment Service (inverter compressors and intensive allocation of the compressors). The Energy Conservation and O&M Service includes the Cloud FEMS and O&M. When delivered, the Air Conditioning Service will assure an air conditioning capacity of 6,205,865 BTU/H, while the Factory Equipment Service will enable the target factories to stably operate compressors at a power range of 630 kW. An energy efficiency is estimated to increase approximately by 15% resulting from use of the Air Conditioning Service, and similarly by 6% from use of the Factory Equipment Service (compressors).

In addition to the above performance indicators, the O&M Service will minimize troubles and failures of the equipment to be operated by the 4 companies. The project will achieve improvement. Employment of 2,760 workers will be sustained, while also a profit will be generated annually in a range of 516,000 and 1,163,000 THB.

Furthermore, besides the above-mentioned services suggested by the project, the On-Site Power Generation Service and the UPS-based Factory Power Supply Stabilization Service are also available. EIRR of these businesses is estimated as high as 75.7 to 79.9%.

The quantitative impact of the project, albeit difficult to evaluate, includes such primary effects as an increased energy efficiency and stable utility supply, and secondary effects such as increased production and management efficiencies, sustainable employment, and reduced CO2 emissions.

In light of the above, the project expects wide-ranging effects, delivering benefits to factory workers and people in Thailand. The feasibility of the project has been verified by economic indicators, and therefore the study concludes that it should be implemented as intended.

■Prospective Challenges

Challenges in the project implementation are highlighted below.

(1) Risk Sharing among the Member Companies in an Agency Agreement

The project implementation is scheduled to start with the Alliance or Agency Agreement to deliver the services for the initial 3 years. The SPC will be subsequently established in the 4th year when a reasonable number of clients are obtained. The member companies will entail different business risks in either scheme of the Alliance or Agency Agreement to be implemented during the initial 3 years prior to the SPC's start-up. A company acting as an agency will be exposed to more risks associated with business operations, contracts, and responses to the clients. Such risks, when centered on a particular entity, will cause insecurity in the business to be sustained under the Agency Agreement. This may pose a further problem in the SPC's start-up. It is thus essential to diversify the agency's risks among the member companies so as to maintain continual business operations.

(2) Research to Explore Local Client Companies in Thailand

The study carried out interviews with about 100 factories in total, including Japanese-affiliated companies and local Thai enterprises. Brief plant diagnoses were conducted for those interested factories, followed by suggestions of relevant services. The promotional efforts have chiefly targeted these Japanese companies for the reason that the majority of the interested entities are Japanese-affiliated factories. Given this background, the project is likely to target Japanese companies when implemented upon completion of this study. Major reasons of such background are supposed that Japanese-affiliated companies have comparatively higher intension to energy saving than Thai enterprises; and high quality services by Japanese-affiliated companies are attractive to Japanese-affiliated companies in Thailand. Therefore, main marketing target will be Japanese-affiliated companies for the implementation of the business after the project.

On the other hand, NESDB, which is the counterpart of this study, anticipates the project's service provision to local Thai companies as well as a positive impact on the economy obtained through the resulting industrial advancement. The Reason why Thai enterprises have comparatively small intension to the project is supposed that Thai enterprises have comparatively lower intension to the energy saving than Japanese-affiliated companies, and Thai companies are likely to put priority on relationship with existing manufacturers and engineering companies. In other words, such Thai enterprises will have possibility to increase intension to the project by increase of demand for the energy conservation technology and high efficient equipment followed by improving energy saving awareness, and increase of reliability of the project followed by project achievements. Therefore, Thai enterprises will be preferable marketing targets for future as well as Japanese-affiliated companies.

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List of Abbreviations

Abbreviation	Description
AOTS	Association for Overseas Technical Scholarship
AQMS	Air Quality Management System
ASEAN	Association of South‐East Asian Nations
BOD	Biochemical Oxygen Demand
BOI	The Board of Investment in Thailand
BOO	Build Own Operate
BOT	Build Operate Transfer
BTO	Build Transfer Operate
CEMS	Continuous Emission Monitoring System
CSR	Corporate Social Responsibility
DEDE	Department of Alternative Energy Development and Efficiency
DEQP	Department of Environmental Quality Promotion
DIW	Department of Industrial Works
DSCR	Debt Service Coverage Ratio
EEDP	Energy Efficiency Development Plan
EGAT	Electricity Generating Authority of Thailand
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
EIEB	Environmental Impact Evaluation Bureau
EMC^2	The Environment Monitoring& Control Center
ENCON Fund	Energy Conservation Promotion Fund
EPA	Economic Partnership Agreement
ESCO	Energy Service Company
EV	Electric Vehicle
FBL	Foreign Business License
FCV	Fuel Cell Vehicle
FEMS	Factory Energy Management System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPS	Global Positioning System
HEPS	High Energy Performance Standard
HIDA	Overseas Human Resources and Industry Development Association
IEA	International Energy Agency
IEAT	Industrial Estate Authority of Thailand
IEE	Initial Environmental Examination
ILO	International Labor Organization

Abbreviation	Description
IPP	Independent Power Producer
IPS	Industrial Power Supplier
IPU	in-plant utility
IRR	Internal Rate of Return
ISO	International Organization for Standardization
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JODC	Japan Overseas Development Corporation
JTECS	Japan-Thailand Economic Cooperation Society
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
MEA	Metropolitan Electricity Authority
MFN	Most Favored Nation
MOC	Ministry of Commerce
MOE	Ministry of Energy
MOI	Ministry of Industry
MONRE	Ministry of Natural Resources and Environment
THB	Thai Baht
NEPC	National Energy Policy Council
NESDB	National Economic and Social Development Board
NGO	Non Governmental Organization
O&M	Operation & Maintenance
ODA	Official Development Assistance
ONEP	Office of Natural Resources and Environmental Policy and Planning
PCD	Pollution Control Division
PEA	Provincial Electricity Authority
PPP	Public Private Partnership
PWA	Provincial Waterworks Authority
RASS	Radio Acoustic Sounding System
SEPO	State Enterprise Policy Office
SMEs	Small and medium-sized enterprises
SODAR	Sonic Detection And Ranging
SPC	Special Purpose Company
SPP	Small Power Producer
TNI	Thai-Nichi Institute of Technology
TOT	Thai state-owned Telecommunications Company Limited
TPA	Technology Promotion Association (Thailand-Japan)
TT & T	Thai Telephone & Telecommunication Public Co. Ltd.

Abbreviation	Description
UNESCO	United Nations Educational, Scientific, Cultural Organization
UNDP	United Nations Development Programme
UPS	Uninterruptible Power Supply
VAT	Value Added Tax
VOC	Volatile Organic Compounds
VOD	Video On Demand
VSPP	Very Small Power Producer
WTO	World Trade Organization
WQI	Water Quality Index
WQMS	Water Quality Management System

1 Outline of the study

1.1 Background of the study

1.1.1 Existing Conditions and Issues in the Industrial Development Sector in Thailand

The manufacturing industry leads the national economy in Thailand; the secondary sector of the Thai economy including the automotive industry, IT, and mechanical and chemical products, comprises around 50% of the nominal GDP. The total export amount of the nominal GDP is 60% and especially the automotive industry is a main component of the national economy and leads the national economy (the production volume in 2012 was 2,480,000 units, which makes it the world's 9th leading manufacturing country in the global automotive industry). In this economic circumstances, Japanese companies are highly significant presence; 4,000 companies that are known of have advanced to Thailand, according to one source, 7,000 companies have a presence in Thailand. Industrial estates support Japanese manufacturing activities.

There was a severe flood in the central Thailand in 2011, which has caused the industrial areas in east Thailand (including Prachinburi province) to have a high demand for replacing those companies damaged by the flood as well as adding new companies.

In addition, many small and medium enterprises (SMEs) have recently rented factory space so as to save initial costs; the demand for industrial estate which SMEs do not need initial investment such as utility setup is expected to increase, which will accelerate Thai economic development.

1.1.2 Development Policies of the Industrial Development Sector in Thailand and the Role of the Project

In Thailand, the energy consumption rate has increased by 4.4% per year for the last 20 years, which raises concern over a lack of electricity in the future. The acceleration of using renewable energy and reducing energy consumption are priority policy issues, as exported natural gas is a current main energy source. Reducing energy consumption in industrial estate is the most important issue due to its large volume of energy consumption.

The National Energy Policy Council (NEPC), a part of the Thai government body, submitted an Energy Efficiency Plan (2002-2011) to pursue energy saving policy and implemented a non-interest loan policy for energy efficient electrical products in 2008 as well as a low-interest loan policy for investment in renovation or mechanical renewal by SMEs for energy-saving purposes.

Currently, the Thai government is trying to achieve the goal of energy conservation, which is established in the Energy Efficiency Development Plan (EEDP) (2011-2030): 13,400 ktoe in the transport sector, 11,300 ktoe in the industrial sector, 2,300 ktoe in the commercial and residential sector, with a goal of 25% energy saving in 2030 compared to 2005.

The Thai government pursues an eco-friendly industrial estate, and the Industrial Estate Authority of Thailand (IEAT) formulated the Eco Industry Town Concept in 2009, which includes the vision of an eco-friendly relationship between industrial areas and surrounding communities with a trial period from 2010 to 2014.

The Industrial Estate Smart Community Development Project (hereafter referred to as "the project") aims to implement high energy efficiency concept and activities in industrial areas and enhance the

connectivity between the industrial estate and surrounding communities, which matches Thai government development policies. However, the current energy efficiency situation is depending on individual factories; a cooperative activity as a whole industrial estate is still under development.

1.2 Purpose of this study

The purpose of the project is to realize an Industrial Estate Smart Community through centralizing construction, operations, and maintenance of utilities – power, heat and steam, air, and air conditioning in particular, as an outsourcing business; and establish a service provider for Energy Service, and/or Energy Conservation and O&M Service. This allows realization of energy efficiency, which is the main challenge for Thailand and provides a high-quality infrastructure service to contribute to the country's industrial development and support SMEs to start new businesses in Thailand.

In addition, the project will also consider transportation and human resources development services to solve the issues of Thai industrial estates in order to achieve an Industrial Estate-type Smart Community.

This feasibility study is conducted to propose the best business scheme through formulating detailed business plans, including basic design, cost estimation, a demand forecast, a Public Private Partnership (PPP) scope, a financial scheme, a O&M management scheme, a risk analysis, and the environmental impact assessment (EIA).

Furthermore, a Special Purpose Company (SPC) will be established to develop business for the Energy Service, and the Energy Conservation and O&M Service. However, at initial phase of the business, the business may be operated by alliance agreements or agency agreements with existing specialist companies. (Detailed plan is mentioned in Chapter 7 "Development of the Business Plan".) This plan is considered as a possible business plan to enable immediate business operation by collaboration among existing specialist companies.

1.3 Study Site

Country: the Kingdom of Thailand

Area : Prachinburi Province, Rayong Province, Ayutthaya Province and Chonburi Province (Ayutthaya Province and Chonburi Province were added according to the result of the field survey in May, 2015)

1.4 Executing Agencies

National Economic and Social Development Board (NESDB)

Industrial Estate Authority of Thailand (IEAT[1])

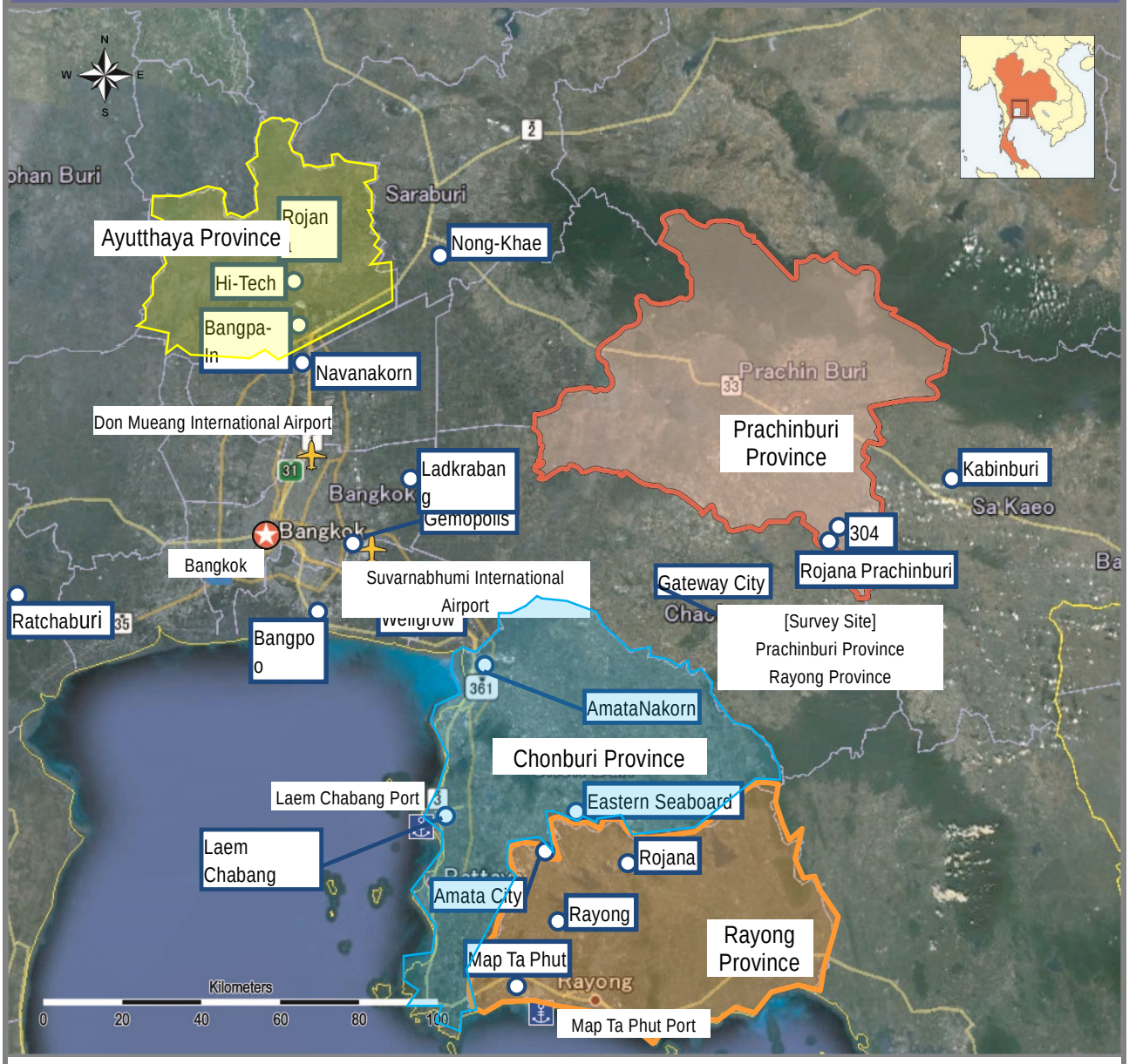
1.5 Study Period

January 2015 - February 2016

[1] Refer to section 4.2.1 (2) for details on IEAT

The Kingdom of Thailand

Research Object Area Map



Socio-Economic data of the Kingdom of Thailand

■Area	514,000 km² (about 1.4 times that of Japan)	■Trading	
■Population	65.93 million (2010, National Statistical Office of Thailand)	(1) Export	US$ 228,530 million (2013, JETRO)
■Capital	Bangkok	(2) Import	US$ 250,723 million (2013, JETRO)
■Ethnic Group	Mostly Tai. Others: Ethnic Chinese, Malay, Minority mountain tribe, etc. (MOFA of Japan)	■Currency	Baht
		■Exchange rate	US$ 1 = 32.02 Baht (2014 yearly average, Bangkok Bank)
■Language	Thai	■Japanese ODA for the Kingdom of Thailand (ODA White Paper, JICA)	
■Religion	Buddhist 94% Muslim 5% (MOFA of Japan)	(1) Yen Loan	US$ 48.72 million (2012, Net distribution basis)
■Nominal GDP	US$ 387.3 billion (2013) (■GDP per capita: US$5,779, World Bank)	(2) Grant Aid	US$ 13.86 million (2012, Net distribution basis)
			Grant aid except for Grassroots Grant Aid and Cultural Grant Aid for Thailand finished in 1993
■GDP growth rate	1.8% (2013, World Bank)	(3) Technical Cooperation Project	
■Principal Industries (MOFA of Japan)			US$ 71.48 million (2012, Net distribution basis)
Agriculture	some 40% of labor force/ 12% of GDP		
Manufacturing	15% of labor force/ some 34% of GDP/ some 90% of export value		

Figure 1-1 Site Map

2 Background and Needs for the Project

2.1 Current Status and Issues on Infrastructures in Thai Industrial Estates

2.1.1 Current Status and Issues of Infrastructures in Thai Industrial Estates

Industrial estates in Thailand are developed, operated, and managed by various entities such as IEAT, private real estate operators, and international corporations including Japanese corporations.

According to statistics of Japan ASEAN center, there are a total of 74 industrial estates in Thailand, out of which 48 are managed by IEAT. Various infrastructure necessary for the operation of industrial estates, such as electricity, water supply, telecommunication, road, and drainage are developed at international standard. Steam and natural gas supply necessary for production are also provided in industrial estates. Moreover, there are industrial estates with various services, such as a security service, fire station, waste collection, medical service, living accommodations, commercial facilities, etc. In addition, there are sales of high-standard factories and rental factory services provided recent years.

In industrial estates located in the Ayutthaya region which were heavily damaged by a flood in 2011, flood prevention measures have been taken to prevent damages in the future.

Infrastructures outside industrial estates, such as ports and roads for the transportation of goods and raw materials are also developed to meet international standards.

Some industrial estates have issues with the occurrence of momentary power failure and blackouts several time a year, resulting in demands for a more stable supply of electricity. In addition, there are some industrial estates that supplies poor quality water to tenant factories resulting in demand for an urgent improvement. Internet connections in many of industrial estates are also low stability and slow, resulting in demand for a prompt improvement.

2.1.2 Current Status of Electricity Demand, Human Resource and Transportation in Thailand

(1) Electricity Demand in Thailand

In 2012, the total power generated by Thai electric companies was 166.6 billion kWh, and the total electricity supplied including the 8.4 billion kWh interchange of power with neighboring countries (imported 10.3 billion kWh, exported 1.9 billion kWh) was 175 billion kWh. The total power consumption, subtracting the 5.3 billion kWh power consumed in the power plant and the 9.5 billion kWh lost through distribution from the domestic electricity supply, is 161.7 billion kWh. The breakdown of the power consumption is as follows: residential (22.6%), commercial (34.8%), industrial (41.5%), and agriculture (0.2%), etc.

The largest consumers are the industrial sector, and power consumption of the food industry is outstanding, followed by iron and steel industry, electric and electronic industry, fiber industry, automotive industry, plastic, cement, and chemical industry. Within the commercial sector, power consumption are high in the order of commercial facilities, hotels, followed by housing complexes.

The number of factories in the industrial sector - the largest power consumer, have increased at an annual rate of 2.9% for 10 years from 2000~2010, and are expected to continue increasing at a comparable rate in the future. As for future electricity demand, it is expected to grow at an annual average of approximately 4.1%. According to Electricity Generating Authority of Thailand (EGAT), the

power consumption in 2030 is expected to double from 2011 and reach 346,767 GWh. As described above, there are concerns regarding future power shortages, however a planned development of power sources is conducted based on demand forecast, and continuous and stable supply of power is anticipated.

The power supplied in Thailand is dependent mostly on natural gas, and considering the fact that a large portion of electricity is currently purchased from abroad, utilization of renewable energy and promotion of energy conservation will continue to be an important political issue. Energy saving measures in industrial estates have also become an urgent issue for a large power consumer.

(2) Current Status of Human Resource and Transportation

Although the unemployment rate is at low 0.84% due to steady economy, the lack of labor force including the automotive industry has become increasingly severe. In addition, due to the significant increase in minimum wage implemented in April 2014, deterioration in SMEs' revenues are of concern.

Securing necessary human resources have become difficult, as many employees repeatedly change their jobs depending on employment conditions, such as salary and treatments, etc. For this reason, as the number of foreign companies entering the market and the number of local companies increase, securing good workers/ engineers through human resource development and training manager class have become an issue, particularly for factories located in an industrial estate.

There are two ways employees commute to industrial estates; first is by private cars or motorcycles, with companies subsidizing the cost of gas based on commuting distance, and secondly by commuter buses arranged by the company. Each factories within an industrial estate individually charter buses to travel through surrounding residential areas on a specific bus routes to transport their employees to their factory. Since the morning and afternoon commuting time for various factories overlaps with one another, this causes traffic congestions near the gate and in surrounding areas for many industrial estates. Air pollution due to car exhaust has also become a big issue.

2.1.3 Interviews with Thai Industrial Estate Operators

(1) Recent Trends of Japanese Companies Entering Industrial estates

In addition to the downturn in the automotive industry in Thailand due to the stagnation in sales of new vehicles affected by the termination of both the incentive system and tax relief for environmentally-friendly vehicles in October 2013 and 2015 respectively, decline in production and sales in Thai electronic industry in association to reduced demand for vehicle control modules and other associated parts have been observed. The electronic industry in Thailand is also experiencing a downturn due to a decline in sales of personal computers as a result of the rise of smartphones and tablet PCs as an internet browsing device and the associated decline in production of hard disk drive. Moreover, as a result of the military taking control of the authorization for car sales after the coup, sales of used cars have slowed down, leading to a downturn in the entire Thai economy.

Investment in Thailand has lost its advantage for Japanese companies, compared to investing within Japan, due to the depreciated value of Japanese yen against US dollar since 2013. However, there are increase in number of Japanese SMEs with a strategy to expand its production in anticipation to growing demands not only in Thailand but across Asia-Pacific taking up new tenancy in rental factories with

floor space of 500 m^2 or less, utilizing energy-saving utility equipment and receiving affiliated maintenance service due to the reason that the initial investment cost can be reduced. In light of this situation, demand for rental factories which can save on initial investment and running costs by SMEs looking to deploy its business in Thailand is thought to increase further in the future. In order to supply the needs of SMEs for a low-cost small-scale factories, IEAT has determined a policy to provide multilevel factories, and has begun development of a 3~4 stories factories in cooperation with Amata Nakorn Industrial Estate.

In addition, since the Board of Investment in Thailand's (BOI) investment promotion policy based on zones has been terminated last year, there have been a change in location of industrial estates. Since there are no benefits granted for being located in a remote industrial estate, there are increase in companies taking up tenancy in rental factories within industrial estates and in privately owned rental factories outside industrial estates located near the Suvarnabhumi Airport in Bangkok.

On the other hand, major Japanese companies, anticipating the increase of demand in Thailand, as well as other countries in the Asia-Pacific, Middle East and Africa, and establishment of a common market in ASEAN region after 2020, have intensions to expand production in Thailand to meet the aforementioned demand and to establish a hub within ASEAN region. In doing so, there are increase in Japanese major companies seeking sites 10,000 m2 or greater for sale to construct a large-scale factory to enable large-scale production, and cases of logistics companies seeking large site for sale for the construction of large-scale storages to increase the number of distribution base to shorten the delivery distance. As a result, the current state of the entry of Japanese companies into Thailand are polarized.

(2) Status of Restoration in Industrial Estates Damaged by the Flooding

The flooding that occurred in central Thailand in 2011 caused damages in industrial estates located in the region. After the flood, floodwalls have been constructed throughout industrial estates in this region, embankments were built along the highway, drainage system such as drainage pumps were installed, and flooding prevention measures were taken in full.

On the other hand, many new companies deploying businesses in Thailand after the flood and companies affected by the flood have the tendencies to avoid areas prone to flooding, and consequently the demand for industrial estates in eastern and southeastern regions such as Prachinburi province and Rayong province are increasing.

2.2 Current State of Efforts for Eco / Smart Industrial Estate in Thailand

Development of industrial estates gained momentum in Thailand in the 1970s, and as a result of the establishment of IEAT in 1972 and construction of industrial estates by private companies, environmental pollution accompanying the sudden economic development began to raise questions. In industrial estates, hazardous substances in the wastewater and smoke emerged as a social issue.

IEAT conducts monitoring and enforcement of industrial standard for factories in industrial estates under its management and operation. Standards include items related to the environment. Efforts by IEAT include introduction of a drainage standard for industrial estates under their ownership based on the Decree No. 45 issued in 1998.

Furthermore, in order to advance the efforts for eco-industrial estate, IEAT implemented "Eco Industrial Estate & Network Development towards ECO TOWN and Eco-cities" in two phases. In the first phase (2010~2014), IEAT aimed to ① prepare the Eco Industrial Estate Standards, ② prepare the master plan for the eco industrial estate by selecting 15 locations as pilot industrial estates (3 locations per year), ③ along with implementation of the master plan, incorporate the 15 pilot industrial estates into the Eco Industrial Estate & Network Development System, and ④ complete the master plan at 3 locations. In the second phase (2015~2019), IEAT aims to incorporate all of their industrial estates in to the Eco Industrial Estate & Network Development System along with implementation of the master plan.

To create an Eco Industrial Estate, it is required to publicize the industrial estate's development principles, continue to implement environmental measures by establishing an eco-team and eco network, periodically hold eco forums to exchange opinions with the core team consisting of interested parties, and acquire the ISO14001. IEAT have set 5 aspects in 22 areas as the Specification of Standard and Criteria for Eco-Industrial Estate & Network.

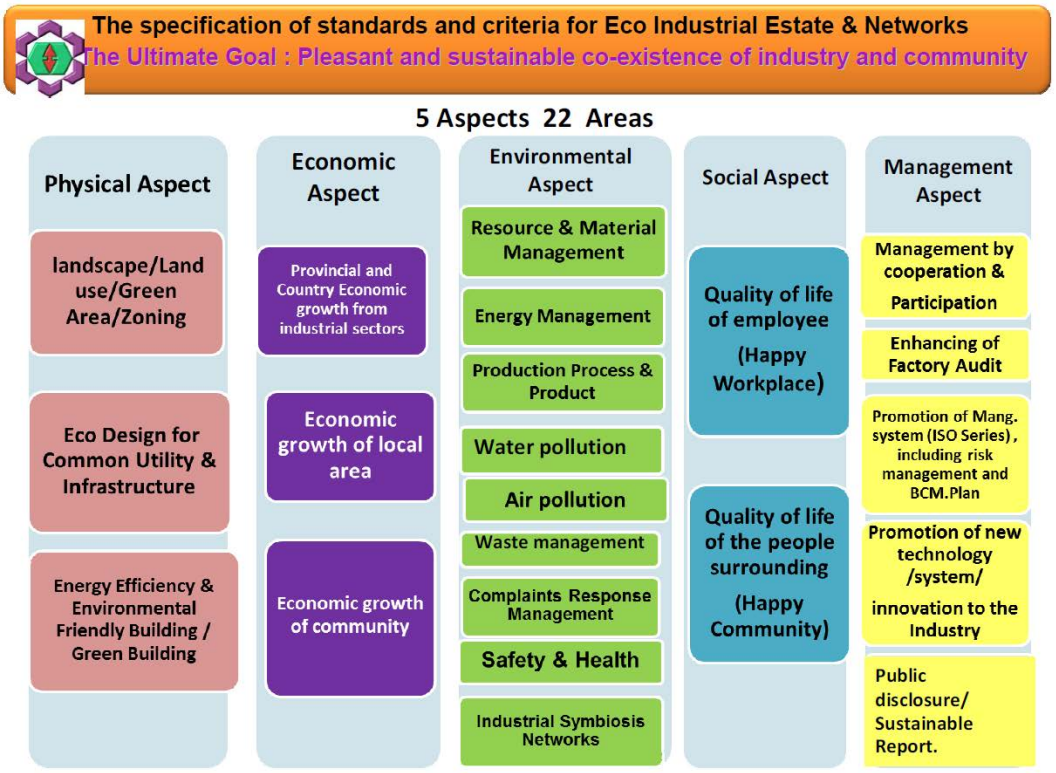


Figure 2-1 Specification of Standard and Criteria for Eco-Industrial Estate & Networks

Source: IEAT, "ECO INDUSTRIAL ESTATE and networks Development towards ECO TOWN and Eco-cities"

Concerning the collaboration with the project, the study team has already received an answer through the interview with Thai Ministry of Industry (MOI) that the project has potential for collaboration as it contributes to adding new value to industrial estate development and is also consistent with the schedule for development of industrial estates. As a result of the interview with IEAT, it was also confirmed that;

the project complies with IEAT's efforts on eco industrial estate, and will be conducted with the cooperation of IEAT.

2.3 Needs for Industrial Estates' Infrastructure Service Focused on Japanese Companies

In this study, interviews were conducted with more than 100 companies, cumulative; mainly with Japanese companies located mainly near Bangkok, confirming the needs for infrastructure service. Infrastructure service here include services such as power (stable supply of power and maintenance of facilities), efficient transportation service etc., which would otherwise require initial investment. The services are characteristic in a way that; longer contract term will result in lower annual fees, while short contract term result in higher annual fees reducing the merit of the services.

In the interviews conducted, as a generic form of business deployment overseas, several cases where medium-sized manufacturing industry produced products that were no longer able to create added value in Japan, using used generic machineries and low labour costs in Thailand were identified.

In these medium-sized manufacturing industries, there are demands to operate at the same level as Japan, and interests for infrastructure services provided at the same quality as Japan were expressed during the interviews.

However, opinions regarding the payment for these services were severe, such as wanting to maintain costs within plus 5% of current infrastructure related expenditures.

For example, some smaller manufacturing industries such as a tenant of rental factories expressed strong needs for the services due to difficulties they faced maintaining utilities and related facilities. Nevertheless as these companies operate factories for first few years of the business on a trial basis, deciding whether to continue operation in the long term depending on the outcome of the trial years, contract term for the services are inevitably kept short, reducing the potential merit of the infrastructure services. Furthermore, rental factories usually require restoration to its original state upon terminating tenancy, potentially constraining the opportunity for long-term provision of the services.

For large companies and large manufacturing industries, depending on manufactured items, some factories were observed to be providing maintenance for utilities in-house, achieving quality management of similar standards to Japan. It can therefore be said that, in manufacturing industries of certain sizes, needs for the infrastructure service is not so high.

2.4 Current Status and Issues on Transportation in Industrial Estates

Field study and interview results on the current status and issues of commuting at major industrial estates in Thailand are summarized in this section.

2.4.1 Interview Results

Main results of interviews with industrial estate operators, tenant companies, and public administrations are summarized in this section.

The characteristics of commuting vary depending on factories, however there are no public transportation at industrial estates and are highly dependent on private commuter bus, van, and cars. At commuting hours these commuter vehicles concentrate and cause traffic congestion around the entrance

to the industrial estates and connecting highways. The number of private cars are increasing annually, and is identified as a cause of congestion.

Secondhand vehicles are used for commuter buses and the impact of exhaust gas to the roadside environment are pointed out as an issue.

(1) Map Ta Phut Industrial Estate

At Map Ta Phut Industrial Estate, the public administration do not consider traffic congestion as a major issue, however several companies have pointed out the congestion at commuting hours an issue.

Method of commuting includes private cars, motorcycles, vans, and commuter buses. Vans and commuter buses are provided by each companies. Large portion of the companies located in Map Ta Phut Industrial Estate are Thai-domestic companies, and consider service expenses of vans and commuter buses including employment of drivers as one of corporate responsibility.

Table 2-1 Interview on Transportation (Map Ta Phut Industrial Estate)

Interviewee	Key Opinions
Private companies	Congestion occurs every morning and evening, and traffic conditions are getting worse every year. There is an impression of traffic being caused not only by the industrial estate, but by various factors such as schools, companies, and government-affiliated.
Map Ta Phut city	The city is aware of traffic congestion, however it is considered as not as bad as in Chonburi. The city has plans to deal with the condition through road improvement. Traffic signals on highways are controlled by the Rayong Highway District, city roads by the Map Ta Phut city, and roads within the industrial estate are under the jurisdiction of IEAT. Traffic signals at intersections are controlled manually during traffic congestion, and only let one out of four directions through at a time, emphasizing on the safety. At Map Ta Phut city, the priority of the transportation issue is relatively low compare to others.

(2) Other Industrial Estates

According to expatriate staffs of Japanese companies in Thailand, the gates of Nava Nakorn Industrial Estate are concentrated around national road no.1, and there are daily congestion caused by commuters. Japanese companies located in Rojana Ayutthaya Industrial Park have 150 commuter buses operating, and pointed out commuter buses operated by many companies as one of the factor causing traffic congestion.

According to a Japanese company located in TPARK, a logistics park in suburban Bangkok, one of the important challenges faced when locating their factory in Thailand is securing commuting method, and the cost burden of transportation by vans is acknowledged as an issue.

Table 2-2 Interview on Transportation (other industrial estates)

Interviewee	Key Opinions
Private company (Rojana Ayutthaya IP)	Each companies operate transportation service by large buses, and employees commuting by a private car or a motorcycle are given gas allowance. There are traffic congestions in the morning and afternoon when buses and trucks concentrate. There are some large companies that operate 150 buses on their own.
Private company (TICON Industrial Estate)	Security of transportation method is a major issue for its location, commuting cost are relatively high, and there are cases where one employees commuting cost reach 3,500 THB per month. Due to the increase of private cars, companies lack the number of parking lots.

2.4.2 Field Study Results

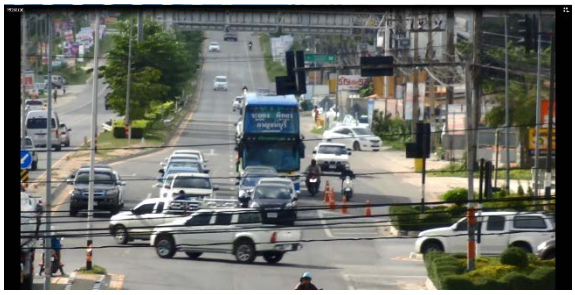
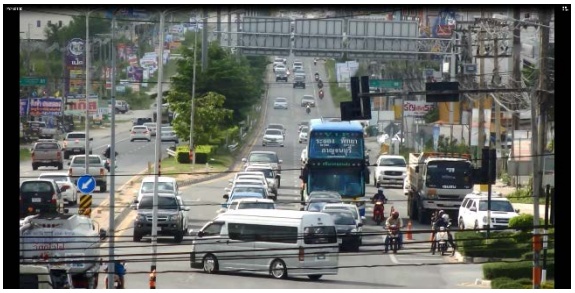
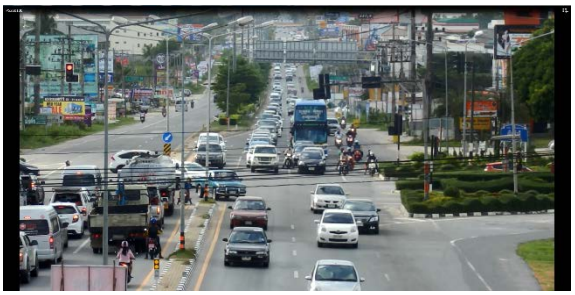
The field study has been conducted at Map Ta Phut Industrial Estate and Amata Nakorn Industrial Estate where company interviews for the project concentrated.

The confirmation results of transportation status around the industrial estate are organized below.

(1) Map Ta Phut Industrial Estate

The number of cars and motorcycles in the area surrounding the Map Ta Phut Industrial Estate is extremely high. However, as indicated in the following table, the traffic signals allows traffics to flow only in one direction for a long period of time, and it is noticeable that cars pile up at red lights. It is surmised that the flow of traffic between the signal indications is not facilitated well as the traffic signal is controlled manually.

Table 2-3 Transition of Vehicles Waiting at Traffic Signal

① Immediately after the red signal	② Waiting at a red signal 1
	
Approximately 10 vehicles are waiting	Recognizable that vehicles are gradually piling up in the back
③ Waiting at a red signal 2	④ Waiting at a red signal 3
	
Waiting line is building with vehicles approaching from the back	Waiting line has been built all way to the end

(2) Amata Nakorn Industrial Estate

Amata Nakorn Industrial Estate is an extremely vast industrial estate with many gateways. It is surmised that, vehicles entering and exiting the industrial estate joins the same main road which also accommodates numerous private passenger vehicles, and as a result causing traffic congestion.

Figure 2-2 Traffic Around the Amata Nakorn Industrial Estate

(3) Rojana Ayutthaya Industrial Park

The gate to the industrial estate generates a bottleneck, causing congestions of commuter buses.

Figure 2-3 View of the Target Area

2.4.3 Current Status and Issues on Traffic Conditions

In summary, the current status and issues of traffic conditions at industrial estates in Thailand can be organized as follows.

(1) Commuting

Due to the growing car-oriented culture, the number of commuters commuting by a car is increasing year on year.

- Traffic concentrates in the morning and the afternoon commuting hours due to numerous small-scale vans and commuter buses.
- Since there are no public transportations around industrial estates, commuters rely on private cars, buses and motorcycles.
- Due to the high number of cars, roadside air conditions are not very good, and it is surmised that old buses with bad fuel efficiency emits large amount of CO_2.
- Commuting cost borne by factories are relatively high, and has room for reduction.

(2) Road Traffic Status

- Traffic volume exceeding the capacity is accommodated by vehicles running on roadside strips however, traffic congestion occurs near the intersections of main roads.
- At some industrial estates, time required to pass an intersection are prolonged due to traffic signal only allowing traffics from one direction to pass for a long period of time.

2.5 Current Status and Issues on Human Resource Development

The transition of vocational education in Thailand are as follows.

- 1898: Introduced as an education system of Thailand, and targeted particular occupations such as handicrafts.
- 1909: Education system in Thailand was divided into two: a formal education consisting of basic education, and non-formal education specializing on occupations such as medical, arithmetic, English, and commerce etc.

- 1936: Non-formal education established as a vocational education
- 1938: Education Bureau and Academic Research Bureau were established in the Ministry of Education (MOE), and vocational education was managed by the Academic Research Bureau.
- 1941: Academic Research Bureau was disestablished and the Vocational Education Bureau was established.

Organizational support from foreign governments and international organizations are as follows.

- 1965: Established the Khonkaen Technical Junior College with the aid from Germany in Kohnkaen province.
- 1967: Vocational Education Bureau opened the World Bank Finance Office.
- 1969: Established a technical junior college in Chonburi province with the aid from Australia.
- 1989~90: Completion of Technical Normal University with the aid from United Nations Development Program.

Since, United Nations Development Programme (UNDP), International Labor Organization (ILO), United Nations Educational Scientific and Cultural Organization (UNESCO), and various countries such as Denmark, Germany, Australia, Japan, Canada, and Italy provided assistance for vocational technical education in Thailand.

In 2003, Vocational Education Bureau was promoted to the Office of the Vocational Education Commission, and took responsibility of monitoring the development of program planning and vocational training system. Currently, there are over 400 vocational education organization authorized by the commission, and the breakdown is as follows.

Technical Junior College：109 colleges
Vocational Education Junior College：36 colleges
Agricultural Technical Junior College：44 colleges
Artisan Training Junior College：54 colleges
Vocational Junior College：144 colleges
Commercial Junior College：5 colleges
Industrial Shipbuilding Technical Junior College：3 colleges
Industrial Art Junior College：2 colleges
Management and Tourism Junior College：3 colleges
Fishery Junior College：3 colleges
Brass Artisan Junior College：1 college

Japan has provided assistance in industrial human resource development in Thailand in various industrial fields through Japan International Cooperation Agency (JICA), and Overseas Human Resources and Industry Development Association (HIDA: established by the merger of Association for Overseas Technical Scholarship [AOTS] and Japan Overseas Development Corporation [JODC] in 2012).

Assistance provided by JICA includes support for establishment, acceptance of trainees, and dispatch of experts to the Metal Work Machine Industrial Development Research Institute in 1999, the energy management-training center in 2005, and Automobile Institute in 2011.

In addition, the Japanese Ministry of Economy, Trade and Industry (METI) and HIDA have been the focal point for continued effort on establishment of an industrial human resources development organization. In 1973, Technology Promotion Association (Thailand-Japan) (TPA) to provide independently, industrial human resource development was established as a Thai counterpart of Japan-Thailand Economic Cooperation Society (JTECS), providing services such as training and seminars, Japanese-language education, publication of technical specifications and technical information magazine. In 2007, Thai-Nichi Institute of Technology (TNI) was also established.

In addition to above mentioned efforts by Japanese government, private companies have also provided various educational program in cooperation with local educational organizations and universities to provide capacity building for the local employees.

Toyota Motors started educational support and technology transfer in 1973, co-founded the automobile engineering division in the engineering department at Chulalongkorn University, and donated an experimental laboratory. In 1998, the Toyota Motor Technical School was established, and provided technical programs such as automobile engineering, auto body repair, and spray painting, and also educational equipment and engines in cooperation with the Ministry of Education. Toyota Motors also provide assistance to Chulapron Engineering College, Krikangwon Vocational Junior College, Pradobos School, etc.

Honda Motors have also provided assistance in 1999 for the establishment of Automobile Engineering Technical Junior College in Ayutthaya, and provided the land, building and infrastructures. The two-year curriculums include mechatronics, automobile manufacturing, welding, industrial technology, manufacturing technology, and electronics.

The Yokohama Rubber established a tire service training center in Rayong province in 2011, and Toyota Tsusho established a safe-driving education center in Chachoengsao province in 2013, and Mitsubishi Materials established an engineering center (metal cutting tool test and educational facility) in the Amata Nakorn Industrial Estate.

Through these efforts on industrial human resource development by local Japanese companies described above, and the interview results of each industrial estate operators and factory representatives conducted at the field study for the project, it can be concluded that even though the recruitment of highly-skilled engineers are desired by the Japanese companies advancing locally, recruiting activities is not enough to secure human resource with a certain level of capacity.

According to the 2013 Wage Labor Status Survey of the Japanese Chamber of Commerce Bangkok, initial salary for the industrial human resource by academic background are indicated in Table 2-4 below. As it can be seen from the table, there are no significant difference in initial salary between graduates of upper secondary school, technical colleges, and vocational training graduate (technical junior college). Recruitment is difficult due to combination of the relatively low social standing of engineers and the low unemployment (under 1%) due to the strong economy.

On that regard, each companies are driven by necessity to educate the recruited human resource to increase the number of highly-skilled engineers.

Furthermore, even if companies educate skilled engineers at their expenses, due to the chronic lack of skilled human resources, employees repeat career changes to companies offering better conditions. The increase of job-hopping has become a major issue.

As described above, vocational education systems have been developed through domestic and foreign assistance in Thailand, and currently efforts for the development of industrial human resource are led by private companies as well as by public administrations. However, there is a lack of highly-skilled engineers to meet the demand in Thailand's rapidly growing industrial field, and the rampant job-hopping due to the strong seller's market of skilled engineers has become a hindrance to the cost of human resource development in each companies.

Table 2-4 Initial salary for Industrial Human Resource by Academic Background

Academic Background	Initial Salary
Upper Secondary School	10,200 THB
Technical College (Worker)	10,500 THB
Technical College (Technical)	10,800 THB
Technical Junior College (Technical)	12,380 THB
University degree (Technical)	17,600 THB

Source: The Japanese Chamber of Commerce, Bangkok "2013 Actual Conditions Survey of Wage and Labor"

2.6 Conformity with the Japanese Assistance Policy and JICA Project Implementation Policy

In the "Country Assistance Policy for the Kingdom of Thailand" prepared by the government of Japan in 2012, "promotion of mutual benefit and contribution to regional development based on strategic partnership" is held as the basic policy for assistance. The "sustainable development of economy and coping with maturing society" is pointed out as one of the priory areas of the "Country Assistance Policy". Cooperation aims to undertake issues such as environment and climate change by utilizing Japanese knowledge and experiences, and the project is in accordance with our country's policy and direction.

The project will consider not only Thailand but future development as a pilot project in the ASEAN regions. It is note in the aforementioned "Country Assistance Policy" that the "ODA for Thailand is expected to be a model for development cooperation for upper-middle income countries and its outcome is aimed at utilization and cooperation in other countries such as those in the ASEAN Region". In this regard, the project is in conformity to the "Country Assistance Policy".

In addition, interview with the Japanese Embassy in Thailand was conducted to confirm conformity with the efforts of local Japanese government agencies. It was also confirmed to investigate the possibilities of cooperation on SMEs assistance.

One of the activities conducted by Japan External Trade Organization (JETRO) Bangkok Office is the technical cooperation project in the environmental technology and energy conservation field. The project is considered to comply with the activity policy of JETRO Bangkok Office. Appropriate cooperation with JETRO Bangkok Office will be pursued for the promotion of the project.

HIDA Bangkok Office implemented the "low carbon technology transfer promotion human resource development business" in 2014, for human resource development of maintenance management such as energy infrastructure, and also accepts trainees from Japan. The project also complies with the policies of HIDA Bangkok Office, and will pursue information sharing and partnership.

HIDA aims to contribute to the country's economic development by transferring technology to developing countries, and operates acceptance of trainees and dispatch experts for training. This system is not only utilized by major companies in automobile, electric and electronic industries with their own human resource development, but is also widely utilized by SMEs, such as metallic mold companies. HIDA Thai Office has close to 20 years of history from 1997, including the history as AOTS.

Acceptance of trainees are conducted in Japan, by inviting workers recruited by Japanese companies deployed overseas to Japan for training, and also provides assistance on funds and issuance of visas. In addition to the fundamentals such as Japanese-language education, understandings of Japanese society and culture, and political concerns on low carbon (etc.), HIDA also provides "technical training programs" for engineers on Japanese manufacturing and service technology, and "management training programs" for managers on business management, factory management and environmental response. There are 20~30 training programs, and the curriculums and educational materials are prepared by the instructor each time in cooperation with each company. HIDA also provides interpreters as necessary to provide English training and local language training.

Dispatch of experts are conducted on the initiative of the company, who dispatch employees from the Japanese headquarter to the local company. It is utilized to increase production and for quality improvement.

Currently, there are two streams of budget; one utilizes the existing ODA program and the other utilizes the "low carbon technology transfer promotion human resource training program" implemented last year. Taking the movement of the current administration to proceed with infrastructure export (including maintenance management) to promote overseas deployment, targets the human resource development for maintenance management of energy infrastructure, and also the human resource development for energy saving production. Energy saving production is a process to increase productivity by reducing the rate of excess and defective goods, which results in energy-saving. Specifically, giving instructions to improve quality and reexamination of the process, such as cutting a 10 step process to 8 steps.

Last year, there were approximately 800 trainees who came from Thailand to Japan, amongst those trainees approximately 300~400 trainees utilized the low carbon program. Also, approximates 50 experts have been dispatched to Thailand, amongst those 10~15 experts were of the low carbon program.

If this proposal is specifically targeted to Thailand, there has been a suggestion to pursue the possibilities of cooperation with JTECS, TPA, TNI, etc.

This may be positioned to complement the conventional training business and expert dispatch with physical and financial constraints. Also, there are many factors obtained by actual training and expert dispatch, e-learning specializes in the part implemented and may be possible to achieve synergistic effect. Furthermore, more the e-learning student increases, the more will the students want to learn deeply and widely, and therefore can prospect more demand for application of the training. In that regard, the project may be able to expand the synergistic effect by the cooperation with the conventional training and expert dispatch businesses.

3 Current Status of the Project Site and Surrounding Areas

3.1 Current Status of the Project Site and Surrounding Areas

3.1.1 Project Site Selection Process

In selecting industrial estates for the project, six provinces with more than five industrial estates were selected from the 23 provinces with industrial estates. Amongst these, Bangkok and Saraburi provinces were eliminated based on the lack of clients listed by the study team member companies, leaving Chonburi, Rayong, Ayutthaya, and Prachinburi provinces to be selected.

Selection criteria for industrial estates were set as follows:

① Industrial estate with numerous Japanese SMEs as tenants
② Industrial estate with numerous clients listed by the study team member companies
③ Industrial estate with a Japanese company as a part of the developer in joint venture

Industrial estates with tenant companies participating in workshops and questionnaires during the study were selected.

3.1.2 Industrial Estates in Chonburi Province

Chonburi province is located in southeastern Thailand approximately 80km southeast of Bangkok, and approximately 50km from the Laem Chabang deep-sea port, and forms eastern coastal industrial zone along with Rayong province. Located within commuting distance of Bangkok, and closer to Bangkok than Rayong province, Chonburi province is attracting interests of many foreign companies, including Japanese companies. There are 8 industrial estate and parks in Chonburi province, including Laem Chabang Industrial Estate, Amata Nakorn Industrial Estate, Pinthong Industrial Estate, and Eastern Seaboard Industrial Estate, and there are wide range of manufacturers such as automobile, home electronics, electric, chemical, food, etc. located in this area. Chonburi province has the second largest Japanese community in Thailand called Sri Racha where Japanese schools, preschool, hospital, Japanese restaurants, hotels, serviced apartments, trading firms have been developed by the deployment of Japanese companies to the surrounding industrial areas, and has grown as a Japanese residential district convenient for Japanese expatriates to reside. On the other hand, this region is avoided by manufacturer of potable water due to water shortage in the dry season.

Amata Nakorn Industrial Estate and Pinthong Industrial Estate was selected as a candidate for the survey in Chonburi province.

Amata Nakorn Industrial Estate is an industrial estate developed in 1989 by Amata Corporation Public Company (2.34% stake held by ITOCHU Corporation). Wide range of manufacturers such as automobile, home electronics, electric, chemical, food, etc. are located in this industrial estate. There are 600 tenant companies, approximately 65% of which are Japanese.

The infrastructures within the industrial estate are maintained at high standards. Electricity can either be supplied by the Small Power Producer (SPP) established within the industrial estate, which uses

natural gas-fueled thermal power generator, and also by Provincial Electricity Authority (PEA), therefore tenants are able to expect the stable supply of electricity.

Amata Nakorn Industrial Estate has been selected as a project site as it is occupied by numerous Japanese manufacturers, and as the smart service company established under the project is planned to be located in Bangkok, its proximity to Bangkok allows high accessibility for the O&M Services, anticipating high convenience for the Energy Service, the Energy Conservation and O&M Services. Pinthong Industrial Estate developed in 1995 by Pinthong Group and IEAT is occupied by wide range of manufacturers centered on auto and electronic parts. There are approximately 200 companies located in this industrial estate, and approximately 70% are Japanese companies.

Infrastructures within the industrial estate is maintained at high standard, and has well-developed public facilities by the cooperation of IEAT.

Pinthong Industrial Estate has been selected as a project site as it is occupied by numerous Japanese manufacturers, located at commuting distance from Bangkok where the smart service company is planned to be located and therefore highly accessible for the O&M, anticipating high convenience for the Energy Service, the Energy Conservation and O&M Services.

3.1.3 Industrial Estates in Rayong Province

Rayong province is an industrial province with 15 industrial estates and parks developed based on the Eastern Coastal Development Plan. Map Ta Phut Industrial Estate and IRPC Industrial Park located in the coastal area are focused in heavy chemical industry, and Amata City Industrial Estate and Eastern Seaboard Industrial Estate located inland are focused in manufacturing such as auto parts. Rayong province is located near the Laem Chabang deep-sea port and major infrastructural facilities. It is also close to Sri Racha, and many foreign companies including Japanese companies are located in industrial estates in Rayong province. Demands to relocate to Rayong province by companies affected by the flood in 2011 are also high. On the other hand, the region is avoided by manufacturer of potable water due to water shortage in the dry season.

Amongst the industrial estates located in this province, Rojana Rayong Industrial Park and Map Ta Phut Industrial Complex were selected as a candidate for the study.

Rojana Rayong Industrial Estate was developed in 1995 by a joint venture between Vinichbutr Group and NIPPON STEEL & SUMIKIN BUSSAN CORPORATION. Rojana Rayong is a compact industrial estate with 25 tenant companies. Tenants mainly consist of manufacturers of automobile, electronics, chemical and textile products and approximately 70% of tenants are Japanese companies.

This industrial estate has been selected as a target industrial estate, as there are Japanese tenants, and as market potential is anticipated for the Energy Service and Energy Conservation and O&M Services under the project.

Map Ta Phut Industrial Complex consists of 5 industrial estates; 1) Map Ta Phut Industrial Estate established by IEAT in 1988 as an industrial estate for heavy chemical industry; 2) Hemaraj Eastern Industrial Estate developed by Hemaraj Land And Development Public Company Limited in 1990, forming a cluster for automotive industry; 3) Hemaraj R.I.L Industrial Estates developed by RIL 1996 Company Limited in 1989; 4) Pha Daeng Industrial Estate developed by Pha Daeng Properties Company

Limited in 1994; and 5) Asia Industrial Estate developed in 2000 by City Reality Co., Ltd and Sophonpanich family in partnership with IEAT, with main tenants from heavy industry and chemical manufacturers . The industrial zone is occupied by heavy chemical industry, auto parts, electric, and electronic related manufacturers, many of which are foreign companies including Japanese companies. Infrastructures within the industrial zone are maintained at high standard, with thermal power station fueled by natural gas providing stable power supply.

Map Ta Phut Industrial Complex has been selected as a target site, as the estates have numerous Japanese tenants, and as market potential for the Energy Service, the Energy Conservation and O&M Service and the Smart Services can be anticipated.

3.1.4 Ayutthaya Province

Ayutthaya province is located in central Thailand approximately 70 km north of Bangkok, and 90 km from the Suvarnabhumi International Airport. Although Ayutthaya province is over 100 km away from major ports and airports, it falls within commuting distance from Bangkok and is attracting interests from Japanese companies considering business deployment in Thailand. There are 7 industrial estates and parks located in Ayutthaya province, including Rojana Ayutthaya Industrial Park, Bang Pa-in Industrial Estate, Hi-Tech Kabin Industrial Estate, with wide range of industries such as auto parts, electric, electronic, precision products, food etc. Ayutthaya is located midstream of Chao Phraya River, and industrial estates in this region were affected by the flood in 2011. Floodwalls have since been constructed throughout the disaster-stricken industrial estates, embankments of highways and surrounding roads have been raised, drainage pumps have been installed, and countermeasures against flood damage in the future has been taken in full.

Amongst the industrial estates located in Ayutthaya province, Rojana Ayutthaya Industrial Park has been selected for the study.

Rojana Ayutthaya Industrial Park was developed in 1988 by a joint venture between Vinichbutr Group and NIPPON STEEL & SUMIKIN BUSSAN CORPORATION. Wide range of industries such as auto parts, electric, precision products, food, etc. have been located in Rojana Ayutthaya Industrial Park. There are approximately 200 companies located in this Rojana Ayutthaya Industrial Park, 50% of which are Japanese companies. Infrastructures within the industrial estate are maintained at high standards, including a thermal power station fueled by natural gas. Plan for solar power plant is also under progress.

Rojana Ayutthaya Industrial Park was originally anticipated as a potential beneficiary of the Energy Service due to its high occupancy by Japanese manufacturers and proximity to Bangkok where the service company is planned to be located, allowing easy access for the O&M however, it was found that, the Energy Service and the Energy Conservation and O&M Service were not needed in this area as factories had recently renewed utilities damaged by the flooding in 2011.

3.1.5 Prachinburi Province

Prachinburi province located in central Thailand is approximately 120 km east of Bangkok and 130 km away from the Laem Chabang deep-sea port. Route 304 which connects Thailand-Laos-Vietnam runs through this province which is known to have relatively easy access. The fact that Prachinburi

province, unlike the northern Ayutthaya area, is located in high altitude and has low risk of natural hazards flooding, and that it is relatively close to Isan, northeastern Thailand where it is said to be relatively easy to secure workers are great advantages for the location of industrial estates. For this reason, Prachinburi province is one of the areas with high potentials for the development of industrial estates in the future.

Amongst industrial estates located in Prachinburi province, Rojana Prachinburi Industrial Park and 304 Industrial Park have been selected for the study.

Rojana Prachinburi Industrial Park was developed in 2013 by a joint venture between Vinichbutr Group and NIPPON STEEL & SUMIKIN BUSSAN CORPORATION. Occupancy by an automobile factory (Honda Motors' second factory is currently under construction), and distribution warehouse have been decided however, there are land parcels still for sale. Infrastructures within the industrial estate are maintained at high standards.

Since the occupancy by Honda Motors' second factory has been decided, occupancy by supplementary factories such as Japanese auto part manufacturers were expected however, the industrial park was filled mainly by distribution warehouses with limited number of manufactures designed to benefit from the Energy Service and the Energy Conservation and O&M Service. For this reason, Rojana Prachinburi Industrial Park has been determined as an unsuitable target for the project.

304 Industrial Park was developed by Soon Hua Seng Group in 1994. Auto part, electric and electronic industries occupy this industrial park. There are approximately 110 companies in the industrial park, amongst which approximately 45% are Japanese companies. Infrastructures within the industrial park are developed, in particular there is a 300MW coal and biomass-fueled combined thermal power plant and a 106MW biomass-fueled thermal power plant capable of supplying stable power to all the factories within the industrial park.

304 Industrial Park is occupied by many large scale Japanese factories capable of procuring and maintaining utility equipment, and therefore not requiring the Energy Service nor the Energy Conservation and O&M Service offered by the project. 304 Industrial Park has therefore been determined to be unsuitable for the project.

Table 3-1 indicates the distance from central Bangkok, major airports and ports, and Figure 3-1 indicates the location of industrial estates considered above as a candidate site for the project.

Table 3-1 Distance to main facilities

No.	Main Facilities Names of IE or IP	Central Bangkok	Suvarnabhumi Int'l Airport	Don Mueang Airport	Laem Chabang Deep sea-port	Map Ta Phut Deep sea-port
1	Amata Nakorn IE	57 km	42 km	85 km	40 km	96 km
2	Pinthong IE	95 km	65 km	100 km	12 km	50 km
3	Rojana Rayong IP	140 km	120 km	140 km	65 km	32 km
4	Map Ta Phut Industrial Complex	140 km	115 km	120 km	50 km	3 km
5	Rojana Ayutthaya IP	69 km	90 km	43 km	145 km	190 km
6	Rojana Prachinburi IP	140 km	115 km	100 km	130 km	133 km
7	304 IP	100 km	80 km	93 km	105 km	135 km

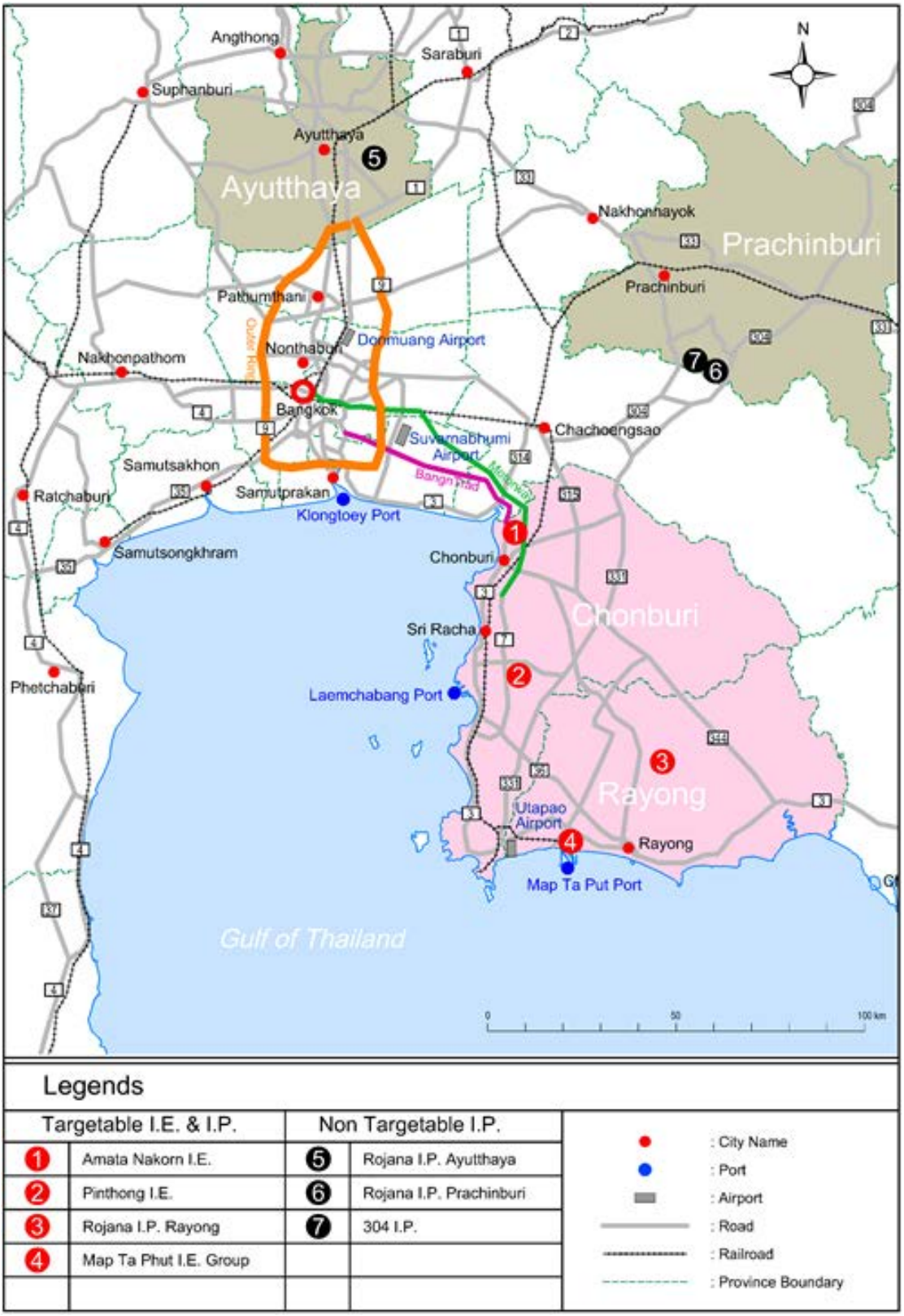


Figure 3-1 Locations of Industrial Estates and Parks and Major Facilities

3.2 Current Status of Infrastructures within and Surrounding Industrial Estates

This section describes the information on current status of infrastructure development in and around the industrial estates obtained from interviews with industrial estate operators during the field study of the four sites; Amata Nakorn Industrial Estate and Pinthong Industrial Estate in Chonburi province and Rojana Rayong Industrial Park and Map Ta Phut Industrial Complex in Rayong, chosen as the target industrial estates for the project in the previous section.

3.2.1 Amata Nakorn Industrial Estate

Amata Nakorn Industrial Estate is a private industrial estate developed in cooperation with IEAT. 26 years have passed since the development, during which basic industrial infrastructure including electricity supply, water supply network, drainage system, telecommunication system, wastewater treatment facility, road network, logistics, etc. have been developed, maintaining high standard. In particular, electricity is supplied by both PEA and the 332 MW SPP (Amata power plant) within the industrial estate, and maintains a stable supply of power.

In order to enhance the convenience for tenant companies, Amata Nakorn Industrial Estate is considering the development of an information communication environment (Wi-Fi) within the industrial estate, and mitigation measures for the traffic congestion that occurs every morning and afternoon on employees' commuting hours on roads within and around the industrial estate are also under consideration.

Amata Nakorn Industrial Estate has a good road networks with main highways, motorways, national roads, etc. leading to eastern Bangkok, and are easily accessible from major ports and airports, as well as to the surrounding major industrial estates and parks where many automobile-related companies and electronic industries are located.

3.2.2 Pinthong Industrial Estate

Pinthong Industrial Estate is a private industrial estate developed in cooperation with IEAT. 20 years have passed since the establishment and along the way have developed basic industrial infrastructures, such as power supply, water supply network, drainage system, telecommunication system, wastewater treatment facility, road network, logistics, etc. at a high standard.

Old parts of the power distribution network are continually-replaced to mitigate transmission losses. Although SPP is not implemented due to low profitability, it is under consideration as a measures to secure a more stable power supply for the rise in demand in the future. The traffic congestion that occurs at the morning and afternoon commute of employees within and around the industrial estate has not been identified as too much of an issue.

Pinthong Industrial Estate has a good road network to major ports, airports, and industrial estates being located in the center of the Eastern Seaboard Industrial Estate complex, and is under favorable conditions for transportation of manufactured goods, raw materials, etc. Especially, Pinthong Industrial Estate is located along route 331, making it a highly strategic location for automobile industries and electronic industries, endowed with well-developed infrastructures.

3.2.3 Rojana Industrial Park Public Co. Ltd. / Rayong

Rojana Industrial Park was established 20 years ago by a private company, and has since developed power supply, water supply network, drainage system, telecommunication system, wastewater treatment facility, road network, logistics, etc., and is fully-equipped with basic industrial infrastructures of high standard. The traffic congestion that occurs at the morning and afternoon commute of employees within and around the industrial estate has not been identified as too much of an issue.

Rojana Industrial Park has a good road network with highways to Bangkok and national roads, and has good access to major ports, airports and surrounding industrial estates, agglomerated by automobile and electronic industries.

3.2.4 Map Ta Phut Industrial Complex

Map Ta Phut Industrial Complex consists of five industrial estates and a port. Map Ta Phut Industrial Estate was developed by IEAT, whereas Hemaraj Eastern Industrial Estate, Pha Daeng Industrial Estate, and Asia Industrial Estate, and Hemaraj R.I.L Industrial Estates were developed by private companies under the jurisdiction of the IEAT.

Map Ta Phut Industrial Complex is the center of the Eastern Seaboard Development Program implemented in 1981, and is an old industrial estate complex with its history of development second to the Bangkok urban area. For the past 27 years, it has been developed as the center of industrialization in Thailand, and receiving large amount of investments for the development of industrial infrastructures, such as large capacity power supply, water supply network, drainage system, telecommunication system, wastewater treatment facility, natural gas, steam, road network, etc. Infrastructure within industrial estates have been maintained at high standards, maintaining stable supply. Electricity is provided by more than one SPP and local Independent Power Producer (IPP); and there is few momentary power outage. Additionally, transportation of products and low material in this complex has a high level of convenience due to railway in the complex.

Since Map Ta Phut Industrial Complex is occupied by many heavy chemical factories and few assembly factories, number of workers is low, and thus the morning and afternoon traffic congestion has not been identified as much of an issue. However, Map Ta Phut city government recognize the occurrence of traffic congestion on surrounding roads due to increase in the number of private cars, and seeks to respond by improvement of roads.

Similar to Japan, Map Ta Phut Industrial Complex has a history of heavy pollution which led to interrupting a development project. In recent years, efforts for the “Eco industrial estate, Eco Industrial Town” concept has been practiced at Map Ta Phut Industrial Complex and IRPC Industrial Park to overcome this situation. This situation is a big plus factor for the project since it can stimulate demand for energy-saving technology and environmental technology of Japan. Furthermore, Kitakyushu-city, one of the cooperating organization of this study, has signed the Memorandum of Understanding (MOU) with IEAT and Development of Industrial Works (DIW) to promote “Eco industrial estate, Eco Industrial Town” concept in Rayong province. High interests for Japanese cooperation allowed understanding and cooperation for the project to be easily acquired.

Since Map Ta Phut Industrial Complex have been developed as the industrial center of Thailand, road networks to main ports, airport, and major industrial estates are well-developed. Moreover, a branch of the Eastern Line Railroad from Krunthep Station to Aranyaprathet Station connects the Map Ta Phut port operating freight trains.

The following table indicates the site area and scale of on-site infrastructures for the 4 industrial estates targeted for the Energy Service.

Table 3-2 Details of the On-site Infrastructures

No.	Industrial Estate	Developed area (ha)	Infrastructure					
			Power Supply	Natural gas/Steam	Telephone	Industrial Water Supply	Wastewater	Road
1	Amata Nakorn Industrial Estate	2,652	On-site PEA substation: 22kV Amata Power Plant (Capacity 332MW): 22kV	Supplied from Amata National Gas Distribution/Supplied from Amata Power Plant	Supplied by TOT AND TT & T	Treatment facility: 44,000 m^3/day Fee: 9 THB/m^3 (PWA)	Treatment facility: 20,000m^3/day	Highway: 6-lanes road (width 48 m) Auxiliary lane: 4-lanes (width 32 m)
2	Pinthong Industrial Estate	640	On-site PEA substation: 22kV Supply capacity: 50MW	—	Supplied by TOT AND TT & T	Reservoir: 380,000 m^3 Water supply capacity: 450 m^3/day	Activated Sludge system: 2,000 m^3/day Extended capacity: 2,400 m^3/day	Highway: 4-lane road (width 30 m~40 m) Auxiliary lane: 4-lane road (width 24 m)
3	Rojana Industrial Park PCL Rayong	380	On-site PEA substation: 22kV	Supply optional	Supplied by TOT	Treatment facility: 30,000 m^3/day	Treatment facility: 24,000 m^3/day	
4	Map Ta Phut Industrial Complex	1,634	PEA: 80MW, 115kV converted and supplied at 22kV BLCP (Capacity 1346 MW)	Supplied from BLCP	Supplied by TOT	Treatment facility: 15,300 m^3/day	Activated Sludge system: 4,000 m^3/day	Highway: 4-lane road (width 40 m) Auxiliary lane: 2-lane road (width 22 m)

Key: BLCP: BLCP Power Limited Company, PEA: Provincial Electricity Authority, PWA: Provincial Waterworks Authority, TOT: Thai state-owned Telecommunications Company Limited, TT & T: Thai Telephone & Telecommunication Public Co. Ltd.

3.2.5 Traffic Volume of the main road around Map Ta Phut Industrial Complex

As the basic data for consideration towards realization of smart community industrial estate in the transportation aspect, the traffic volume of the main road around Map Ta Phut Industrial Estate, where

efforts for the “Eco industrial estate, Eco Industrial Town” concept by IEAT has been practiced as mentioned in 4-1-2, has been organized below as an example.

The data on traffic volume for 24 hours in 2011 and 2015 has been organized based on the data received from Map Ta Phut city police.

(1) Target Section

The traffic volume has been organized for the area around Map Ta Phut Industrial Estate based on the study periodically conducted by the Map Ta Phut city police.

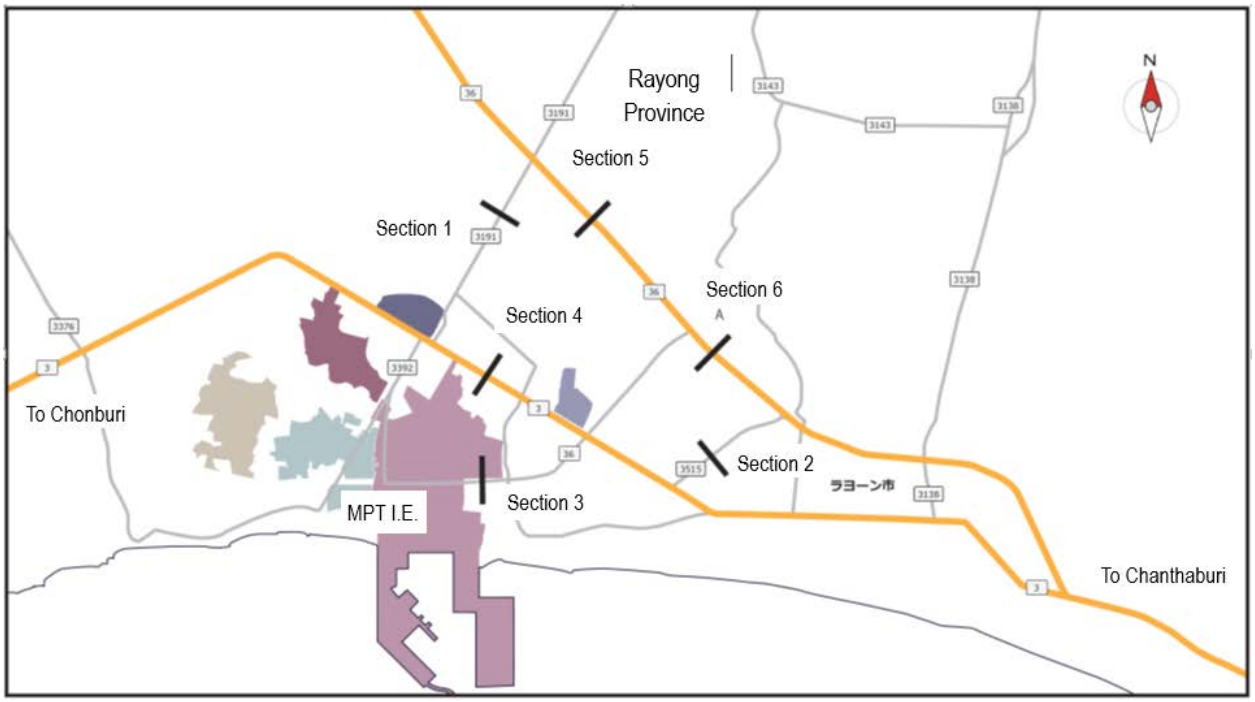


Figure 3-2 Map of Target Sections

(2) Road Structure

Table 3-3 shows the road structure of each target section. It should be noted here that, when there is enough space on a side strip, the side strip is often used as another lane.

Table 3-3 Road Structure (Section 1~6)

Road Section	Route	Number of lanes		
Section 1	3191	One side: 3 lanes Both sides: 6 lanes		
Section 2	3515	One side: 2 lanes Both sides: 4 lanes		
Section 3	36	One side: 2 lanes Both sides: 4 lanes		
Section 4	3	One side: 2 lanes Both sides: 4 lanes		
Section 5	36	One side: 2 lanes Both sides: 4 lanes		
Section 6	36	One side: 2 lanes Both sides: 4 lanes		

※Pictures are cited from Google Street View

(3) Traffic Volume

1) Sectional Traffic Volume

The following diagrams show the traffic volume in 2011 and 2015 respectively. Each of the values indicated are the sum of the traffic volume studied for 12 hours.

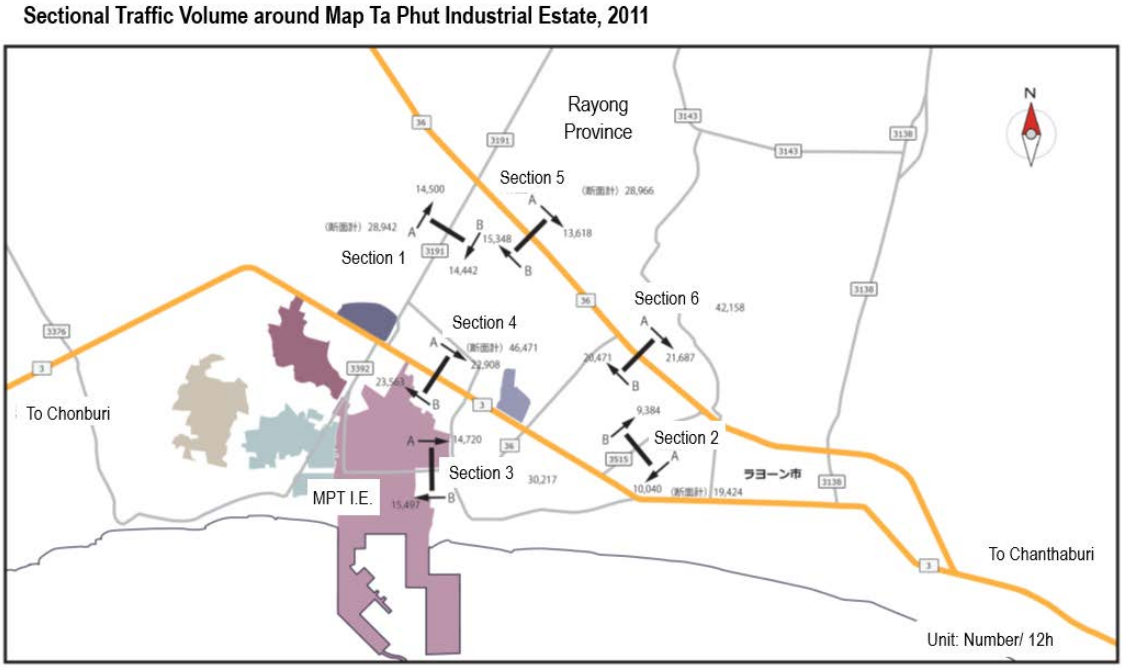


Figure 3-3 Sectional Traffic Volume (on 27th July, 2011)

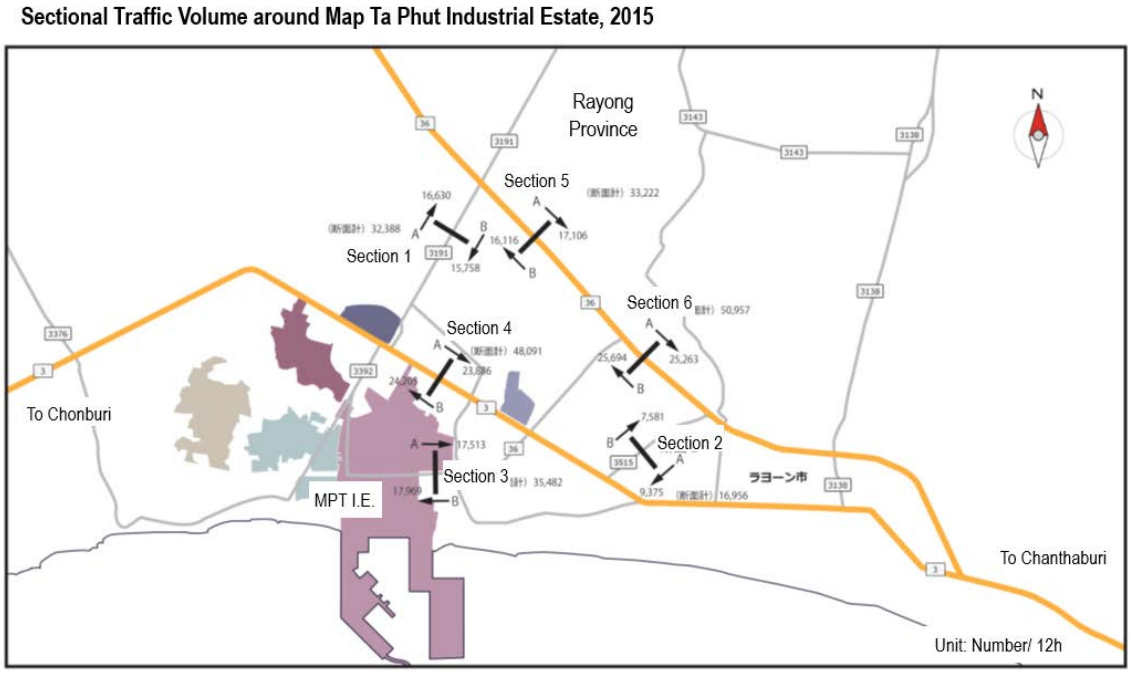


Figure 3-4 Sectional Traffic Volume (on 22nd April, 2015)

2) Transition of the Traffic Volume

Overall, the traffic volume has increased in 2015 compared to 2011. Traffic volume on highway 3 and 36 are high, and the traffic volume of Section 3 are relatively low.

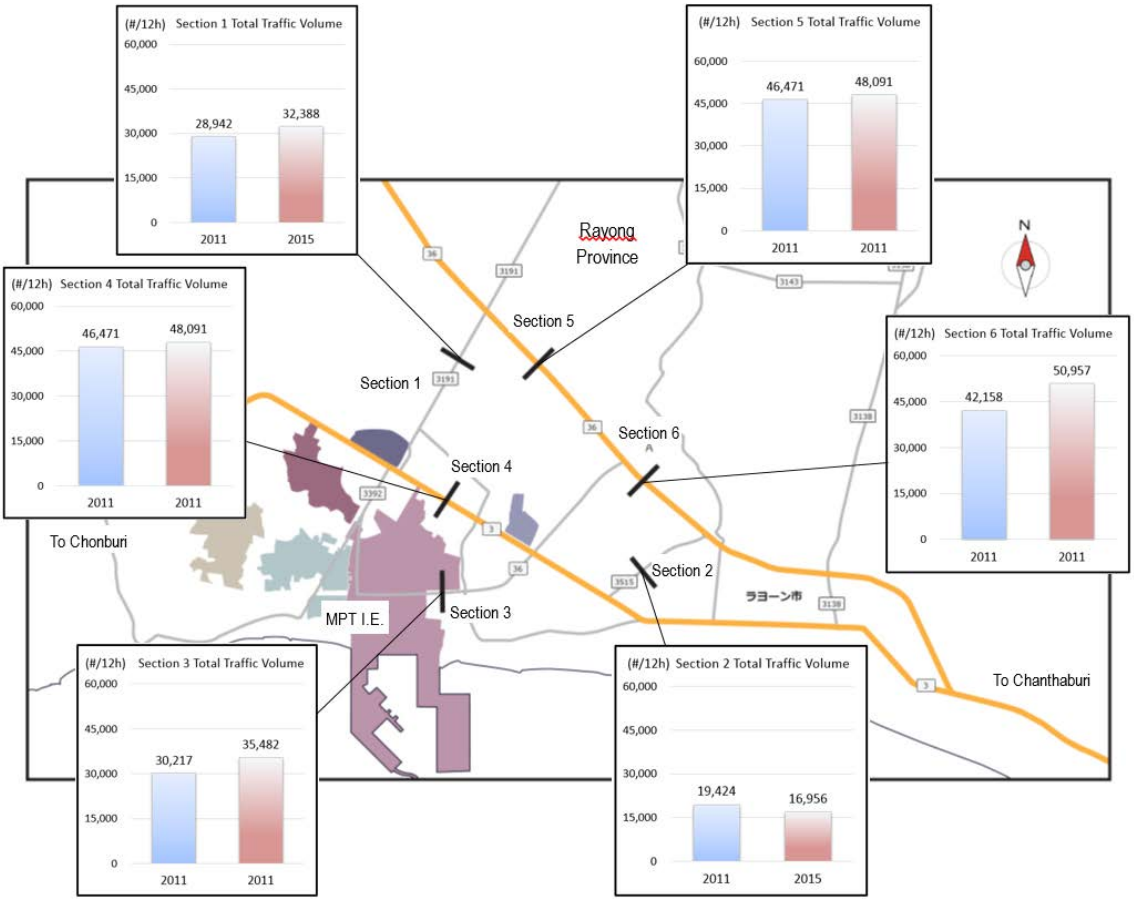
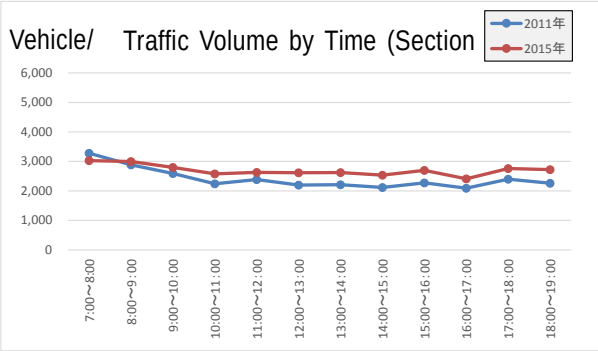
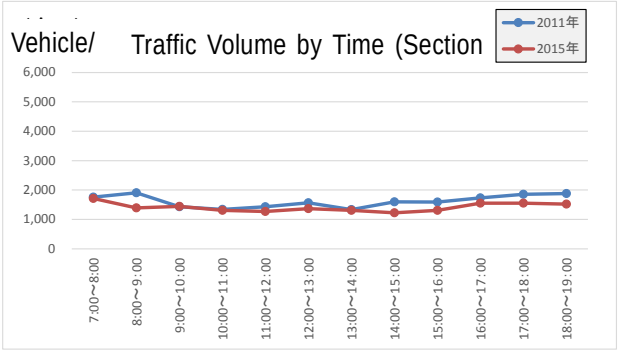
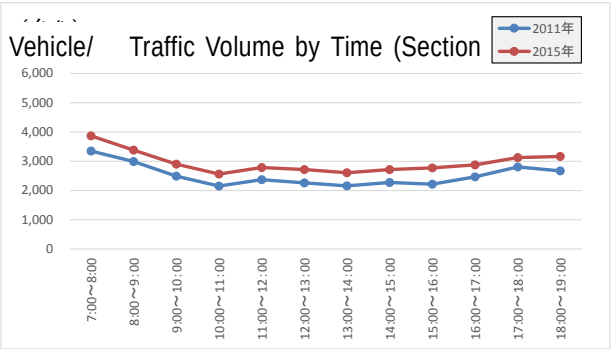
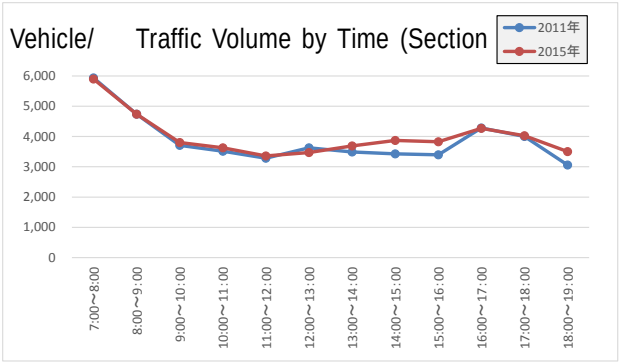
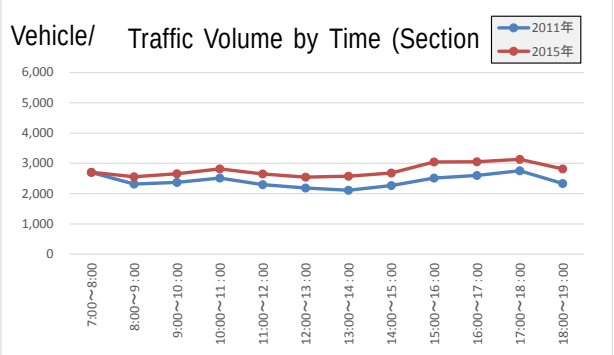
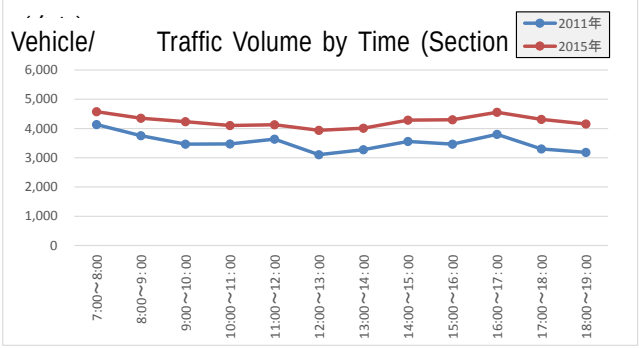


Figure 3-5 Total Traffic Volume by Sections (comparison of 2011 and 2015)

3) Traffic Volume by Time

The following indicates the traffic volume by time at each target sections.

Table 3-4 Traffic Volume by Time (Section 1~6)

Section 1 (Route 3191)	Section 2 (Route 3515)
	
Peak hour is between 7~8 o'clock in both 2011 and 2015. (3,025 vehicles/h in 2015)	Peak hour in 2011 was between 8~9 o'clock. However, traffic remained at the same level at all-time hour in 2015. (1,713 vehicles/h in 2015)
Section 3 (Route 36)	Section 4 (Route 3)
	
Peak hour is between 7~8 o'clock in both 2011 and 2015. (3,869 vehicles/h in 2015)	Peak hour traffic is extremely high between 7~8 o'clock in both 2011 and 2015. (5,901 vehicles/h in 2015)
Section 5 (Route 36)	Section 6 (Route 36)
	
Peak hour is between 17~18 o'clock in both 2011 and 2015. (3,132 vehicles/h in 2015)	Peak hour is between 16~17 o'clock in both 2011 and 2015. (4,553 vehicles/h in 2015)

(4) Road Standard and Capacity

1) Road Standard

The following indicates the categories of each section under the Japanese Government Order on Road

Design Standards under the current traffic volume.

Table 3-5 Road Standards (Section 1~6)

Section	Region	Traffic Volume*	Category Type and Class
Section 1	Regional	42,752	Type 3, Class 1 equivalent
Section 2	Regional	22,381	Type 3, Class 1 equivalent
Section 3	Regional	46,836	Type 3, Class 1 equivalent
Section 4	Regional	63,480	Type 3, Class 1 equivalent
Section 5	Regional	46,493	Type 3, Class 1 equivalent
Section 6	Regional	67,263	Type 3, Class 1 equivalent

*The 12 hour traffic volume had been converted into 24h by the general road average day-and-night rate 1.32 of 2010 Road Traffic Census.

2) Road Capacity Check

Collating the standard design volume of each section and actual traffic volume, the traffic volume of Section 3, 4, 5, and 6 are exceeding the Japanese standard design volume and indicates the lack of lanes.

However, the side strips of Section 3 and 4 are actually used as vehicle travel lane, and seems not to be indicating the lack of lanes on single-roads.

Table 3-6 Capacity Check (Section 1~6)

Section	Standard Design Volume of 1 lane	Number of Lanes	Standard Design Volume	24h Traffic Volume	Check
Section 1	11,000	6	66,000	42,752	○
Section 2	11,000	4	44,000	22,381	○
Section 3	11,000	4	44,000	46,836	×
Section 4	11,000	4	44,000	63,480	×
Section 5	11,000	4	44,000	46,493	×
Section 6	11,000	4	44,000	67,263	×

Figure 3-6 Current Status of Side Strip Travels (near Section 4)

(5) Summary of the Current Traffic Status

The summary of the current traffic status around the Map Ta Phut Industrial Estate is as follows.

- Overall, the traffic volume has increased over time.
- For sections around the industrial estate, peak hours are between 7~9 o'clock in the morning, and

is assumed to be highly affected by the commuter traffic to the industrial estate.

- Although there are some areas which indicates the lack of capacity on single roads, the side strip are regularly used as driveways and as a result the lack of capacity on single roads is assumed not to be the cause.
- Given the previously described interview and field study results, there are some times when traffic occurs during commuting hours of the industrial estate. It is sought possible to improve this situation by the adjustment of the traffic signal (aspect setting).

3.3 Needs of Existing and Scheduled Tenant Companies

As a result of interviews, it is derived that existing tenant companies and companies planning tenancy have varying needs.

- For existing tenant companies, there were needs to improve failures caused in infrastructure services such as utilities as a result of operation however, a trend in which there are difficulties associated with the decision making for renewal of equipment at additional costs was observed. Furthermore, many of the factories continued to receive services from the same contractors since the beginning of the tenancy, and views that an entry of a new business would be difficult were expressed.
- For companies planning to take up new tenancy, two patterns were prominent; tenancy by companies newly deploying its business in Thailand, and tenancy by companies relocating from its original location due to expansion or to avoid natural disasters etc. For companies newly deploying its business in Thailand, there was a trend to hold back on investment due to assumed risk of withdrawal from the country, and although the needs for infrastructure is high, there are uncertainty for continuity of the use.
- For companies relocating from its original location due to expansion or to avoid natural disasters etc., there is a trend for strong will in continuing operation, and should the timing for relocation match, the needs to reduce the cost of relocation by using the infrastructure service, making the group one of strong targets.
- Taking into accounts the aforementioned result of interviews and field study, there are occurrence of traffic congestions during commuting hours however, improvement is considered possible through adjusting the method of processing intersections (current-setting).

3.4 Natural Environment and Social Conditions

Natural Environment and Social Conditions will be mentioned in Chapter 8.

4 Relevant Legislation

4.1 Policies, Regulations, and Incentives for Eco-Industrial Estates

4.1.1 Efforts towards Development of Eco-Industrial Town

MOI is set to promote environmentally friendly Eco-Industrial Towns at five model provinces and nine industrial estates.

The five model provinces are Samut Prakan, Samut Sakhon, Rayong, Chachoengsao, and Prachinburi.

4.1.2 Efforts towards Development of Eco-Industrial Estate

Against the background of environmental issues due to the industrial growth in Thailand and at industrial estates, IEAT began the “Eco-Industrial Estate Development” efforts in 2000.

In 2009, not only has IEAT made efforts to promote the environmental performance of industrial estates, IEAT initiated the concept of “Eco-Industrial Town” to expand their efforts towards Eco-Industrial Town and Eco-City.

In Phase 1 (2010~2014), the formulation of the “Standards for Eco-Industrial Estate” has been proceeded such as the preparation of the master plan by three pilot industrial estates. In Phase 2 (2015~2019), IEAT plans to proceed with the development of Eco-Industrial Estates at other estates. Detailed information is as shown in Chapter 2-2.

The five aspects on Eco-Industrial Estate are Physical Aspect, Economic Aspect, Environmental Aspect, Social Aspect, and Management Aspect.

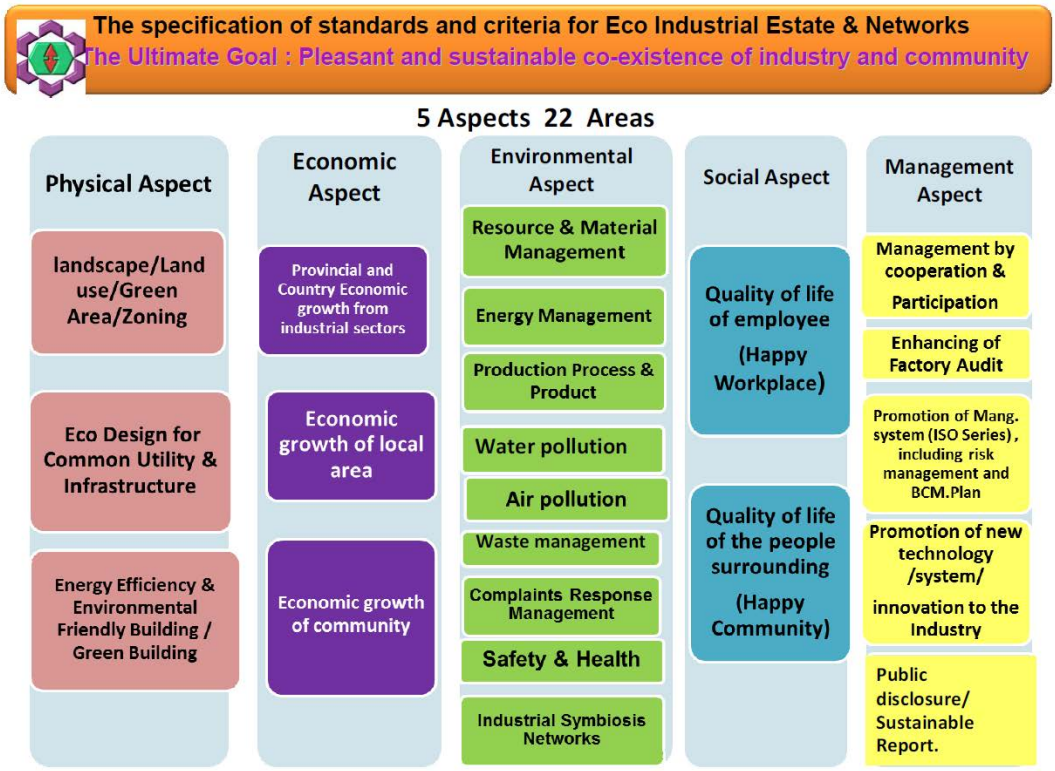


Figure 4-1 Standards and criteria's of Eco-Industrial Estate and Network

Source: ECO INDUSTRIAL ESTATE and networks Development towards ECO TOWN and Eco-cities, IEAT

4.1.3 Efforts by Kita-Kyushu City

Kita-Kyushu City and Thailand has discussed to establish Eco-Town; and Kita-Kyushu City had a model project of "recycling-orientated society" with Rayong in 2011. The Eco-Town[2] project is the business with the aim of zero emission, "be utilized as raw material for other industries all wastes, to zero wastes finally", and promote the construction of a recycling-based societies. Eco-Town project also aims to promote regional development based on the Eco-Town as well as city development with advanced harmonization of humans and nature.

In August 2014, the Memorandum of Understanding (hereinafter referred to as MOU) on cooperation has been signed between Kita-Kyushu City and IEAT aimed at the promotion of Eco-Industrial Town, to provide support in the environmental field such as recycle, resource conservation, energy-saving, etc. on efforts towards the development of industrial estates aimed for the realization of Eco-friendly town.

[2] Definition of the Eco-Town is based on the website of Ministry of the Environment Government of Japan http://www.env.go.jp/recycle/ecotown/

4.2 Regulations and Incentives on Energy Conservation Service at Industrial Estates

4.2.1 Thai Industrial Estate Law

(1) Thai Industrial Estate Law

The Industrial Estate Authority of Thailand (IEAT) Law (revision 2007) prescribes the details on the establishment of IEAT, authority, and types of industrial estates, etc. The law also describes the land acquisition and sale, entry, and a free zone for business entities which operates within an industrial estate. IEAT free zone is a zone set by IEAT mainly for export businesses within an industrial estate set, and businesses located within these zones can receive incentives.

IEAT is a corporation capitalized by the national investment and budget.

Industrial estates in Thailand consists of the industrial estates managed by IEAT and industrial estates developed, sold, and managed by private companies.

(2) Industrial Estate Authority of Thailand

IEAT operates under the jurisdiction of MOI, and aims to expand industrial development throughout Thailand through development and operation of industrial estates.

【Responsibilities of IEAT】

1. To establish industrial estates and to promote and support the establishment of industrial estates with private companies and government.
2. To provide public facilities and infrastructural services necessary for industrial operation.
3. To promote and support private companies to be able to invest in public facilities and infrastructures necessary for industrial operation.
4. To construct and manage environmental management system and system to prevent/mitigate industrial hazards.
5. To grant license/approval for business operations within an industrial estate, and to grant benefit/premium to facilitate industrial operation.

IEAT hold 58 industrial estates in 18 provinces (as of September 2015). IEAT is directly responsible for operational management of 11 industrial estates, and operational management of the other 47 industrial estates are shared with private companies (as of September 2015).

【Core Business】

1. Establishment and development of industrial estates
2. Joint development of industrial estates with private companies
3. Development and operational management of industrial harbor
4. To provide, construct and develop public facilities and infrastructural services
5. To value environmental management, safety management, and connection with local community
6. To provide services for license/approval and benefits by “One-stop Service”

IEAT consider the realization of energy conservation at industrial estates as an urgent issue, and pursues various efforts.

4.2.2 Incentives by IEAT

IEAT provides incentives for businesses joining the industrial estate. There are investment promotion policy that apply to all factories, and measures limited to Free-Zones.

Measures which apply to all industrial estates

- Approval of land ownership by companies with 51% and more foreign ownership
- Approval of foreign employment and residency
- Ease limits on allocation of foreign currency

In addition to the measures above, there are special exemptions in taxes at free zones, such as exemption of import/export duties, Value Added Tax (VAT), excise tax etc., and exemptions on quality control standards for materials used for production within a free zone.

4.3 Regulations and Incentives for Energy Conservation, Cogeneration and Leasing

4.3.1 Energy Conservation

(1) Energy Conservation Promotion Law

The Energy Conservation Promotion Act B.E.2535 was established in Thailand in 1992.

This act imposes severe obligation on the owner of "Designated Building" and "Designated Factory" with ① contracted power greater than 1,000 kW, ② total quantity of installed transformer greater than 1,175 kVA, ③ annual electricity and steam consumption greater than 20 million MJ. Obligations are as follows:

- To appoint a qualified person for energy management (PRE: Person Responsible Energy)
- To report energy consumption and energy conservation activity
- To submit energy conservation goal and plan

For power-related businesses, the "Investment Promotion for Sustainable Development (No.2/2553)" was issued in 2010[3], which provided preferential tax treatments and investment incentives for energy conservation / alternative energy industry, eco-friendly industry and high-technology industry up to 31st December 2012.

Although there are no specific restrictions by IEAT regarding investment to the SPC, if the investment ratio exceeds 50%, it must be treated as a State Enterprise based on the Budget Procedures Act. Although it is not specified by law, there is a policy that government agency, including IEAT, to assign their office staff to the board member of all investing companies regardless of the amount invested. IEAT plays a

[3] Buddhist calendar is used in Thailand where whereas 2010 would be 2553, and 2015 would be 2558.

monitoring or observatory position even for small investment companies. Companies who decide to accept investment from IEAT maintains the possibility to receive BOI's incentives.

(2) Energy Conservation Promotion Fund

As a measure to promote energy conservation based on the "Energy Conservation Promotion Law", there is the Energy Conservation Promotion Fund (ENCON Fund) that is financed by gasoline taxes, which offers research and development and subsidies for promotion of energy conservation and renewable energy.

There is a subsidy program for energy conservation facility investment. The budget for 2015 fiscal year is 500 million THB. By applying and gaining approval from Department of Alternative Energy Development and Efficiency (DEDE), large-scale facility / factory are given 20%, small and medium-sized facility/factory are given 30% subsidy for facility investment. However, the payback period for the investment must be less than seven years. Other incentive programs set to commence from October is coordinated with commercial banks, who will loan investment for energy conservation facility at a low-interest rate (less than 3.5%). The budget for this program is 1,500 million THB. The ceiling for each loan is 500,000 THB.

There are approximately 800 applications for the subsidy program of which approximately 80% is to be approved. The above 2 subsidy programs can also be applied to leased equipment.

(3) ESCO Fund

ESCO Fund was established by DEDE under the MOE to promote energy conservation by Energy Service Company (ESCO) projects. ESCO Fund was created as the low interest loan scheme for ESCO operators and SMEs with limited financial power, and functioned as asset investment (investment period is 5~7 years), ESCO business investment (investment period is 5~7 years), emission trading, facility lease (for 5 years, 4% interest), technical support, and credit guarantee. This fund has been terminated in 2012.

(4) HEPS

1) Targets for HEPS

MOE holds authority over the classification of HEPS (High Energy Performance Standard) product and equipment in Thailand. Currently, HEPS is classified into following 8 types under ministerial ordinance of MOE.

1. Refrigerator
2. Water Cooler
3. Electric Water Heater
4. Electric Rice Cooker
5. Electric Water Boiler
6. Air Conditioner
7. Energy Conservation Glass

8. Desktop -, Wall-mounted -, Floor Fan

Each ministerial ordinance specifies the method of calculation for energy efficiency.

Since the beneficiary of HEPS are manufacturers of above listed products subject to benefits, the system is thought to not take in consideration, receiving of benefits by companies not producing thee products.

2) Incentives under the Energy Conservation Promotion Law

Anyone who manufacturers, imports, transports and/or sells above HEPS products, regardless of whether the business is public or private, are given the rights for the Assistance Fund from the Fund Committee. The following indicates items subject to the Fund.

1. Preparation of the business plan
2. Cost to execute the business
3. Demonstration project
4. Market study and expansion of the machinery market
5. Establishment of Energy Conservation Information Center
6. Operation fund of machinery business targeting HEPS and other energy conservation products

Fund Committee provide support up to 20% of the business fund, up to a ceiling of three million THB.

The business operator shall submit the application in accordance with the Energy Conservation Plan to the Fund Committee. Once the application has been approved by the Fund Committee, the application will be verified by the Energy Policy and Planning Office (EPPO), and may dispatch an expert to verify the business plan in some circumstances. Approval of the business plans will be determined case-by-case.

4.3.2 Cogeneration

(1) License

In Thailand, generation, transmission, distribution, retail of electricity, and operation of electrical system greater than 1,000 kVA requires licenses based on the Energy Industrial Act. For capacity less than 1,000 kVA, licenses are unnecessary regardless of whether the electricity is used in-house or supplied to other companies.

Construction of buildings to install power generators will need to be in accordance with the Factory Act and the Building Control Act.

1) Electricity Generation License

Power plants 1,000 kVA or greater will need to obtain the Electricity Generation License regardless of whether they are Industrial Power Supplier (IPS), Very Small Power Producer (VSPP), or In-Plant Utility (IPU).

2) Power Purchase Agreement

Electricity generated at the power plant may be sold to both PEA and clients in an industrial estate, or may be sold just to the clients in an industrial estate.

3) Compliance with Code of Practice

For the planned power plant (3 MW in scale), the business operator will be exempt from the Environmental Impact Assessment. However, depending on the raw material used to generate power, there are some cases which will require the compliance with the Code Practice of the Energy Regulatory Commission (ERC).

4) Factory Operation License

Since the relevant power plant falls under the category "type-3 factory", the Factory Operation License issued by DIW will need to be obtained. However, if the power plant is located within IEAT's area, the operation of the plant will be managed by IEAT and not DIW, and thus Factory Operation License will not be required. In which case, the business will be subject to the land use policy by IEAT.

5) Building Construction Permit

The Building Construction Permit will need to be obtained prior to the construction of buildings. After the construction has been completed, the business operator will need to obtain a Building Permit.

6) Regulated Energy Production Permit (PorKor.2)

Power Plants larger than 200kVA in capacity will need to obtain the Regulated Energy Production Permit.

If the project company, who is not in the transport, procurement, wholesale, or retail business of natural gas, is purchasing natural gas from an officially licensed supplier for the purpose of the power generation business only, the Natural Gas Business License issued by the ERC based on the Energy Industrial Act will not be necessary in addition to the minimum required licenses.

However, if the business operator decides to run a power generation business using natural gas, this will fall under the category "type-3 regulated business" based on the Fuel Control Act and therefore will need to acquire the license based on the Act.

(2) Power Supply System

Thailand imports nearly 50% of their primary energy supply. Therefore, Thailand puts great emphasis in securing various supply sources, development of energy source, and the adoption of renewable energy to secure the stability of energy.

Originally in Thailand, the power generation business was monopolized by EGAT. IPP and SPP entered the power generation business in 1992, and currently, approximately 50% of the total power generation consists by entities other than EGAT.

The power transmission business is operated by the Metropolitan Electricity Authority (MEA) in the Bangkok metropolitan area, and other region is operated by PEA.

Electricity fees are regulated by law and may not be set freely.

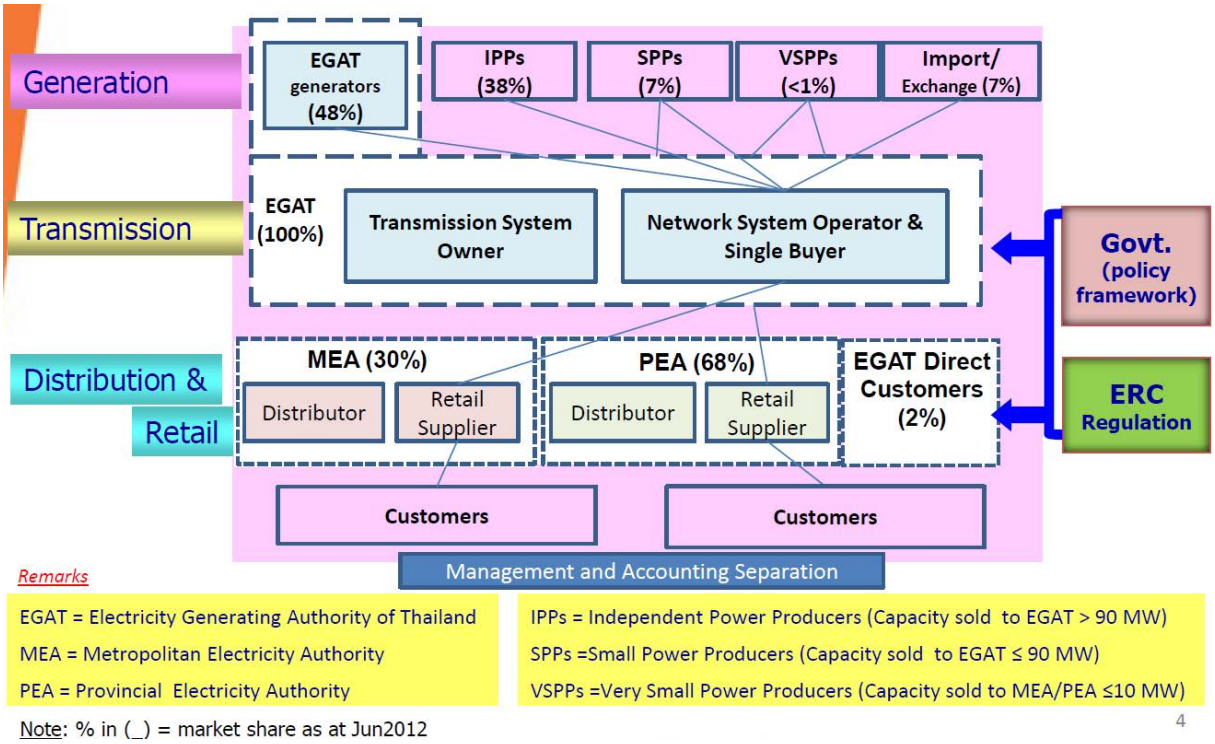


Figure 4-2 Power Supply System

Source: "Power Tariff Structure in Thailand", Energy Regulatory Commission of Thailand, 23 Oct, 2012

(3) Small Power Producer (SPP)

SPP are companies in the power generation business that sell 10~90MW or less power to EGAT. SPP utilize high-efficiency energy by the promotion of cogeneration by natural gas and coal (etc.), and renewable energy such as biomass and solar power (etc.).

SPP Program is a program that EGAT guarantees the purchase of power generated by the SPP business operator for a fixed period of time, and also allows the excess power and steam to be sold to consumers within the industrial estate.

As of December 2013, licenses has been granted to 129 SPP projects, with total capacity of 11,988MW. Most of the power generated consists of natural gas, and partially by renewable energy such as biomass and wind power, etc.[4]

(4) Very Small Power Producer (VSPP)

VSPP sell electricity less than 10MW to MEA or PEA, and can be applied to cogeneration.

[4] EGAT Power Purchase Agreement Division (http://www.ppa.egat.co.th/Sppx/)

Power generated at the power plant may either be sold to both PEA and clients in an industrial estate, or only to the clients in an industrial estate.

As of February 2014, there are 476 VSPP projects (1,585 MW) in operation, 412 projects (2,412 MW) are licensed and is currently under planning and construction, and 313 projects (1,244 MW) are under contract procedure.[5]

In terms of the type of power generation, solar power generation accounts for the large percentage, followed by biomass and biogas.

Although, cases of natural gas cogeneration are few, this is considered an issue of business profitability of cogeneration not being granted the Adder Rates at purchase, and the high generation cost.

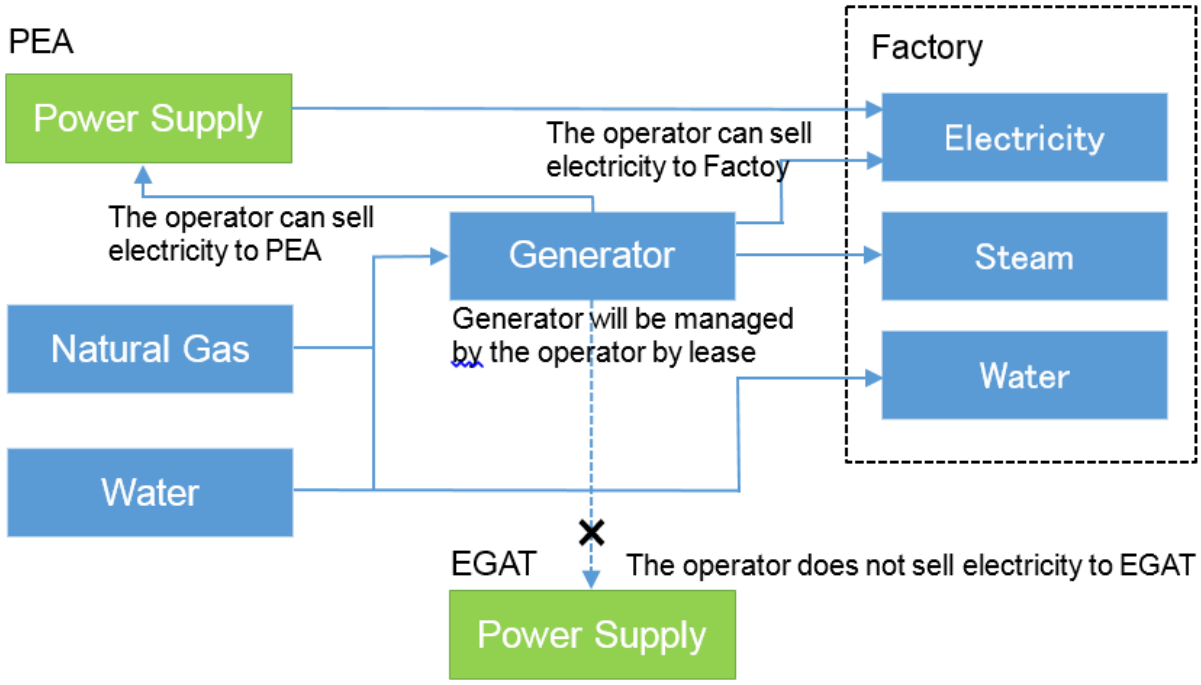


Figure 4-3 Power and Steam Sale Flow of VSPP

(5) Electricity fee (Power supply by 1 transformer)

According to PEA, power supplied by PEA are generally distributed and supplied by a transformer adjusting voltage in response to the power usage.

Electricity fee is paid by the individual or corporate who owns the central electricity meter installed by PEA, and is not paid by owners of transformers. However, if the owner of a transformer also owns the central electricity meter, there will be an obligation to make payment to PEA.

5Cogeneration & on-site power production
http://www.cospp.com/articles/print/volume-15/issue-2/features/distributed-generation-shines-in-thailand.html
Energy Regulatory Commission
http://www.erc.or.th/ERCSPP/Mainpage.aspx

4.3.3 Lease System

In Thailand, both finance lease and operating lease are widespread, and utilized in many industries. There are no special legal systems which prescribes the lease system.

Business operator are able to procure the equipment on lease, including structures that requires construction work at the end of the contract, such as air conditioners that are fixated onto the building, and energy supply equipment, and existence of a lease system shall not become an obstacle of running the business.

In implementing the lease business, for the tax purpose, both finance lease and operating lease will require the lease fee to be treated as a deductible.

(1) Precedent Case of Package Services in Thailand

There are no regulations concerning lease of land and power generators in Thailand. At implementation of the Energy Business, there have been cases of power plants on leased (rented) land, however whether those companies utilize leased (rented) power generators for the operation of the power plant is unknown.

(2) License Concerning Lease Asset

At implementation of the package service, if the project company is to lease power generator of total power generating capacity greater than 200 kVA, the Regulated Energy Production Permit will need to be obtained based on Energy Conservation Promotion Law. In addition, based on the Energy Industrial Act, applicant of an electricity business license will need to show upon application, to have either the ownership or leasehold rights for the land and property/asset related to implementation of the business. In other words, the project company do not have to possess the ownership of the power generator itself to acquire the license, and the law does not prohibit the use of equipment leased from a leasing company.

For the project, the service contract agreed between the project company who are the service providers and the clients within the industrial estate who will be receiving the service, it is assumed that there will be a need to indicate that the client, who are the owners of the land, are permitting the installation of power generators within their property.

(3) Tax Treatment of Package Services

According to Thailand's Tax Law, payment for provision of a service including lease fees are subject to tax withholding in relation to corporate income tax. Therefore, whether the package service is considered as a provision of service including lease, or sales of product will need to be clarified.

Considering sales of power in this matter, the project company will operate the generator to supply power for the client, and although the generator will be installed within the client's property, the owner/user of the generator is the project company and not the client, therefore the business can be considered as sales of power by the project company to the client. If the project company is to manage the generator, and the client is not involved in its management, the business is unlikely to be considered as a lease. Under Thailand's Tax Law, sales of power is considered as a sale of a "commodity" and not a sales of "service", and is not subject to tax withholding.

However, if the client is to operate the generators situated on their site, the result may differ from described above. Furthermore, proceeds from sales of power is subject to VAT of 7%.

On service providing, the termination charge for termination during the contract period may be set freely based on mutual agreement. If the contract has been terminated early, the account period of revenue and cost for both client and the SPC will be calculated at the time of contract termination.

The following business scheme may also be adopted. In this case, the roles of each business operator will need to be discussed further.

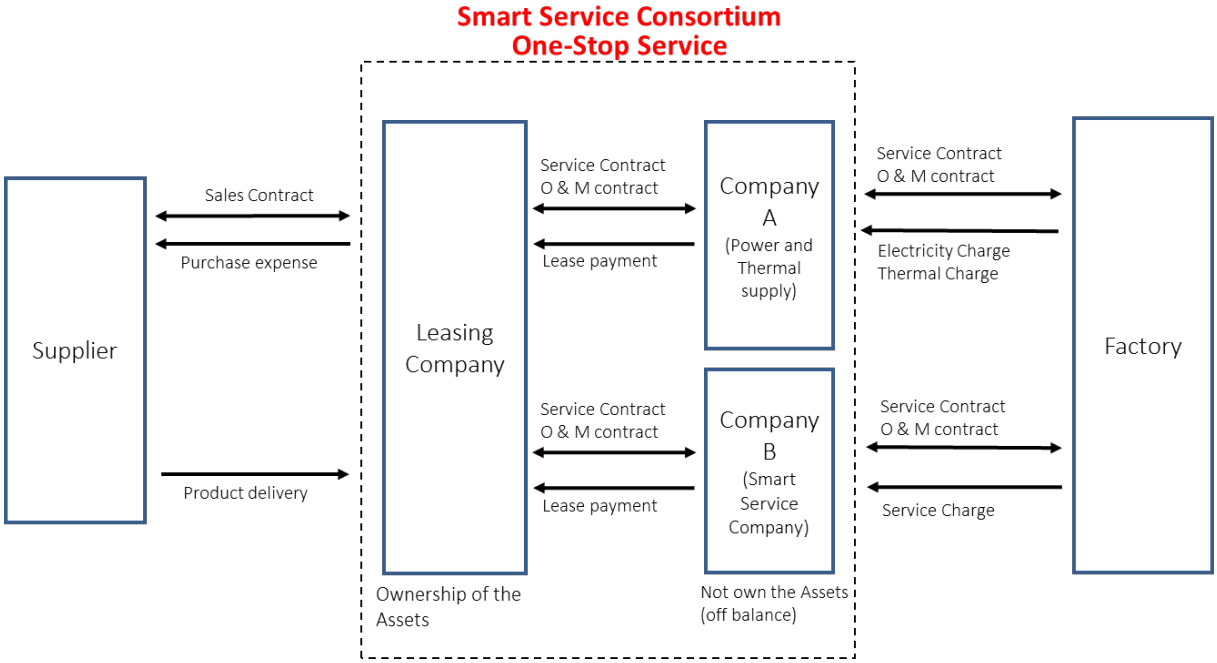


Figure 4-4 Example of Business Scheme Presuming Lease

4.4 Other Relevant Legislation

4.4.1 Foreign Business Act and Land Ownership Regulations

Foreign Business Act of 1999 is a law which regulates foreign businesses in Thailand. Since the project fall under the activity in other service businesses in List-3, the project will be subject to the regulations of the Foreign Business Act, and foreign ownership of the company established must be below 50%. On the other hand, benefits of IEAT and BOI will be exemption of the above, and will be able to establish the company with 100% foreign capital if benefits can be granted.

Land ownership by foreigners and foreign corporations are prohibited in Thailand under the Land Law. However, IEAT and BOI benefits are exemption of the above, and land acquisition will be possible if benefits are granted.

Whether the project will apply to the Foreign Business Act is uncertain at this point.

(1) Foreign Business Act

If the project company is considered a foreign company, project activities will be subject to the project requirement and restrictions of the Foreign Business Act In other words, if the project company is a foreign company executing a projects listed in the restricted business list, especially those specified in

List-3 of the Foreign Business Act, the Foreign Business License will need to be acquired from the Ministry of Commerce (MOC) prior to the project execution.

Table 4-1 Summary of Regulations by the Foreign Business Act

Category	Restriction Level	Regulated businesses
List -1	Prohibited	Businesses absolutely prohibited to foreigners for special reasons (9 businesses) Newspaper, Broadcasting business, Agriculture, Forestry, Fishery, Land Transactions, etc.
List -2	Effectively Prohibited (Requires special permission from the Minister of MOC with the approval of the Cabinet)	Businesses that may affect security, public order, culture, environment, etc. (13 businesses) Weapon manufacture, Land/Marine/Air Transport and Domestic Aviation, Antique/Folk craft Production, etc.
List -3	Determined per case (Requires precertification from government authorities)	Businesses with insufficient competition within the domestic industry (21 businesses) Accounting, Law, Architectural Design, Engineering, Construction (below a certain size), Agency/Brokerage, Sales (below a certain size), Hotel, Tourist business, Restaurant, and other services

Source: JETRO

In relation with restrictions on foreign investment, power generation business (including the sales of generated power) is not subjected to the restriction of foreign investment. However, the project is set to provide various services as a package with power generation (in fact these services are the main product), and therefore it is deemed inevitable to be subject to the restriction on foreign investment as a service business.

Foreign Business Act will apply even if IEAT invests in the SPC.

(2) Energy Industry Act (2007)

The Energy Regulatory Commission (ERC Regulation) has no restrictions on the percentage of Thai capital for the foreign invested project company. However, the Energy Business License is necessary for the execution of electricity and natural gas business, and the following requirements will need to be fulfilled to acquire this license.

- Must have sufficient financial capacity and technology upon the build-up and execution of the energy business
- May not have licenses be suspended or revoked in the past two years from the date of application
- May not be a post board member of a third party project company appointed by the debtor or the debtor of the project company, and may not be proceeding bankruptcy or be declared bankrupt by court, or be under debt management or be filing reorganization proceedings by insolvency law
- Must have the proprietary rights or lease rights upon the use of land or property/asset for business execution

In addition, signing authority, representative or representative director of the relevant project must meet the following requirement.

- Must possess citizenship in Thailand
- May not be adjudged incompetent or quasi-incompetent (adult ward)
- May not be under financial management or be bankrupt for 3 years prior to the application year to the acquisition date of the license
- May not have the license suspended or revoked for the past 2 years from the application date
- May not have been imprisoned by a final judgement to imprisonment, except for a petty offence or an offence committed by negligence

4.5 Regulations and Incentives for Transportation and Human Resource Development Services

4.5.1 Transportation Service

Upon servicing a shuttle bus or share-ride transportation business which supports the transportation and travels of commuting factory workers, or executing the logistics business, necessary licenses must be acquired from the MOC under the Land Transportation Act and Foreign Business Act.

Generally, majority of the investment must be Thai capital and majority of the board members nationality must be Thai based on the Foreign Business Act Category-2.

However, the Foreign Business Act may not apply to free shuttle bus services for one's own factory workers (part of the welfare benefits). Especially if they are free share-ride buses for one's own factory worker.

Currently, there are no incentives concerning implementation of environmentally-friendly vehicles, and transport management systems using GPS.

4.5.2 Human Resource Development Service

In this proposal, the establishment of a local educational institution and educational service provider were originally considered. However, as a result of the study, examining the feasibility in terms of a business, and from the point of enhancing the effectiveness of the business, it has been concluded to consider providing services utilizing applications on smart phones and tablet with high ownership between workers. Therefore, the aims is to provide services that do not infringe the legal system and licensing concerning the establishment of an educational institution, educational standard, and implementation of vocational education service.

4.6 PPP System in Thailand[6]

As for the PPP Infrastructure-related policy in Thailand, law concerning the participation of private entities on public projects was enacted in 1992, and has been utilized on projects in the transportation sector such as high-speed railroad and urban railroad.

[6] http://www.ppp.sepo.go.th/ppps/ppps.htm

The new PPP law (The Private Investment in State Undertaking Act of 2013) passed on April 2013, established the PPP Committee chaired by the Thai Prime Minister, and prescribed requirements and tendering procedures.

In addition, the State Enterprise Policy Office (SEPO) of the Ministry of Finance is considered as the PPP Promotion Office, and SEPO are set to plan PPP strategies such as the five year investment policy plan, projects, budgeting, etc.

The new PPP Act covers over one billion THB (approximately 3.6 billion yen) projects. In order to implement a project, a feasibility study conducted by external consultants is required, followed by an approval from SEPO.

Concession contracts in Thailand employs project finance. Build Own Operate (BOO), Build Transfer Operate (BTO), and Build Operate Transfer (BOT) schemes are also employed according to the characteristics of the project. The ownership of assets for the project shall be based on regulations on the act of incorporation of each project manager.

The Private Investment Promotion Fund for the promotion of the PPP has been established by the Ministry of Finance, and will be utilized to plan the PPP strategies and execution of FS.

In order to be applicable for the new PPP Act, ① total project cost must be greater than one billion THB, and ② must be an IEAT project. It is thus assumed that new PPP will not applied to the project.

4.7 Regulation on Foreign Direct Investment

4.7.1 Investment Promotion Act

The Investment Promotion Act passed in 1977 prescribes the assignment of the BOI members, roles, and tax incentives. In operation, BOI, an affiliated organization of MOI, appoint projects subject to investment promotion and implement the preferential treatment.

The new investment promotion policy from 2015 determines 6 objectives, and offer activity-based incentives and incentives based on the level of contribution to the development (merit based incentives).

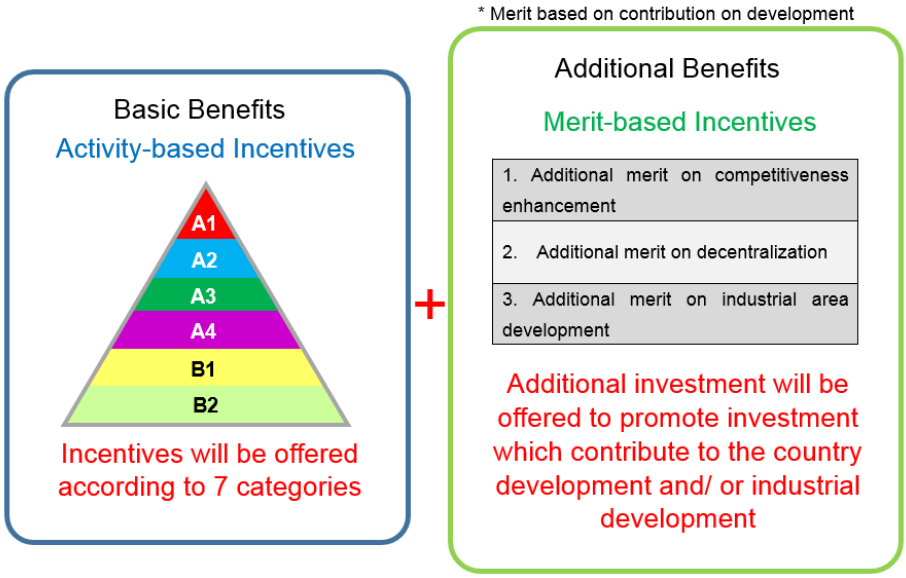


Figure 4-5 Benefit System of the New Investment Promotion Policy[7]

Source: "7 year Investment Promotion Strategy (2015-2021) Investment Promotion Criteria and Activities" BOI, May 14th, 2015

(1) Basic Benefits

Industries subject to investment promotion by BOI are categorized into following 7 categories:

(List of Industries subject to the investment promotion)

Category 1: Agriculture and manufacturing from agricultural product
Category 2: Mining, ceramics, and basic metal
Category 3: Light industry product
Category 4: Metal ware, machinery, transport instruments
Category 5: Electronic/electrical equipment industry
Category 6: Scientific industry, paper and plastics
Category 7: Service and public projects

Part of the project presumed in this study falls under the service business, and may be subject to benefit B2 under the category of "7.7 Trade and Investment Support Office".

B1/B2: Important business for the value chain which do not use advanced-technology

(B2 Exemption of import duty on raw materials for export-oriented product, non-tax benefits)

[7] In an article of the source described "Merit based Incentives" as "Merit based on contribution on development". Thus, "Merit based on contribution on development" was added to the figure by the Study Team.

(2) Merit-based Incentives

Incentives based on the level of contribution to the development (merit-based incentive) are "additional merit on competitiveness enhancement", "additional merit on decentralization", and "additional merit on industrial area development".

In addition to the basic incentives, the project may be able to receive "additional merit on competitiveness enhancement" and "additional merit on industrial area development". However, if the project falls under the category "7.7 Trade and Investment Support Office", additional merit-based incentives will not be applied.

Table 4-2 Additional Incentives to Enhance Competitiveness

Types of Eligible Investment/ Expenditures	Additional Exemption of Corporate Tax
1. Research & Development: in-house, outsourced in Thailand or joint R&D with overseas institutes	200%
2. Donations to Technology and Human Resources Development Funds, educational institutes, specialized training centers, R&D institutes or governmental agencies in science and technology field in Thailand, as approved by the board	100%
3. IP acquisition/license fees for commercializing technology developed in Thailand	100%
4. Advanced technology training	100%
5. Development of Local Supplier with at least 51% Thai shareholding (advanced technology training or/and technical assistance)	100%
6. Product and packaging design: in-house or outsourced in Thailand, as approved by the Board	100%

*: Additional exemption amount on corporate tax shall be calculated by the following total investment amount or cost

Source: "7 year Investment Promotion Strategy (2015-2021) Investment Promotion Criteria and Activities" BOI, May 14th, 2015

Table 4-3 Additional Incentives to Competitiveness Enhancement (Part 2)

Percentage of qualified Investment/Expenditures To combined revenue of the first three years	Period of additional corporate tax exemption
1% or ≧ 200 million THB	1 year
2% or ≧ 400 million THB	2 years
3% or ≧ 600 million THB	3 years

Source: "7 year Investment Promotion Strategy (2015-2021) Investment Promotion Criteria and Activities" BOI, May 14th, 2015

As additional incentives for industrial estate development, there is the "additional one year exemption of corporate tax when located in industrial estates or to locate at an encouraged industrial district".

The following diagram indicates 20 provinces subject to benefits given to businesses located in a province with low per-capital income. However, the project is not scheduled to deploy business in the relevant regions at the initial stage.

Figure 4-6 Prefectures Subject to Additional Incentives on Decentralization

Source: "7 year Investment Promotion Strategy (2015-2021) Investment Promotion Criteria and Activities" BOI, May 14th, 2015

(3) Others

The following are project authorization criteria[8] on receiving benefit relevant to the project.

The project is acknowledged as "other service businesses" in the List-3 of the Foreign Business Act.

[8] Source: "7 year Investment Promotion Strategy (2015-2021) Investment Promotion Criteria and Activities" BOI, May 14th, 2015

Should the project receive the incentives from BOI, the project may legally be implemented by 100% foreign capital. The possibility of receiving the incentives is uncertain at the moment, and is assumed to become clear at the time of negotiation with stakeholders on determining the business scheme.
(Requirements for receiving the incentives)

- Value-added not less than 20% of revenues
- Projects that have investment capital of 10 million baht or more (excluding cost of land and working capital) must obtain ISO 9000 or ISO 14000 certification or similar international standard certification within two years from the full operation startup date, otherwise corporate income tax exemption shall be reduced by one year
- Projects or activities with type and size that are required to submit environmental impact assessment reports must comply with related environmental laws and regulations or Cabinet resolution.
- Projects located in Rayong must comply with the BOI Announcement No.1/2554. (May 2nd, 2011)
- The minimum capital investment requirement of each project is 1 million baht (excluding cost of land and working capital).
- For newly established projects, the debt-to-equity ratio must not exceed 3 to 1.
- Businesses included in the projects categorized in List-2 and 3 of 1999 Foreign Business Act, permits foreigners to hold majority or all shares. However, except for the cases indicated otherwise by law.

4.8 Tax System

4.8.1 Main Tax System

The following table shows the basic tax systems in Thailand. Conditions assume establishment of a local incorporated company in Thailand.

Table 4-4 Summary of Tax System in Thailand

Name	Tax Rates	Items Subject to Taxation
Corporate tax	20%	Corporate income generated in Thailand Retained loss may be carried over for 5 years
Taxation on Dividend income	10% withholding income tax	In case the profit generated at the Thai subsidiary is circulated to the holding company in Japan
Value Added tax (VAT)	7% (At July, 2015)	Value added generated in Thailand. Equivalent to the consumption tax in Japan. Standard tax rate is 10%.
Taxation on Specified Businesses	3.3% (On Finance, and Securities)	Taxation on objects exempted from VAT such as commercial banking, finance/securities, life insurance, pawn broking, real-estate corporation.
Commodity tax	Commodity	Taxation on purchased commodity. ①fuel and petroleum product ②cold beverages ③electronic products ④glass product ⑤automobiles ⑥ships ⑦perfume and cosmetics ⑧entertainment services ⑨alcohol ⑩cigarette and cigars ⑪motorcycles ⑫motorcycle ⑬battery ⑭playing cards ⑮substances which effects the ozone layer
Taxation on house and land property	Expected rental rate×12.5%	Land and buildings used for industrial and commercial use (real-estates are exempted from taxation)

Source: "Thailand's Tax administration and Tax system" National Tax Administration, Tax Journal, 2015.1

(1) Customs

Apart from exemptions due to incentives of BOI etc., customs will be enforced on commodities imported from Japan.

On November 1st, 2007, the Economic Partnership Agreement (EPA) has been issued between Japan and Thailand. The EPA Preferential tax rates will be applied if the certificate of origin can be obtained for the preferential items. The MFN tax rates (WTO standard tax rate) will be applied for non-preferential items and items without the certificate of origin.

If the B2 benefits are granted by BOI, import duties on raw materials will be exempted.

(2) Depreciation

Depreciation shall follow the accounting depreciation method.

Straight-line methods are generally used for the depreciation method, however the declining-balance method may also be adopted.

Table 4-5 List of Depreciation Rate by Assets Using the Straight-line Method

Asset type	Description	Durable year	Depreciation rate
Buildings	General building	20 years	5%
Buildings (temporary)	Temporary buildings	1 year	100%
Debilitating depletion asset		20 years	5%
Leasehold rights	In cases without a contract, or renewal clauses	10 years	10%
	In cases with contract, but cannot be renewed, or may be renewed but has period restriction	Contract period	Divided by contract period
Intangible fixed asset	Limitations on use duration	Duration of use	Divided by duration of use
	No limitations on use duration	10 years	10%
Other depreciation asset	Energy saving devices	5 years	20%
Computer and software		3 years	33.3%

Source: Thai Revenue Agency (http://www.rd.go.th/publish/)

(3) Withholding Tax System

In Thailand, there are many transactions subject to tax withholding. Tax rates are 3% for service contracts, and 5% for lease contracts.

One month net payment of withholding tax shall be made to the Tax Bureau by the 7th of the following month.

(4) Foreign Exchange and International Remittance

In principle, there is no restrictions on the capital transaction. However, some capital transaction require prior notice to BOI or prior authorization by BOI. In addition, some capital transaction have maximum amount. Moreover, there is no special restrictions on the inter-company loan.

Settlement currency for trade is not ruled.

10% withholding tax will be charged on the international remittance in case the SPC transfers revenue by SPC to Japan.

5 Project Concept Planning

5.1 Market Study and Industrial Analysis

5.1.1 Trends of Foreign Investment by Japanese Companies

Although the number of Japanese foreign direct investment in Asian countries varies year to year, the number of investments have been marking a rapid growth, twice, for the past five years.

Japanese foreign direct investment to Thailand marked 6th greater followed to India, Vietnam, Philippine, Malaysia and Indonesia. There is no large difference for the past five years.

Large part of the direct investment amount in manufacturing is in the area of precision machine and equipment, and transportation machine and equipment; and such investment have been marking a rapid growth, twice, for the past five years.

Regarding direct investment by country and region, Japan scores extremely high ratio in the inward direct investment, 60%, as of 2013. Thus, it seems that Japan's role and effect to Thailand is very important.

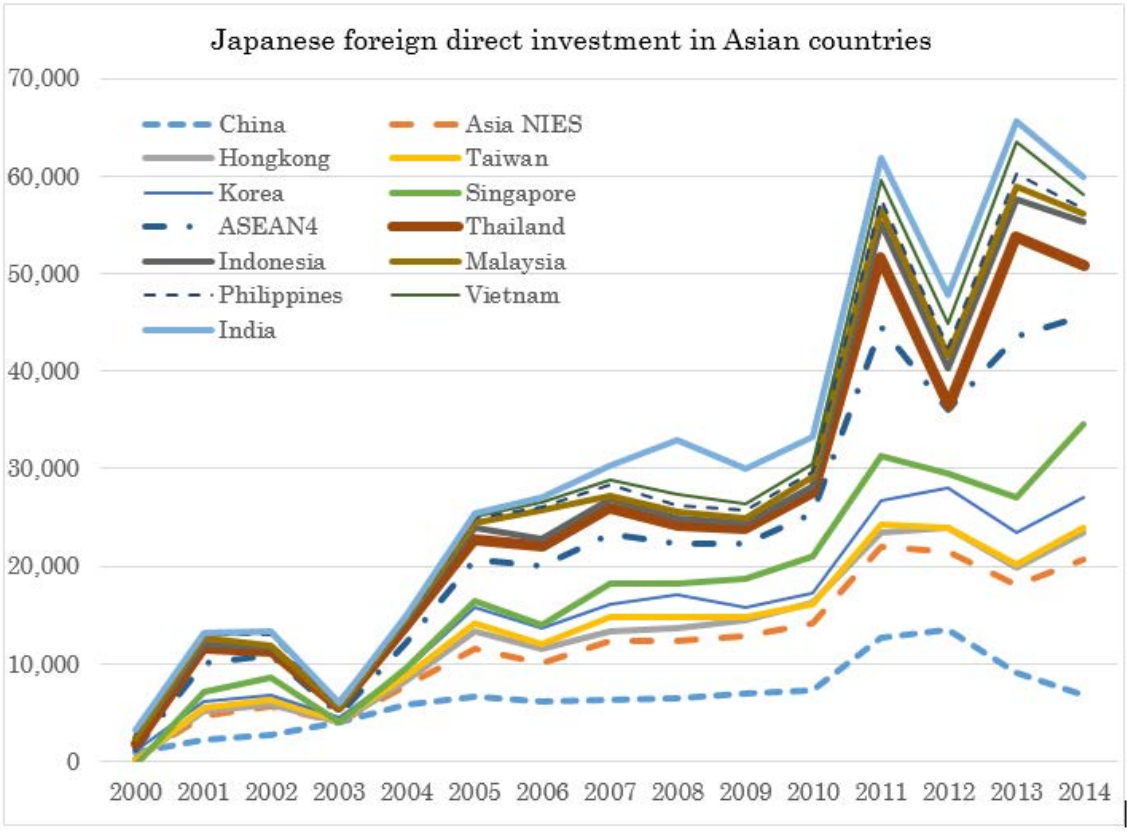


Figure 5-1 Japanese Direct Investment in the Asia

Source: Prepared by the Study Team based on Data by JETRO

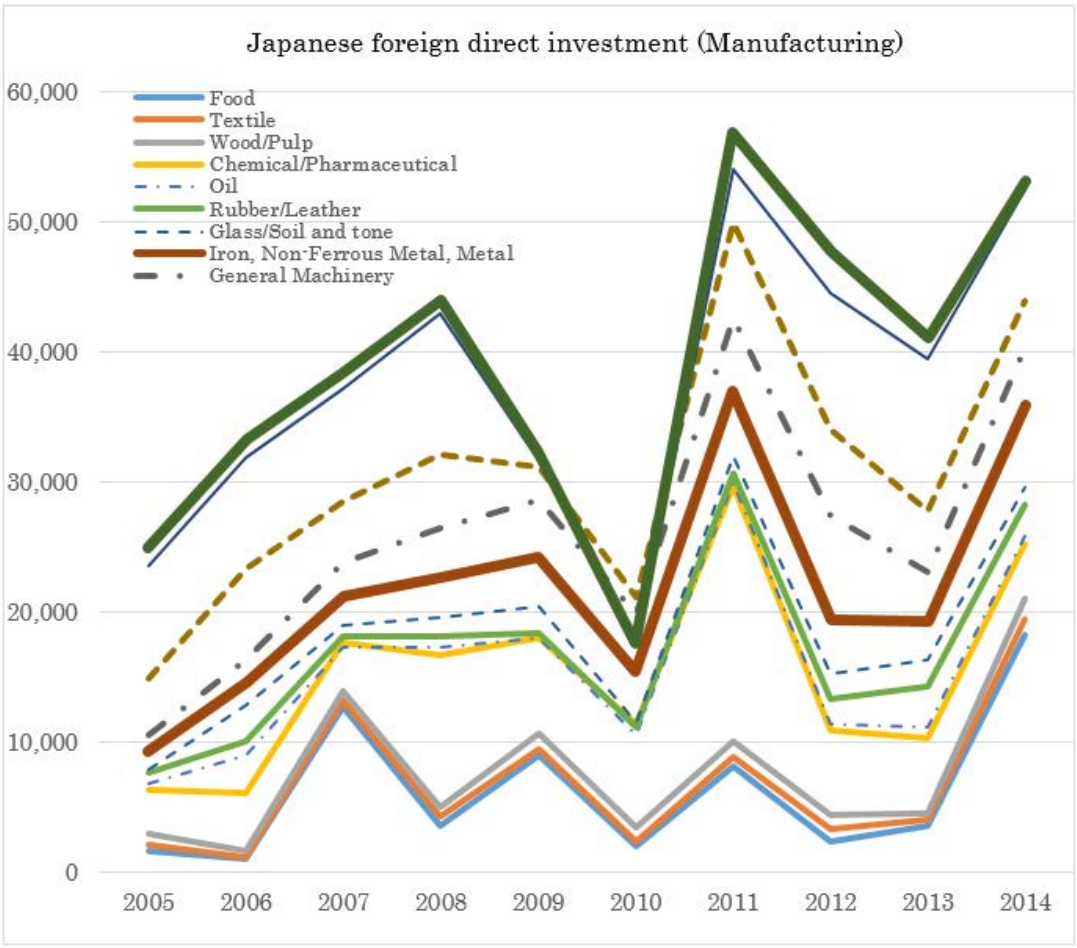


Figure 5-2 Japanese Direct Investment in Manufacturing

Source: Prepared by the Study Team based on Data by JETRO

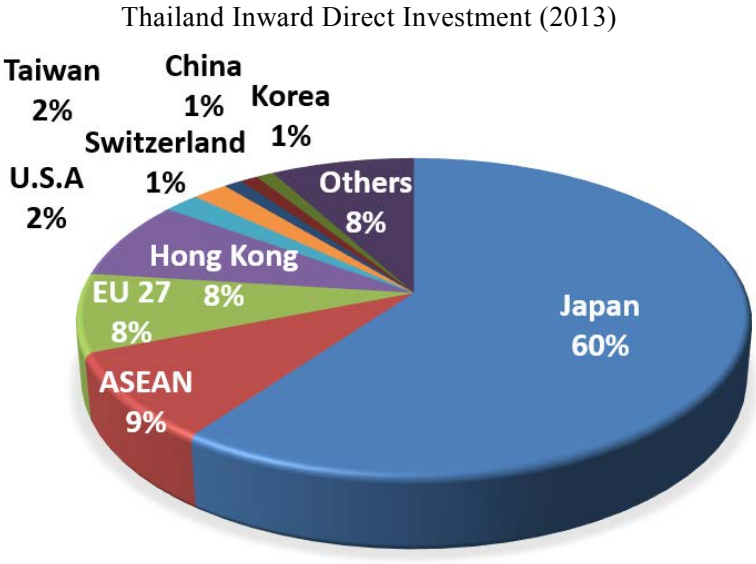


Figure 5-3 Inward Direct Investment, with BOI authorization, in Thailand (by country and region)

Source: Prepared by the Study Team based on Data by BOI

5.1.2 Trends of Factory Deployment in Eastern Thailand

As previously mentioned, Japanese foreign direct investment to Thailand remains large.

These trend in factory deployment in the Bangkok urban area (former BOI zone 1 and zone 2) is considered to be highly in a correlation with the GDP.

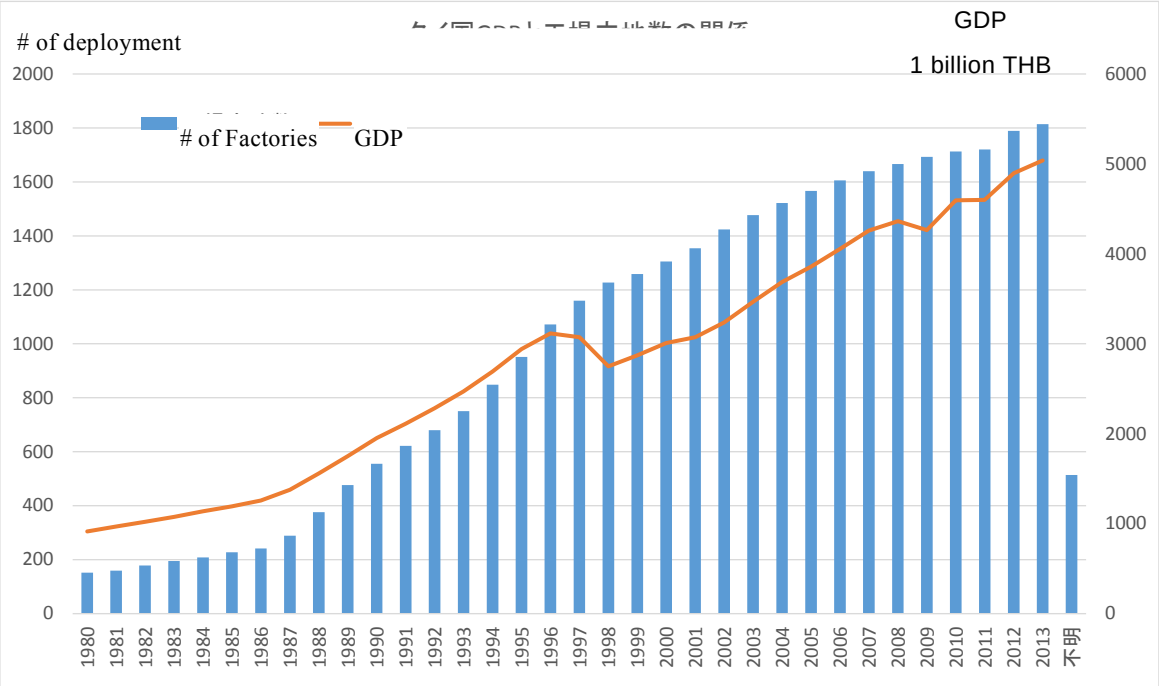


Figure 5-4 Relationship with Thai GDP and the Number of Factory Deployment

Source: Prepared by the Study Team based on GDP "IMF - World Economic Outlook Databases (April, 2015)", and the number of factories "FACTORY DIRECTORY in THAILAND 2014/2015"

5.1.3 Trends of Energy Consumption in Factories in Thailand

(1) Energy Consumption Trends in Thailand

The energy consumption rate in Thailand is increasing annually at 4.4%, and future power shortage are growing concerns (power demand in 2030 is projected to be approximately 2~2.5 times the consumption in 2013).

Power source in Thailand is currently highly dependent on natural gas, and the utilization of renewable energy has become a key political issue for the future.

For this reason, in the Power Generation Plan 2015 the government has raised to aim for implementation of an alternative energy, while estimating the fuel constitution for the future power generation and set a target rate for 2036.

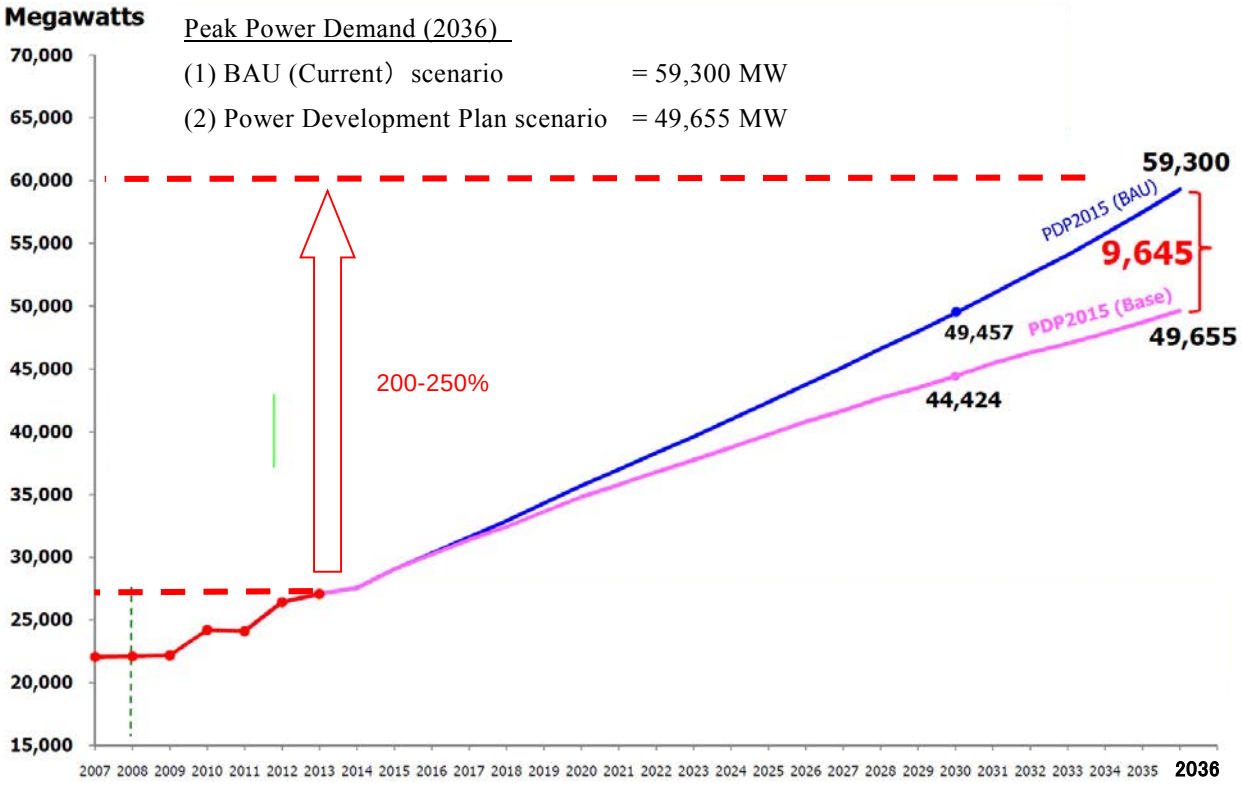


Figure 5-5 Power Demand Forecast in Thailand

Source: Prepared by the Study Team based on EGAT (Thailand's Power Development Plan 2015)

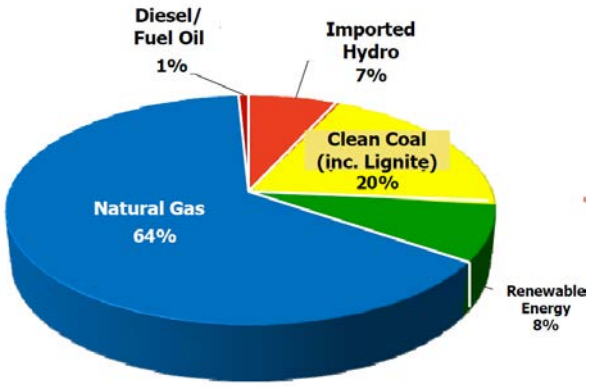


Figure 5-6 Current Generating Capacity by Fuel Type (2014)

Source: EGAT (Thailand's Power Development Plan 2015)

Type	Solar	Wind	Hydro	Mini Hydro (<12MW)	MSW	Biogas	Energy Crops	Biomass	Total
Installed Capacity 2014	1,298.5	224.5	2,906.4	142	65.7	311.5	-	2,541.8	7,490.4
Installed Capacity 2036	**6,000**	**3,002**	**2,906.4**	**376**	**500**	**600**	**680**	**5,570**	**19,634.4**

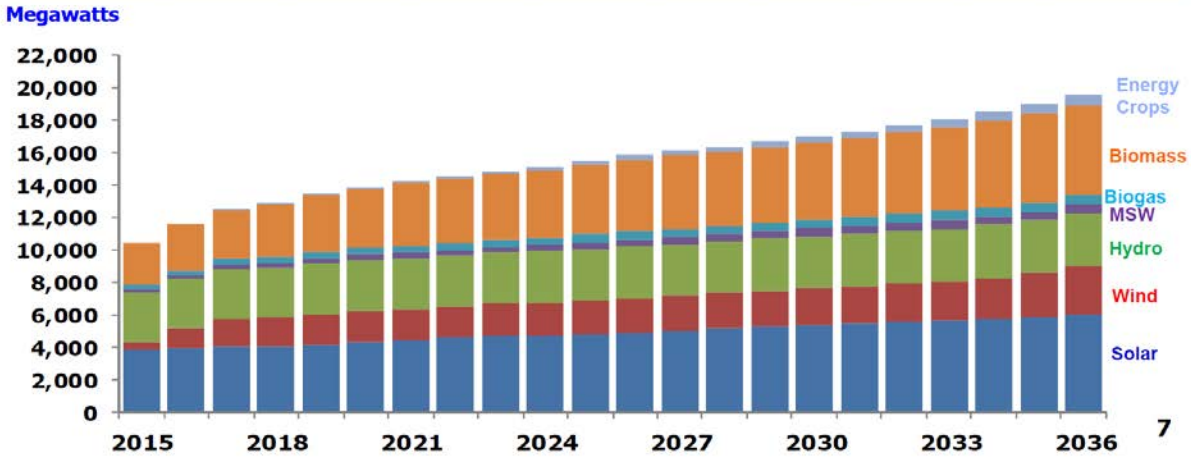


Figure 5-7 Alternative Energy Target

Source: EGAT (Thailand's Power Development Plan)

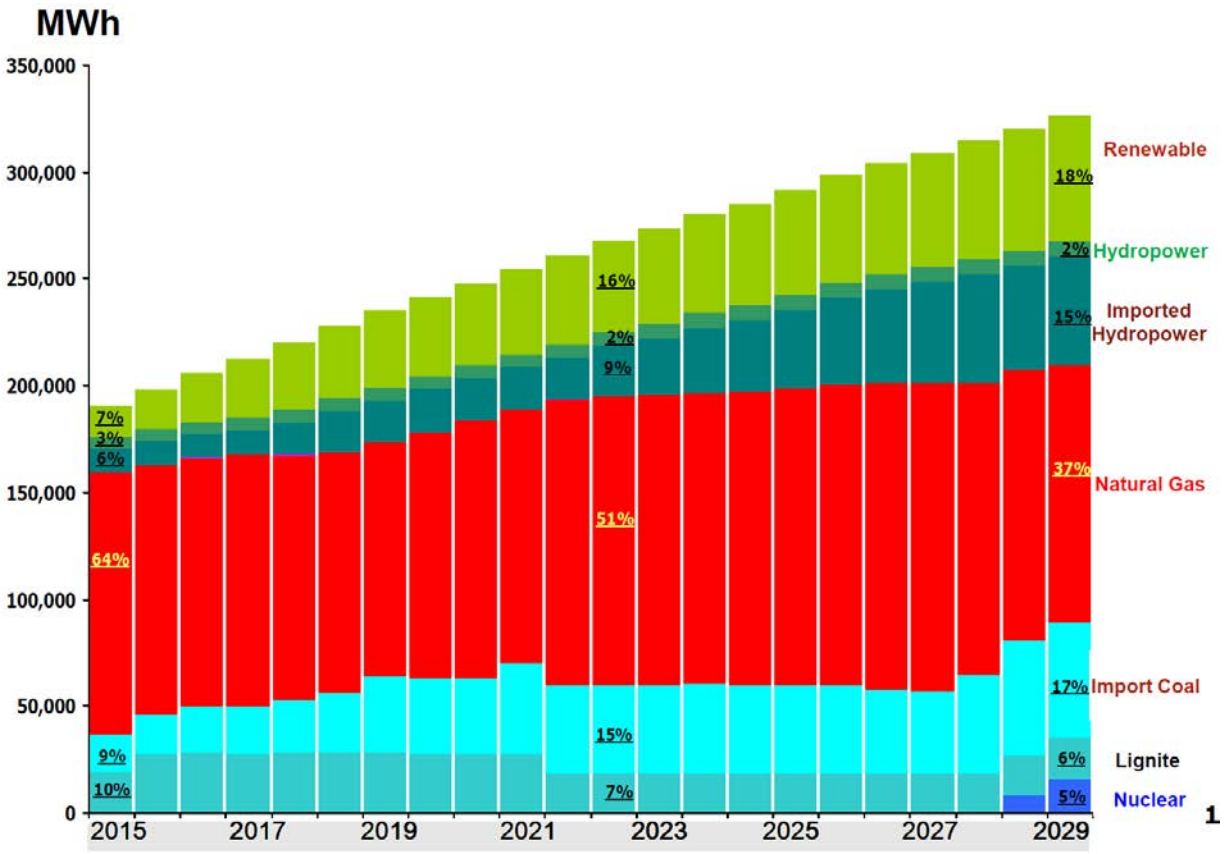


Figure 5-8 Fuel Mix by Energy Generation

Source: EGAT reference (Thailand's Power Development Plan 2015)

(2) Efforts and Policy to Reduce Power Consumption

For the promotion to increase the energy efficiency, the government set a specific energy efficiency policy and target value for each power sectors (government, residential, business, industry).

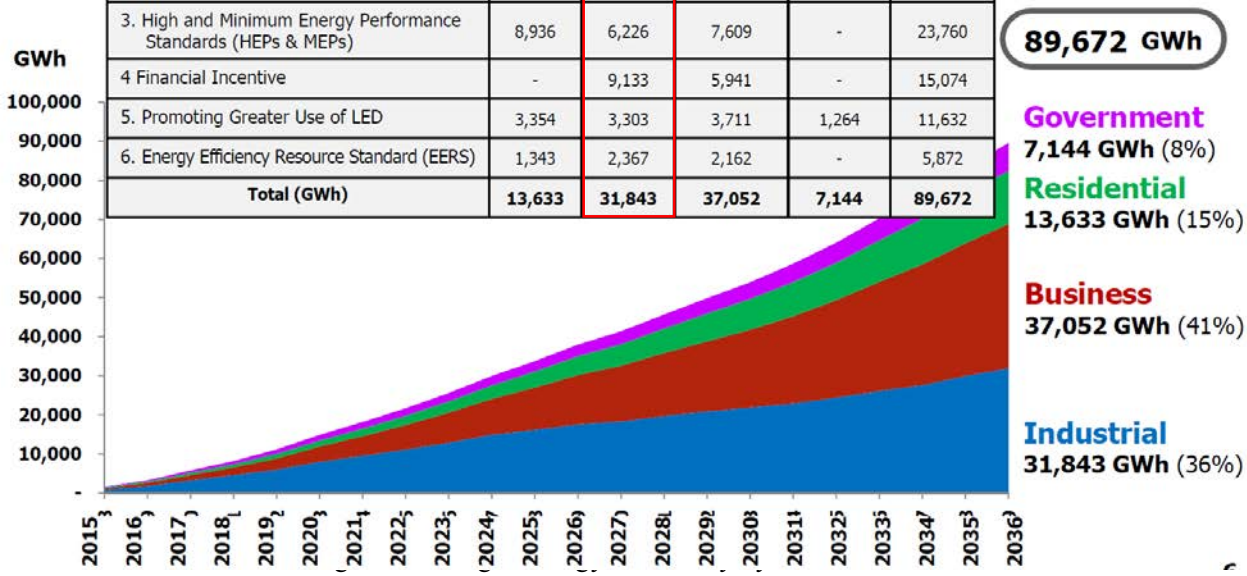
Specific policies in the industrial sector are:

1. Application of Energy Conservation Promotion Act (ENCON Act) on designated factory/buildings and specific energy consumption
2. Application of High and Minimum Energy Performance standards (HEPs & MEPs)
3. Financial Incentives

The policies above are set to reduce energy consumption by 31,843 GWh (equivalent to 36% of the entire energy efficiency).

From the above backgrounds, it is considered that the promotion of energy conservation in factories will progress in concrete terms under the initiative of the government.

Measure	Residential	Industrial	Business	Government	Total (GWh)
1. ENCON Act for Designated Factories and Buildings + Specific Energy Consumption	-	10,814	5,654	3,180	19,648
2. Building Energy Code (BEC)	-	-	11,975	1,711	13,686
3. High and Minimum Energy Performance Standards (HEPs & MEPs)	8,936	6,226	7,609	-	23,760
4 Financial Incentive	-	9,133	5,941	-	15,074
5. Promoting Greater Use of LED	3,354	3,303	3,711	1,264	11,632
6. Energy Efficiency Resource Standard (EERS)	1,343	2,367	2,162	-	5,872
Total (GWh)	**13,633**	**31,843**	**37,052**	**7,144**	**89,672**



Source: EGAT (Thailand's Power Development Plan 2015)

5.1.4 Current Status and Needs of Factories in Thailand

Interview survey with targeted companies and factories were conducted during the project to identify current status of facilities and needs of factories in Thailand. The result of interview survey is summarized in this section.

■Current Status of Facilities and Needs for Services

<Energy Service>

- There is insistent demand for stable power supply, especially for countermeasure against momentary outage and voltage decrease. However, budget for countermeasure against the momentary outage is depends on scale of negative impact to factory and frequency. It seems that needs for stable power supply and countermeasure against power problems decreased due to recent improvement of power supply status.
- Industrial estates managed by IEAT or major developers have stable power supply provided by SPP. Such industrial estates have less demand for stable power supply.
- Number of factories which require heat and stable power supply is limited. In addition, power heat service can be supplied to limited area due to accessibility to the gas pipeline.
- There is demand for cold water supply and regional cooling system. However, those system should be planned from early stage of development.

<O&M Services>

- Facility equipment of each factories are second-hand equipment brought from Japan and many are used for a long period of time through maintenance.
- For the last few years, needs for energy conservation has increased and many factories have been taking energy conservation measures such as replacements to LED.
- Needs for the services proposed by the study team are considered to have needs, since Japanese companies have high reliability on Japanese manufactured goods.
- High needs for water quality measures.
- Major companies in the industrial estate already have services operated by an affiliate company. Services proposed by the study team is believed to target SME factories.

(1) Concept on Selecting Company, Factory and Utility Facility

To select the target companies and factories, the Survey Team aims to boost confidence in establishment of business. For Thai companies, the Survey Team contacted with factories in Map Ta Phut Industrial Estate gathered by IEAT invitation, industrial association introduced by NESDB, and other related governmental administrations. For Japanese companies, the Survey Team basically contacted with companies introduced by member companies, and approached to companies based on general database. Particularly, companies belong to industry using electric machines and companies in unstable power supply are handled as important targets.

To select target utility facilities, non-special equipment and general equipment which can be operated and maintenance by outsourcing are selected; such are industrial infrastructure, generation facility, substation facility, social infrastructure for generation, power electronics facility, and other facilities except production line.

(2) Target Utility Facility

Target utility facilities based on concept in (1) are as shown in below figure.

- Power Generator
- Heat Supply(Boiler／Other)
- Voltage Transformer
- High Voltage Incoming Panel
- Switchgear
- Uninterruptible Power Supply (UPS)
- High Voltage Inverter
- Rotating Machinery
- Compressor
- Air Conditioner
- Lighting Equipment

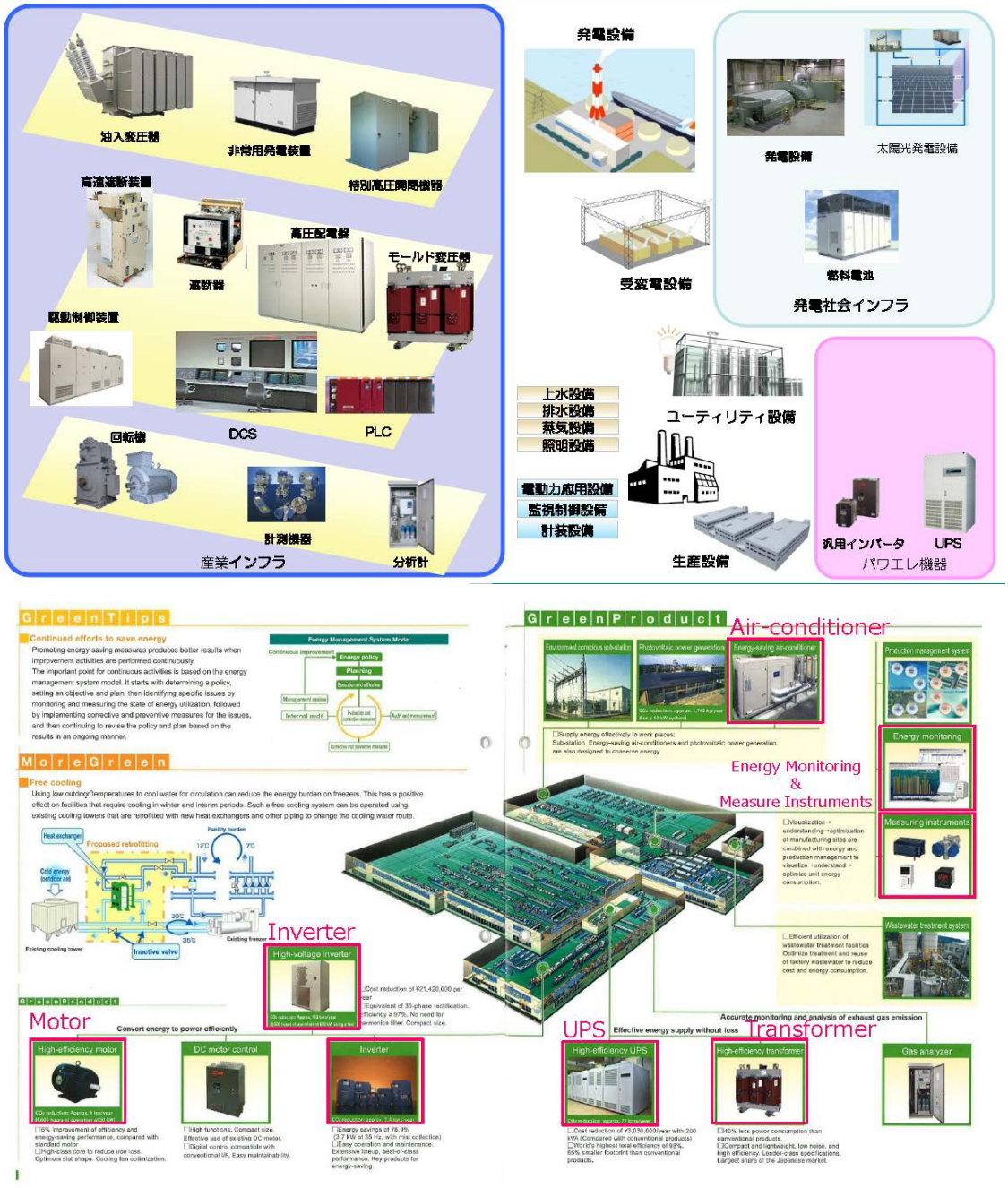


Figure 5-10 Target Utility Facilities

(3) Result of the Interview Survey

1) Current Status of Factory Equipment

- Although the equipment have been used for over 10 years, they intend to continue use by overhaul. (Japanese company)
- 20 years have passed since beginning the operation of the equipment, and requires thorough attention. Antiquated control panel has suddenly caught fire in the past. Control panels need to be replaced every 5 years. (Japanese company)
- Boilers frequently fails. Although the diesel boiler was only replaced by the LPG boiler approximately 4 years ago, failure caused by the ion-exchange water started to emerge. Wishes to renew the equipment due to maintenance difficulty. (Japanese company)
- Replacement time of the voltage transformer is approaching. Currently use old production equipment previously used in Japan. (Japanese company)
- Air compressor and chiller are antiquated, and especially the chiller needs to be replaced this year. Oil transformer will also need replacement as well. Japanese equipment are usually chosen. Used equipment from Japan are transferred to be used in Thailand. (Japanese company)
- The sintering furnace brought from Japan has been used for over 20 years. For heat recovery other equipment will also need to be replaced. Equipment have not been changed since the establishment of the company. (Japanese company)
- There are 65 air conditioners, however there are almost no invertors installed. The air conditioners makes up 30% of the entire consumption. (Japanese company)
- Companies from Japan brings old model machines along. BOI impose customs on import of equipment over 10 years. (Japanese company)
- There is one paint (color) line per factory. Machineries were brought from Japan, whilst utility equipment were newly purchased. (Japanese company)
- The invertor at the coil center used for 10 years had a failure. Received a response that the inventor and motor used after approximately 7~8 years fails. (Japanese company)
- Old air conditioners used. Considering replacing with invertor air conditioners. (Japanese company)

2) Understanding the Needs

<Needs for O&M Cost Reduction>

- O&M cost makes up 10~15% of the entire manufacturing cost, and there is a need for measures to reduce this percentage. (Japanese company)
- Although interested in receiving services including operation lease and function services, decision is dependent on the price, reliability and response speed upon occurrence of issues. (Japanese company)
- Boilers were replaced by LPG boilers 4 years ago, which was able to generate full payout in one year. (Japanese company)
- Under the regulation by headquarter, payout time is set to two years. (Japanese company)
- Maintenance of utilities beside production equipment are contracted to a Japanese maintenance company. (Japanese company)

<Needs for Energy Conservation>

- Electricity fee is on the rise. Interested in energy conservation from the aspect of cost reduction. (Japanese company)
- Visualization of energy consumption is not enough, it will be better if power-saving effects can be expected. (Japanese company)
- Electricity fee is gradually increasing. (Japanese company)
- Implementation energy-saving efforts such as changing to LED, has enabled approximately 20% improvement. (Japanese company)
- Japanese-level energy conservation has already been achieved, and will not be needing any replacements of equipment. (Japanese company)
- Lighting facility have been replaced with LED, and the power consumption has been reduced to 75%. Water spray system has been installed on a couple of air-conditioning equipment to test the energy-saving effect. (Japanese company)
- Lightings have been replaced to LED, and was able to reduce electricity fee by 14~15%. (Japanese company)

<Need for Countermeasure against Power Failure>

- Power failure rarely occurs. (Japanese company)
- Power failure occurs 5~6 times a year. Although power failure damage is not few, implementation of in-house power generation has been considered before. (Japanese company)
- Since majority are computer controlled industries, even a momentary stop can cause a serious matter. Proposing implementation of UPS to factories to allow a response in 10~15 minutes. (Thai company)
- Even if there are a few power failures, some products have a month worth of stock, therefore will not cause much issue. (Japanese company)
- Power failure occurs frequently, and transformer accidents occur frequently by lightning during rainy seasons. The longest time of power failure up until now is 8 hours. (Japanese company)
- Power failure measure depends on B/C. (Japanese company)
- Power failure occurs frequently including momentary failure due to lightening. Since the production of electronic circuits are automatic, even a momentary failure can be a great influence. (Japanese company)

<Needs for stable Water Supply>

- The water quality of the water supplied to the factory is unstable. There are times when the water supply from the industrial estate stops. (Japanese company)
- The water at Amata Nakorn Industrial Estate is extremely dirty. Therefore, the water is purified within the factory. (Japanese company)
- Water in Thailand is hard, and adjustment with the water and maintenance has not gone well. Factories with ion-exchange equipment are facing the same issue. (Japanese company)

・ The most critical issue is the water. There are no distinction between industrial water and drinking water. The water in Thailand will need to be demineralized. Pure water is used for cooling. (Japanese company)

<Other Needs>

・ Proposed services are useful at the establishment of factories. (Japanese company)

5.1.5 Trends of Infrastructure Service for Japanese Companies

Information collected during field study on cases where Japanese factories are receiving infrastructure service by outsourcing are summarized in this section.

■Summary of Trends for Infrastructure Service

・There are cases where the manufacturer are providing package services, including Energy Conservation instructions and maintenance contract.

・Needs for the infrastructure service was identified.

(1) Trends of Similar Services

Expert dispatched from Thai's Ministry of Energy visits the factory for free and provide energy-saving instructions for factories. (Japanese company)

・ Asked for advice from other companies on similar services. (Japanese company)

(2) Others

・ It is not a bad idea to target the services to Japanese companies. It may be difficult for non-Japanese companies considering the understanding of the services and the utilization of Japanese products. (Thai company)

・ Wish if there were a front company that provide support for Japanese companies, and can safely work on production activities. (Japanese company)

5.2 Demand Forecast

5.2.1 General Description of Demand Forecast

This section indicates the general description of demand forecast. Details on each demand forecast are referenced in the following section.

The demand forecast amount for the project has been estimated targeting the factories located within the industrial estate. Based on the result of interview survey, it seems that the service can make demands on factories' urgent needs through establishment of one-stop-service including selection, installation, maintenance, and update of facilities. Thus, the demand forecast was conducted with targeting related utilities such as substation facilities, electric transmission facilities, generation facilities, air conditioning and heat source equipment, and power units. This demand forecast was conducted based on estimated demand of the Energy Service, described in following section, and the Energy Conservation and O&M Service. On the other hand, as mentioned in 6-1-3, establishment of business

for the Smart Service seems difficult at this stage. Therefore, demand forecast on the Smart Service was not conducted.

For the estimation, after the macro demand forecast of the entire factories located within the industrial estate has been conducted, the demand amount has been refined according to the advantages of the project.

At the macro demand forecast, the yearly aggregate investment has been calculated by calculating the investment amount per employee by business sector (2007~2014 BOI total achievement) [9] and multiplying by the number of employees by business sector and by year of the effective sample factories [10]. According to the results, the utility facility investment percentage of the total investment has been set based on the results from the interviews (petrochemical factories: 10~15%, other factories: 20~25%). In addition, the facility replacement demand time (15~20 years from implementation of the facility) has been set based on the results from the interviews. Based on the results above, the total equipment replacement demand amount of the existing factories in 2016~2025 has been estimated to be approximately 121,000~154,000 million THB (approximately 405 billion~515 billion JPY).

Furthermore, for the facility investment demand by new factories, the number of factory deployment by industry and the number of employees up to 2025 has been estimated based on the factory deployment trend by business sector and the number of employee per factory by business sector for the past 5 years (2009~2014). Based on this estimation, the total facility investment amount of new factories up to 2025 has been estimated to be approximately 58,000~82,000 million THB (approximately 195 billion~275 billion JPY), by using the same method used for the total equipment replacement demand amount of existing factories.

By expanding these total demand amount of existing and new factories to the number of total factory deployment within the industrial estate in Thailand, the macro demand forecast amount has been estimated to be approximately 443,000~584,000 million THB (approximately 1.48 trillion~1.95 trillion JPY).

Then, the macro demand forecast amount has been refined by the conditions expected to be advantageous in the project. According to the results of the interview, the conditions expected to be advantageous in the aspect of factory scale are mid-sized factories (29.1% of the total) and Japanese capital input factory (48.7%). Also, for the conditions in the aspect of utility faculties, since the facilities targeted for the project are approximately 50% on value basis, the expected demand forecast amount that is advantageous for the project is estimated to be approximately 31,000~41,000 million THB (105 billion~138 billion JPY).

[9] Board Of Investment Foreign Direct Investment: Annually Statistics 2007-2014

[10] COMM BANGKOK CO., LTD.: Factory Directory In Thailand 2014/2015

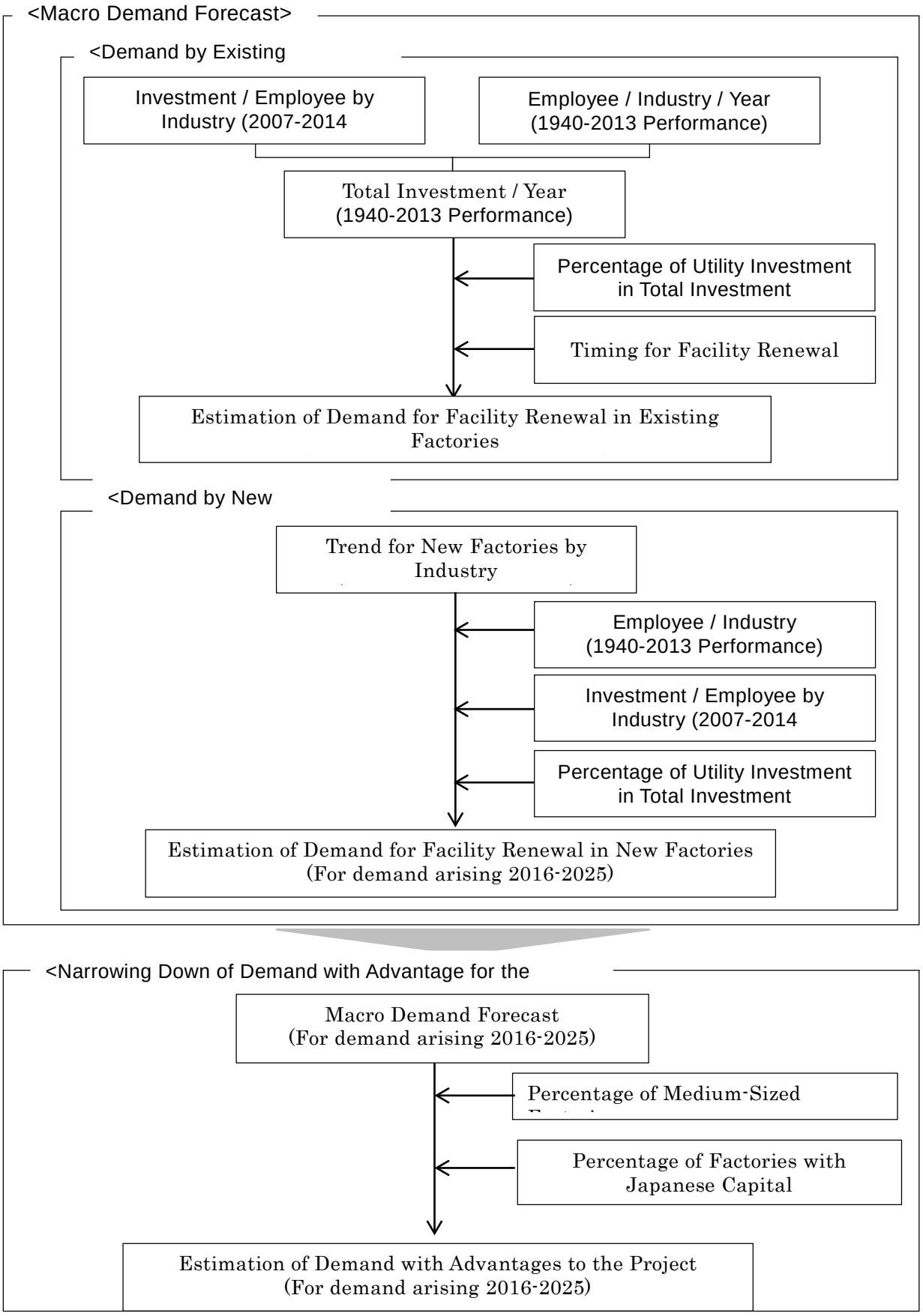


Figure 5-11 Demand Forecast Flow Chart

5.2.2 Macro Demand Forecast

In this section, the utility facility demand amount has been estimated for the entire existing factories in Thailand.

For the estimation of the facility replacement demand amount, two types of demand the facility replacement demand in existing factories and facility new implementation demand in new factory has been estimated.

(1) Demand Forecast of Existing Factories

The investment amount necessary to begin operation at an existing factory is 0.7~39.7 million THB per employee (by 24 business sector) (2007~2014 BOI total achievement). The existing factory investment amount has been calculated by multiplying the number of employees by business sector and by year of startup of the existing factories (effective sample: 2,429 cases). According to this calculation, the estimated investment amount to the existing factories since 1995 is 1,088,513 million THB.

Based on the results of the interview with factories, the percentage of utility facility investment in the total investment amount of factories are 10~15% at petrochemical industries, and 20~25% at other factories. Since petrochemical industries requires large investments for the installment of dedicated plant for production (etc.), utility facility investment amount trends to be relatively low.

In addition, the replacement period of utility facilities shall be 15~20 years, based on the results of the interview with factories. The replacement period do not differ greatly between business sectors since the facility details remains the same. Also, most of the factories are unaggressive about replacements to energy saving equipment, and trends to keep using the equipment used from the startup until the end of durable period.

Based on the basic information above, if the facility replacement demand is assumed to be the same level as the facility fee at startup, the estimated replacement demand amount from existing factories in 10 years between 2016~2025 is 121,112~154,237 million THB (approximately 405 billion~515 billion JPY).

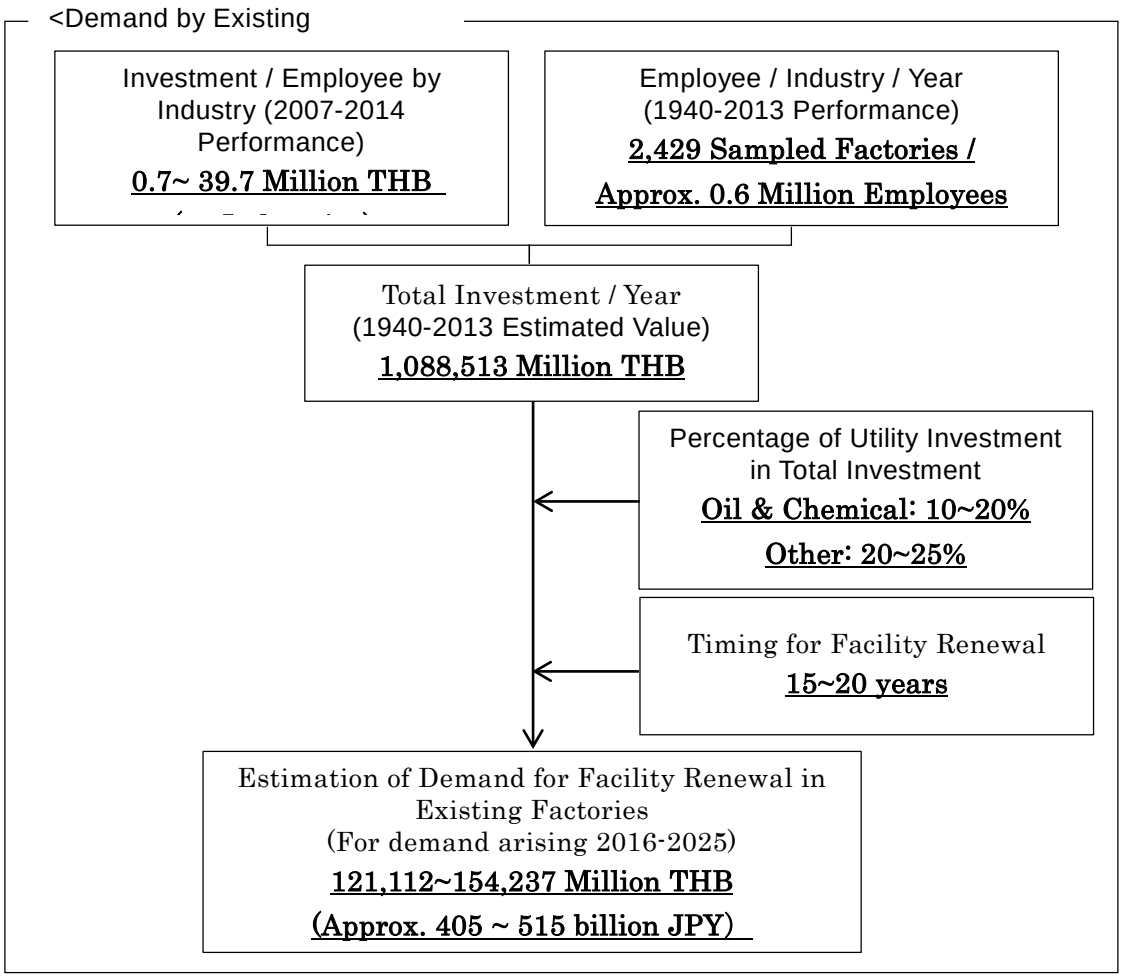


Figure 5-12 Demand Forecast Flow Chart for Renewal at Existing Factories

(2) Demand Forecast of New Factories

Among the effective sample factory, the number of new factory deployment in the past 5 years has been 153 cases, and there are approximately 30 cases of new factory startup annually. Samples from 2014 has been exempted due to the rising trend by the accelerated deployment from the BOI benefit changes.

Based on the data from effective sample factories, the average number of employee per factory of each business sector has been calculated. In addition, the investment amount per employee at startup of each business sector and the percentage of utility facility cost in the total investment amount at startup has been set to the same value as the (1) demand forecast of existing factories.

Based on the basic information above, the facility investment demand forecast amount of new factories has been estimated by multiplying the product of the number of average employee per factory of each business sector, investment amount per employee at startup of each business sector, and the utility facility cost percentage in the total investment amount, to the percentage of new factory deployment in the number of existing factory. As a result, the new factory demand amount up to 2025 estimates to be 58,404~82,167 million THB (approximately 195 billion~275 billion JPY).

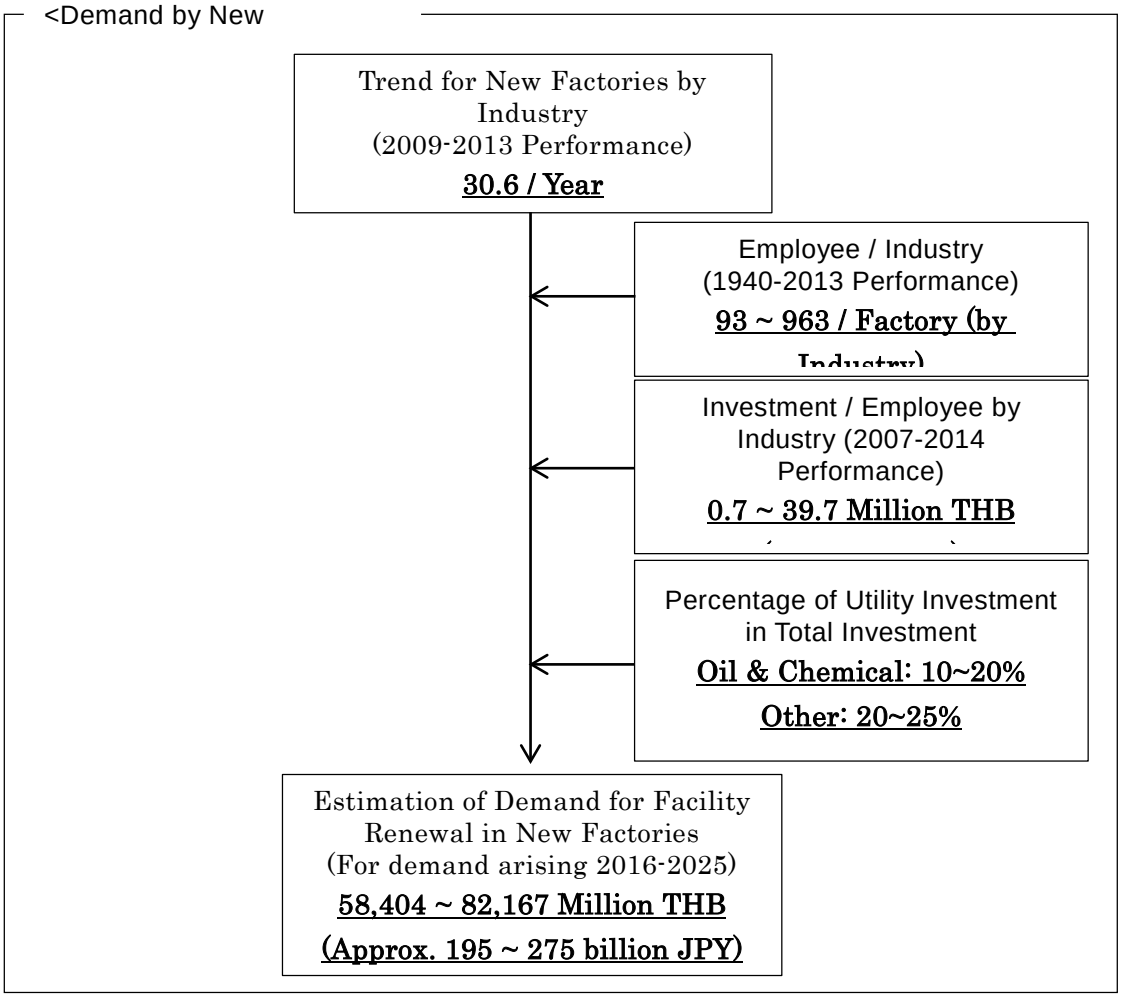


Figure 5-13 Demand Forecast Flow Chart for Renewal at New Factories

(3) Macro Demand Forecast Amount

For the Macro Demand Forecast Amount, the estimation has been conducted based on data of effective sample factories (2,429 cases).

Since the number of factories located in an industrial estate in Thailand (industrial estates managed by both IEAT and private companies) are said to be 6,000~7,000 cases, the estimation has been calculated by the minimum value 6,000 factories when expanded.

As a result, the cumulative total macro demand forecast amount up to 2025 has been estimated to be 443,303~583,918 million THB (approximately 1.48 trillion~1.95 trillion JPY).

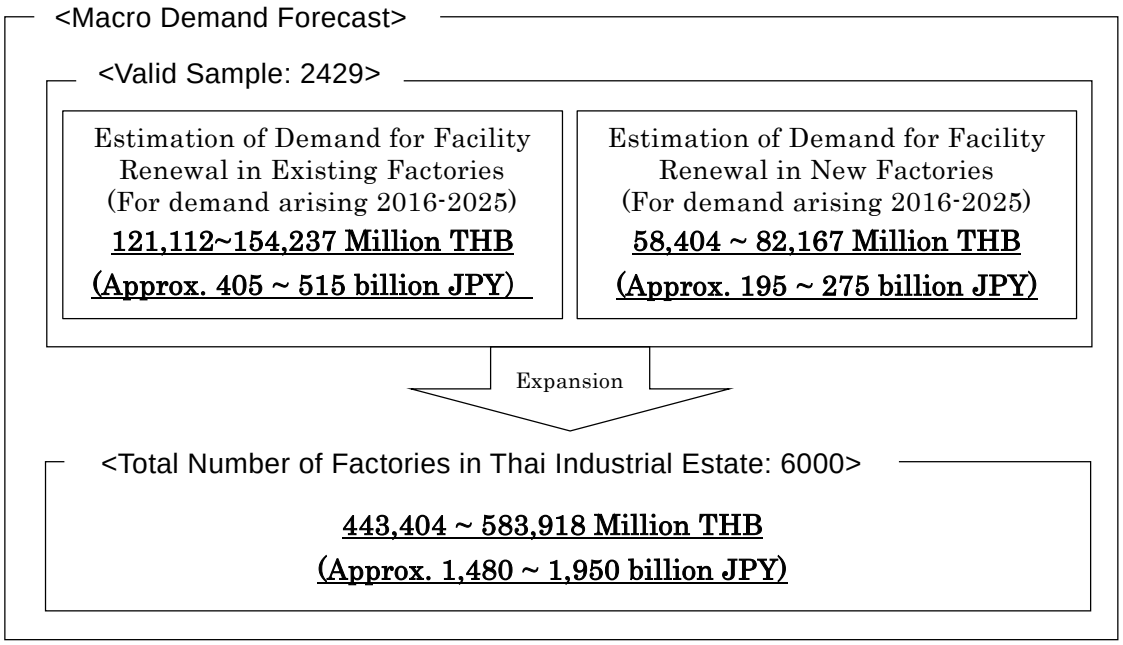


Figure 5-14 Result of Macro Demand Forecast Amount

5.2.3 Forecast of Demand with Advantages to the Project

In this section, the macro demand forecast amount has been refined to the demand amount with advantages for the project, based on the results of the interview with the factories located in Thailand on needs.

(1) Narrowing Down of Demand by Scale of the Factory

According to the results of the interview with the factories, there are large scale business operators that has secured their own designated maintenance team or an affiliate company within the group that undertake a cross-sectional maintenance of facilities at each factory, therefore the demand for procuring lease businesses from an external entity including maintenance management of utility facility is believed to be low.

On the other hand, small-scale business operators are initial investment reduction-oriented, and although demand for lease business do exist at a certain extent, demand scale per company are small, and the operating cost of the facility maintenance management for the project is assumed to be excessive.

Based on the above, the factory scale that the project can expect advantages is considered to be middle-range investment amount (factories besides the top 20% and bottom 20% of the investment amount). This accounts for factory investment amount 155 million THB (approximately 520 million JPY) ~1,519 million THB (approximately 5.07 billion JPY).

The investment amount of the factories that applies to these middle-range investment amount accounts for 29.1% of the entire factory investment amount.

(2) Narrowing Down of Demand by the Origin of the Capital

According to the results of the interview with factories, the tendency of implementing Thai-made product on utility facilities is high due to the manageability by maintenance request to the dealership in Thailand. For this reason, the advantages are considered to be assumed for factories with Japanese capital.

The number of Japanese capital factories in the effective sample factories are 48.7%.

(3) Narrowing Down of Demand by the Target Utility Facility

Target utility facilities for the project are mainly power receiving and transforming facility, conveyance facility, power generation facility, air conditioning/heat source facility, and power facility, and these utility facility investment accounts for approximately 50% of the total investment.

(4) Forecast of Demand with Advantages to the Project

As a result of refining the macro demand forecast amount based on the advantages for the project described above, the demand amount that is highly attainable for the project is estimated to be 31,482~41,458 million THB (105 billion~138 billion JPY). The demand scale is equivalent to approximately 7% of the macro demand forecast amount.

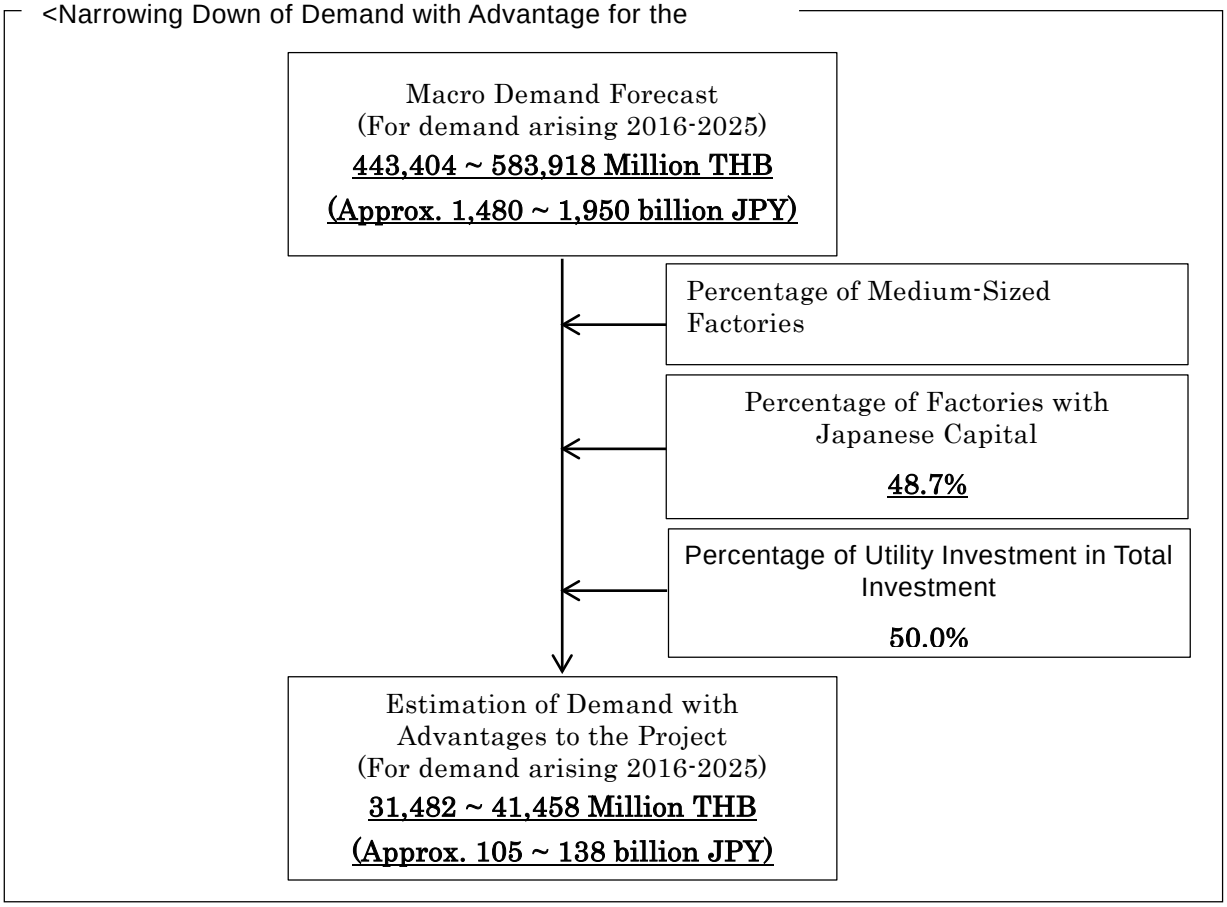


Figure 5-15 Demand Forecast Flow Chart for Demand with Advantages for the Project

5.2.4 Assumed Demand for the Project

In this section, assumed demand forecast amount in demand forecast amount based on the advantages for the project was calculated.

(1) Assumed Number of Factories to be Targets for the Project

Factories which may have demand for facility renewal in this 10 years, which were built from 1990 to 2010, and new factories will be the targets for the project.

Number of factories which may have demand for facility renewal was 1,627 in valid sample 2,429. Calculating this by ratio of number of factories in entire Thailand, 6,000 in lower prospect; it is assumed that 4,019 factories are expected to be the targets of the project.

In addition, number of new factories is expected to increase 30.6 factories in annual based on valid sample, 2,429 factories. Calculating this by ratio of number of factories in entire Thailand, 6,000 in lower prospect; it is assumed that approximately 756 factories are expected to be the targets of the project.

Thus, number of factories to be the targets of the project in coming 10 years is 4,775.

Particularly in this 4,775, middle scale factories (59.7% in total) which has advantage of the project and factories with Japanese capital (48.7% in total) were focused and calculated. As a result, number of factories to be the targets of the project was approximately 1,388.

According to the existing survey report, ratio of using lease equipment in facility investment is approximately 7~8% in Japan, and approximately 15% on the average in major 20 countries in the world. On the contrary, targeting on medium size factories which are the project objectives, ratio of using leased equipment in facility investment will be higher than in the aforementioned figure which includes large scale factories. Thus, it is assumed that the ratio of factories which are proactive to lease system with flat expense for facility renewal and purchase is assumed to be about 20% of approximately 1,388 factories which are the targets of the project. Based on the above assumption, the number of factories to be the targets of the project is finally forecasted approximately 278 factories.

(2) Assumed Demand Amount per Factory

Demand forecast amount based on the advantages for the project was 31,482 ~ 41,458 Million THB (105 ~ 138 Billion JPY). Thus, assumed demand amount for utility facilities per factory is calculated 22.7 ~ 29.9 Million THB (Approximately 77.5 ~ 99.5 Million JPY).

(3) Assumed Annual Demand Amount for the Project

According to above calculation, number of factories to be the targets with the advantages for the project is approximately 278; and assumed demand amount for utility facilities per factory is 22.7 ~ 29.9 Million THB (Approximately 77.5 ~ 99.5 Million JPY).

During the survey, operators who conduct similar business to the planned business, leasing business providing function to the factories, were not found. However it is assumed that there will be a limit to sales share ratio of this planned business due to effect from competitive operators which will be appeared after the start-up of the business. In addition, as a result of the interview survey, factories which are

proactive to have the services in the project are 20~30% of factories which are interested in the leasing business providing function to the factories. Therefore, annual sales share ratio will be approximately 30% considering establishment of sales scheme and network in Thailand. Thus, 8 factories with approximately 182 ~ 239 Million THB (approximately 600 ~ 800 Million JPY) will be actual annual targets for the project.

5.3 Development of the Project Concept

5.3.1 Energy Service

Aforementioned utility facilities targeted by the project (substation equipment, transport equipment, power generation equipment, air conditioning / heat source equipment and power equipment) are categorized as follows: substation equipment, power generation equipment and power equipment as "power supply equipment", air conditioning / heat source equipment and transport equipment as "heat supply and air conditioning equipment". Furthermore, power stabilization equipment for factories are required for stable and efficient operation of these technologies in Thai industrial estates situated in area with unstable power supply. The Energy Service will provide these utility facilities as an outsourced service.

The Energy Service business mainly provides optimum supply of electricity and heat by On-Site Power Generation Service (cogeneration), Air Conditioning Service, and Factory Equipment Service which is to replace factory equipment and to install UPS and Trans for the purpose of the energy conservation and the power stabilization.

The utilization form of the industrial estates in Thailand are private-owned factory or rental factory. Although, the provider of the Energy Service business will be targeted for both factory utilization forms, the content of the service provided will be selected according to the factory utilization form. The following indicates the relationship of the Energy Service business with the factory utilization form.

Table 5-1 User – Service Relationship for Energy Service

Service Detail	Service Period	Private Factory	Rental Factory
Cogeneration	Long-term use of over 10 years is required to recover capital investment on the servicing side	Long-term contract as in-house factory infrastructure	Since rental factory are updated 3-year cycle, long-term contract will result in cancellation risk
Air conditioning	Long-term use of over 10 years is preferable to recover capital investment on the servicing side	Although it depends on the production process, high possibility of long-term contract	Construct a service menu that corresponds with the cycle of rental factory
Factory Equipment Service	Long-term use of over 10 years is preferable to recover capital investment on the servicing side	In-house factory infrastructure will be stabilized and will be a long-term contract	Construct a service menu that corresponds with the cycle of rental factory

The following indicates the general description of the Energy Service.

(1) Optimum supply of Power and Heat by On-Site Power Generation

The On-Site Power Generation Service will install cogeneration to the target factory site owned by the business, and supply power and heat to the factory site. Although the On-Site Power Generation Service basically targets the supply of each individual factory, the service target may provide cogeneration to the adjacent factory if the local factory requests for multiple supply.

(2) Air Conditioning Service

The Air Conditioning Service is a service which implements air-cooled/water-cooled chiller, turbo refrigerating equipment, and absorption refrigerating equipment of the air conditioning equipment into the factory site. In addition, the Air Conditioning Service include the parallel implementation of heat source equipment, such as boiler and cogeneration within the service range as extended business.

(3) Factory Equipment Service

The Factory Equipment Service is to conduct the energy conservation of factory facilities and the optimum supply-demand control of power used within the factory which are to contribute to the stabilization of operation by power supply stabilization, such as improvement of power supply quality and instantaneous voltage drop (power failure), and reliability improvement. The cogeneration optimum control system will be conducted for the heat and power supplied by cogeneration.

For revenue structure of the Energy Service business, the On-site Power Generation Service charges for the power and heat energy usage, the Air Conditioning Service and the Factory Equipment Service charges for the usage of equipment implemented, and services will continue to be provided over the service life period of the equipment.

Since the introduced equipment are not owned by the factory and are possession of the Energy Service business side, the merit of these Energy Service business for factories are being able to outsource the equipment and operation, thus saving initial investment cost, receiving high-quality service, improving the management resource, and saving on human resource.

5.3.2 Energy Conservation and O&M Service

The following indicates the concept of the Energy Conservation and Operation Maintenance Service business based on the needs and issues obtained from the interview with existing factories and industrial estate management entity. Similar to the Energy Service business, the main targets of this business are private-owned factories and rental factories located in the industrial estate in Thailand.

Energy Conservation Service business is a service which studies the optimum energy conservation plan through energy conservation diagnosis of factory facility equipment, and providing energy conservation by leasing high-efficiency energy conservation equipment. In the future, this service is prospected to provide the Comprehensive Energy Diagnosis Service by utilizing the Cloud Factory Energy Management System (FEMS).

Operation Maintenance Service business is a service which implements high-efficiency equipment and conducts the operation maintenance service of these facility equipment.

According to the issues and needs of factories, the business operator will propose the optimal solution by combining several of these services, and the service contents will be determined by discussions with the factory.

Table 5-2 Concept of the Energy Conservation and O&M Service Business

Category	Service Detail	Service Period	Service Target		
			Private factory	Rental factory	New industrial estate/factory
Energy Conservation	High-efficiency and Energy Conservation equipment lease	Over 3 years (temporary)	◎	◎	◎
	Comprehensive Energy Diagnosis Service by Cloud FEMS	Long-term (preferably over 10 years)	△	×	◎
Operation and Maintenance	Operation Maintenance Service (facility management of each factory equipment, operation maintenance of back-up power supply, etc.)	Over 3 years (temporary)	◎	◎	◎

◎ : Main target, △ : Possibility, × : Exempt, low possibility

The following indicates the general description of each Energy Conservation and O&M Service business.

(1) High-efficiency and Energy Conservation Equipment Lease Service

High-efficiency and Energy Conservation Equipment Lease Service is a service which lease high-efficiency and energy conservation equipment necessary at the private factories and rental factories. Specific target equipment are not production facility with a unique technology, target equipment are facility equipment that are common at general factory. Specifically, target equipment are high-efficiency energy conservation equipment that can be proposed by the Survey Team, such as motors, invertors, distribution board, electric transformer, and LED.

By utilizing the lease service instead of purchasing the equipment, the implemented factory can anticipate the realization of energy conservation, restrain initial investment, receive high-quality service, and reduce burdens such as labor involved in operation, maintenance and management.

The business operator will receive the lease fee as income from the implemented factory. On the other hand, the cost of purchasing facility equipment, stock management, transportation, compensation, etc., will occur. As described below, it is important that the lease fee is determined by profitability study based on lease period.

The assumed implementation timing differs depending on the operational status of the factory, however, the main target will be at construction of a new factory, occupancy to a rental factory, and renewal of antiquated facility, etc.

The following indicates the examples of high-efficiency and energy conservation equipment.

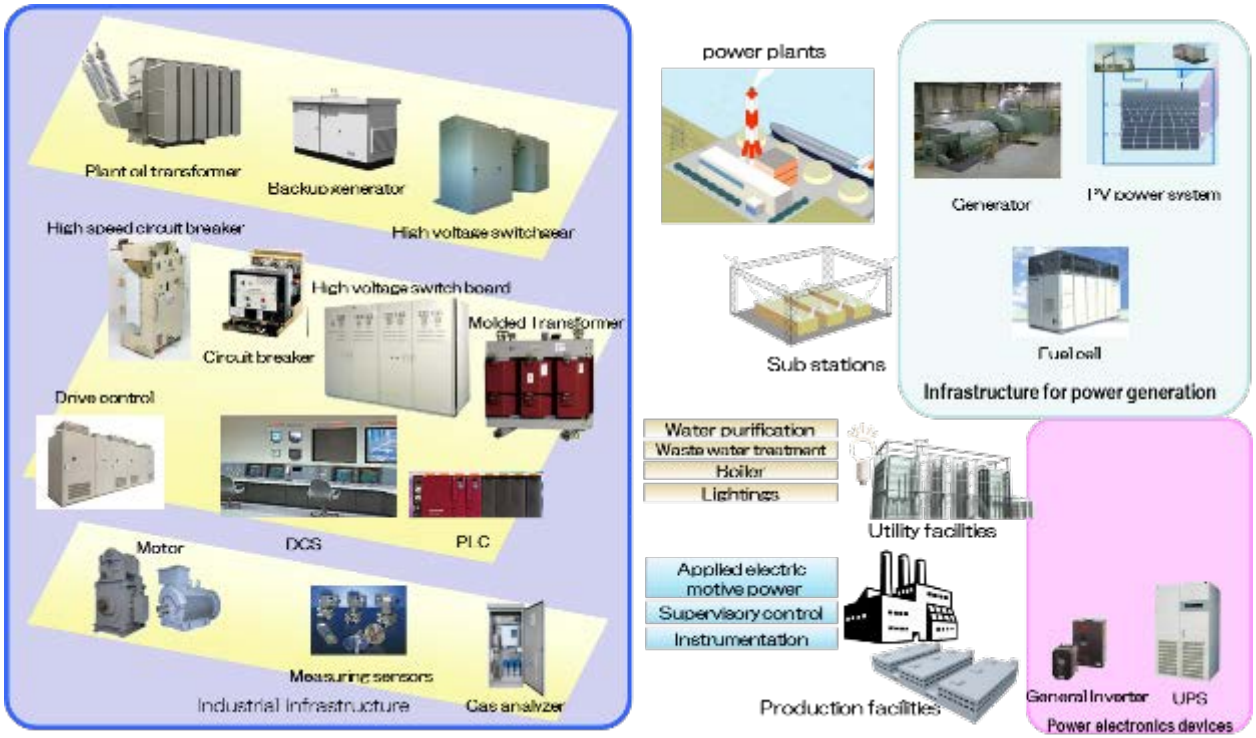


Figure 5-16 Examples of high-efficiency and energy conservation equipment

(2) Comprehensive Energy Diagnosis Service by utilization of Cloud FEMS

The Comprehensive Energy Diagnosis Service by utilization of the Cloud FEMS is a service which implements the management system by parallel use of the monitoring equipment and Cloud to the power consumption facility of the factory. System implementation requires a certain amount of implementation cost, and depending on the range and scale of the target equipment the initial investment may require a substantial amount.

By conducting service provision by lease, factories are able to restrain the initial investment while promoting energy conservation by optimizing the energy consumption monitoring and control of the entire factory (or parts), and anticipate the reduction of factory operation cost.

Timing for implementation timing is preferable at the construction of the new factory or at the development of a new industrial estate considering efficiency and cost of design and construction. Although existing private companies are potential targets, it will be important to propose and study implementation to the occupied factory parallel with the new industrial estate plans.

(3) Operation Maintenance Service

The Operation Maintenance Service which receives compensation for providing operation and maintenance services such as facility management and backup power supply to each factory. Specifically, this service selects the service providing equipment in the factory, and conducts maintenance management service aimed to optimize the operation of this equipment.

The business operator will cooperate with the local company responsible for the actual maintenance work, draw-up the maintenance plan for the target equipment, and provide necessary inspection and maintenance services.

The main target equipment are smart service target facility and high-efficiency energy conservation equipment described above, and Cloud FEMS system, however the service can target other existing factory facility equipment.

For factories, outsourcing the Operation Maintenance Service can anticipate the reduction of the equipment life-cycle cost while committing to the production process, and expect productivity improvement.

The following indicates the general description of the Energy Conservation and O&M Service business.

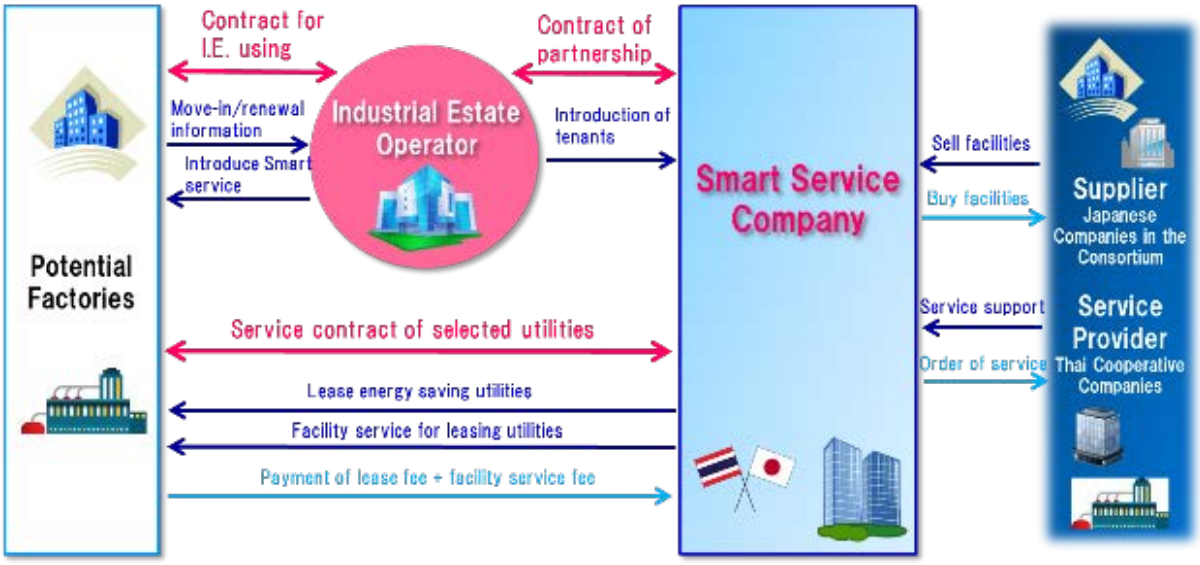


Figure 5-17 Concept of the Energy Conservation and O&M Service

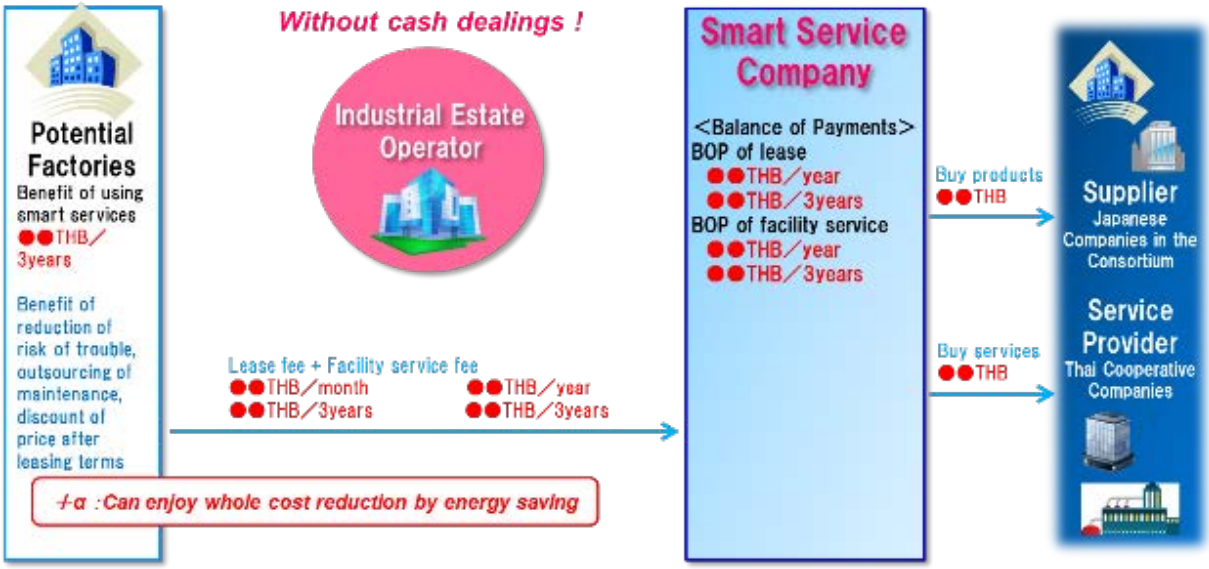


Figure 5-18 General description of Energy Conservation and O&M Service balance flow chart

5.3.3 Smart Services

(1) Transportation Service

Based on the current status and intensions in Thailand, the Transportation Service will propose a service that will assist problems such as traffic congestion of surrounding roads, companies commuter cost load, environmental burden, and energy loss, by the commuting traffic to the industrial estates.

Especially, this service will be devised from the following two points concerning the environmental impact caused by the automobile exhaust gas from industrial estates in Thailand.

- Implementation of Commuter Bus Service will reduce the number of vehicles and decrease traffic congestion and mitigate environmental load
- Improvement of energy efficiency of the commuter bus itself will mitigate environmental load

Based on the above, operate the service aimed for the moderation of traffic congestion, mitigation of environmental load, and realization of energy conservation by “smartization” of transportation, and as a result develop a scheme which can lead to the cost reduction of companies.

In order to devise services based on the above two points, in addition to understand the traffic and environmental circumstances in Thailand, organize the current status of the advanced vehicles in Japan.

1) Organize the current status and intentions of Thailand

a) Vehicle type

As of 2013, there are more motorcycles than automobiles in Thailand.

Among the automobiles, passenger cars and shared-trucks account for 86%, and buses are only account for 1%.

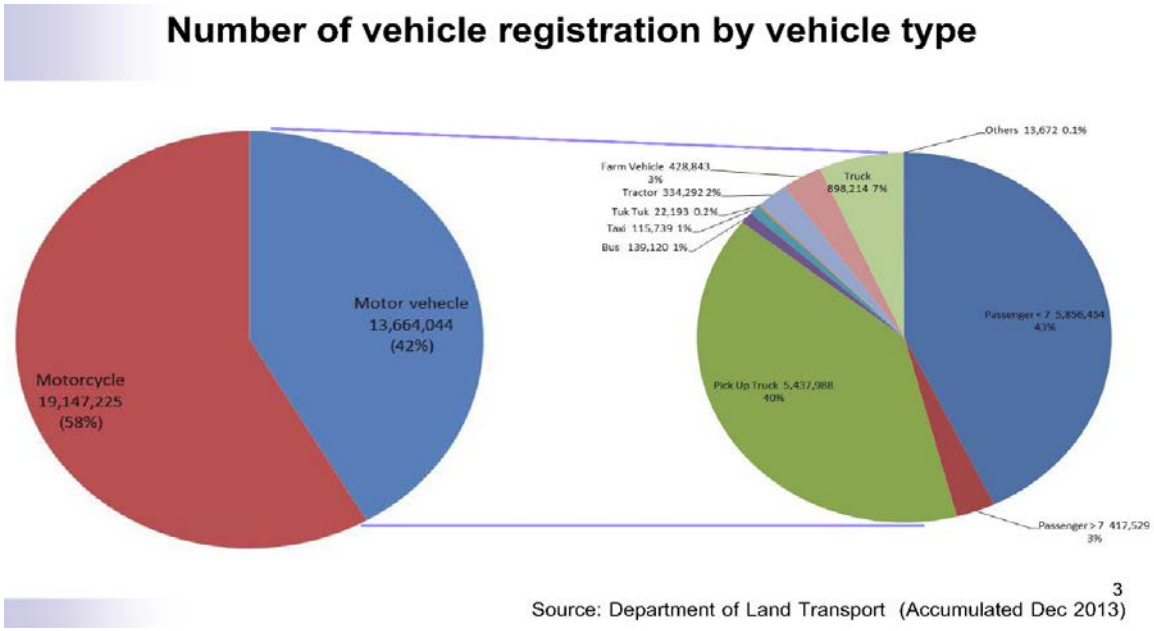


Figure 5-19 Number of vehicles and vehicle type in Thailand

Source: THAILAND AUTOMOTIVE INSTITUTE 2013

b) Fuel

Among the automobiles in Thailand, diesel cars account for 60%, followed by gas-fueled cars which account for 30%.

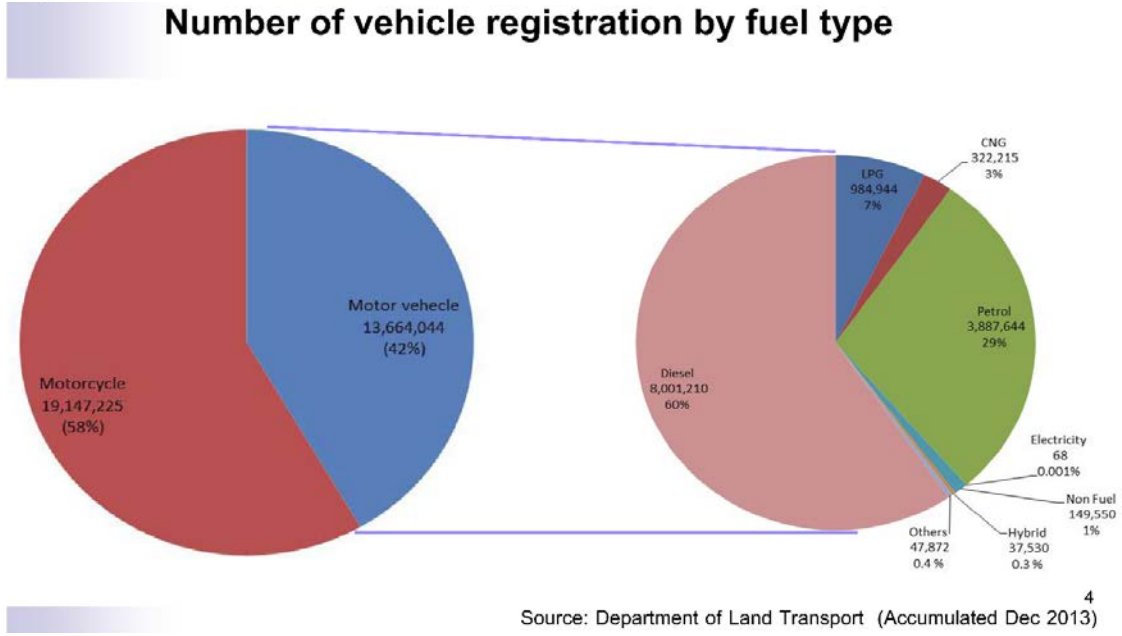


Figure 5-20 Automobile and Fuel ration in Thailand

Source: THAILAND AUTOMOTIVE INSTITUTE 2013

c) Trends of Automobile Production and Sales

Automobile production in Thailand are increasing year-by-year, however, the domestic sales is prospected to continue at the same level as the current sales.

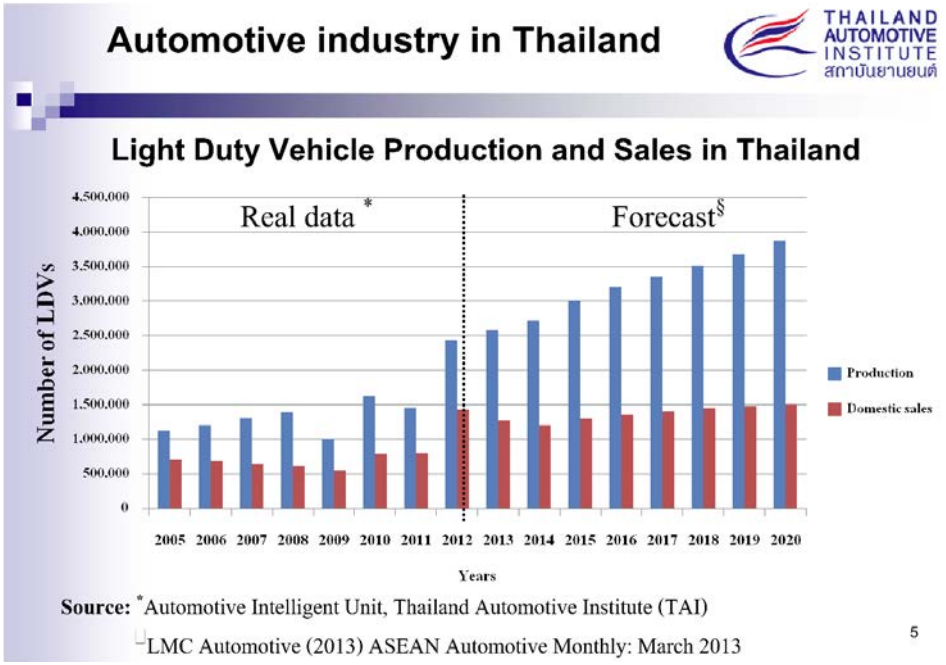


Figure 5-21 Automobile Production and Sales Prospect in Thailand

Source: THAILAND AUTOMOTIVE INSTITUTE 2013

d) Fuel Technology Trends

The future forecast of the automobile fuel technology in Thailand is expected to gradually increase the number of hybrid cars towards 2020.

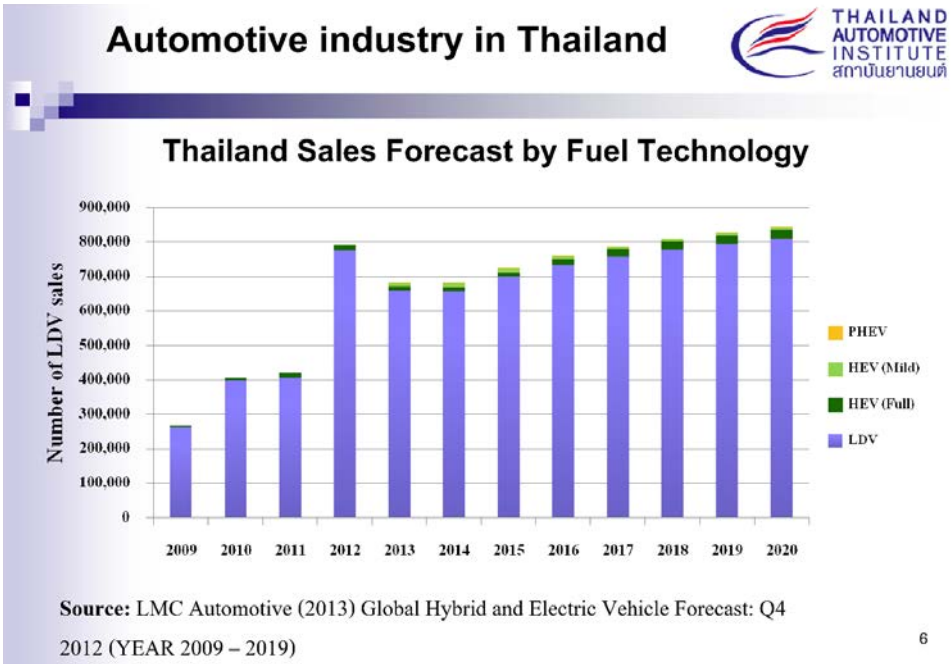


Figure 5-22 Fuel Technology Development Forecast in Thailand

Source: THAILAND AUTOMOTIVE INSTITUTE 2013

e) Energy Consumption Trends

Among the energy consumed in Thailand, transportation section prospected to accounts for 35% in 2011, 31% in 2030, and the reduction of consumed energy in the transportation sector is considered an important issue as environmental load and energy conservation measures.

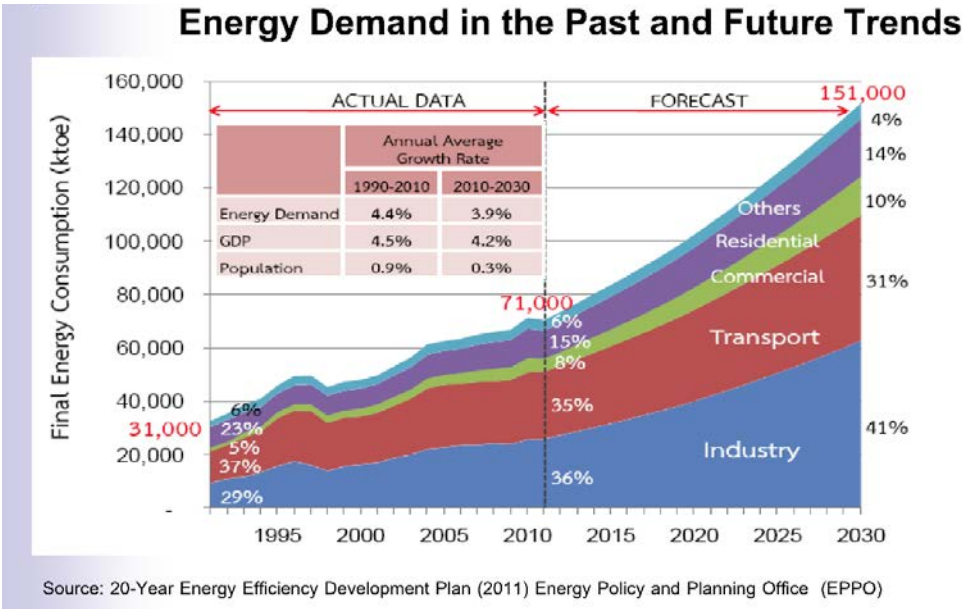


Figure 5-23 Energy Consumption trends in Thailand

Source: THAILAND AUTOMOTIVE INSTITUTE 2013

(2) Organize the current status of domestic FCV/EV

1) Current status of FCV and EV

a) On EV and FCV

FCV have the same level of function as gas-fueled cars, and compared to EV has a longer range and shorter fill time.

■Fuel Cell Vehicle is a type of vehicle which uses a fuel cell to power its on-board electric motor; fuel cells in vehicles create electricity to an electric motor, using oxygen and hydrogen. Fuel cell vehicle needs to fill hydrogen at hydrogen fueling station instead of gasoline at petro station for normal vehicle.

■Fuel Cell Vehicle has almost same functions as existing gasoline vehicle; and it almost reached a level of practical use. Fuel Cell Vehicle emits only water. Cruising range is over 500 km; and it is longer than EV. Charging time is approximately 3 minutes; and this is shorter than EV.

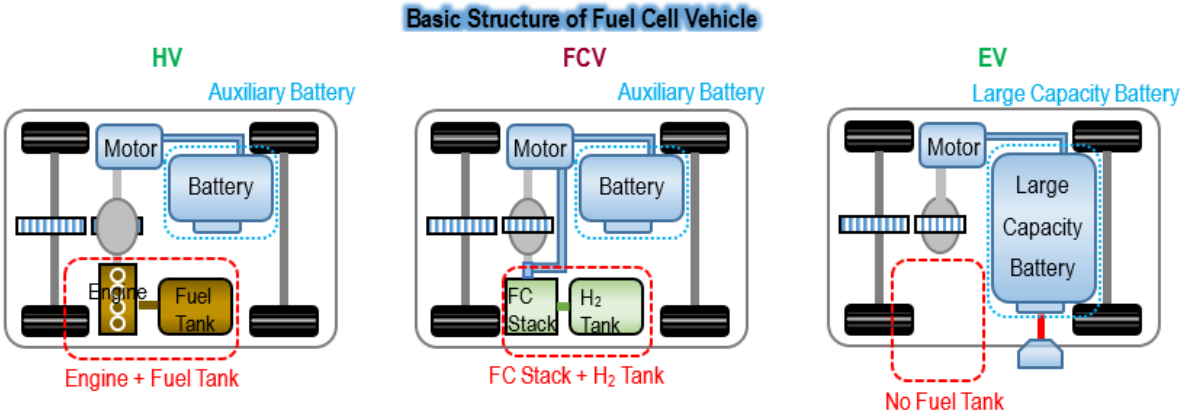


Figure 5-24 EV and FCV

Source: Fuel-cell Vehicles/ Ministry of Economy, Trade and Industry H26

b) Comparison of EV bus and FC bus Specification

The EV bus and FC bus each have advantages and disadvantages appear prominently in range and cost. Environmental performances of both EV and FC buses are extremely high compared to diesel cars.

Table 5-3 Comparison of EV bus and FC bus Specification

		EV Bus	FC Bus	Diesel Bus
Traveling Performance	Range	30 km ~ 80 km	About 160 km	About 300 km
	Recharge Time	3 minutes ~	12 minutes	-
	Fuel Efficiency	Daytime 26 JPY / km Nighttime 17 JPY / km	11 ~ 15 JPY / km * In case of passenger car	20 yen/ km * Diesel oil: 120 yen/ L Fuel Efficiency 6km/ L
Cost	Initial Cost (Vehicle)	80 million JPY	above 100 million JPY	about 25 million JPY
	Initial cost (Infrastructure)	1 ~ 10 million JPY	400 ~ 500 million JPY	100 million JPY
Environmental Performance	CO_2 emission (while running)	40 % reduction of diesel	60 % reduction of diesel	132 g/ km
	Exhaust Gas	zero-emission	zero-emission	NOx 0.9 g/kWh, OM 0.013 g/ kWh (in case of heavy vehicle)
	Quietness	Much quiet than diesel	Much quiet than diesel	-
	Performance in case of natural disaster	Possible to supply electric power	Possible to supply electric power	-
Sales Performance in Japan		Yes	No	Yes
Total	Merit	- Good environmental	- Environmental	

Evaluation		performance - Cheap running cost	performance bears comparison with EV. Traveling performance and performance in case of natural disaster is better than EV.	
	Demerit	- Short range - Expensive initial cost	- Very expensive initial cost - Expensive running cost in the present circumstance	

c) Future Market Forecast by vehicle types of the world

The International Energy Agency (IEA) again prospects future dissemination of the next-generation vehicles in "Energy Technology Perspectives 2012 (ETP 2012)".

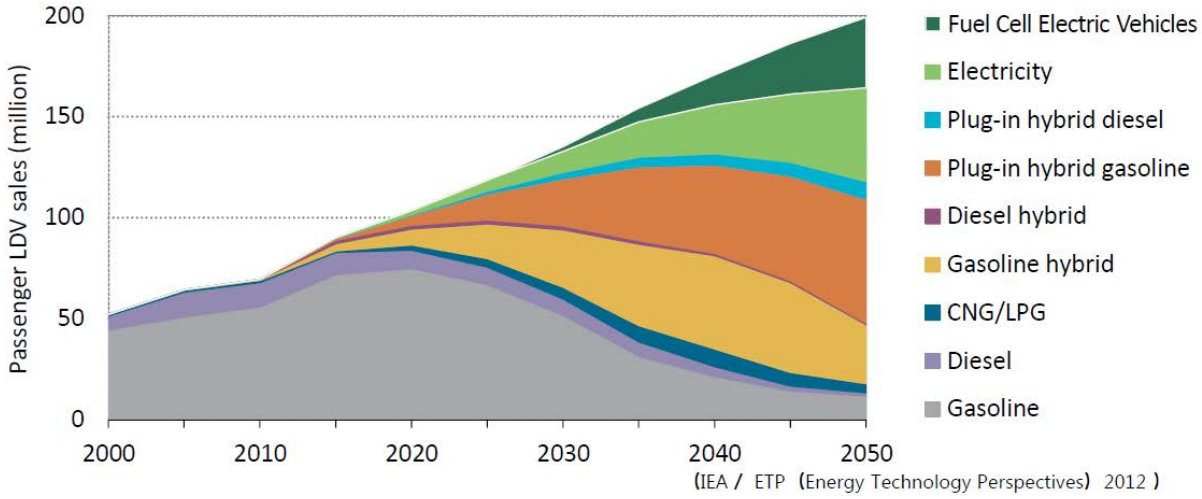


Figure 5-25 Future Market Prospect by vehicle types of the world (ETP2012)

Source: ETP2012

(3) Human Resource Development (Employee, Manager)

Reflecting the strong economic growth, the unemployment rate in Thailand is at a low level of 0.68% (JETRO Thailand Basic Economic Indicator). In addition, career change is frequently repeated according to working conditions such as salary and compensation package, and is currently difficult to secure the necessary human resource. For this reason, due to the advancement of foreign companies and increase of local companies, mainly Japanese companies expanding into the factory in the industrial estate cite the security of high-quality workers and technician by human resource development and training of managerial class workers as an issue.

The Human Resource Development Service will study the feasibility of the human resource development that individual companies currently cannot respond sufficiently. If effective education to work in Japanese companies can be acquired through inexpensive service, companies will be able to

improve the quality of the human resource without imposing a substantial cost. In fact, the prevalence of such services may enhance the quality of the human resource in throughout Thailand.

The study shall first target the training content for managerial class who can instruct the other employees and the training content of fundamental knowledge on business and work for new employees, then target the general education on energy conservation.

In addition, since the target industrial estates are far away from Bangkok, in order to provide the same quality training content at any factory, propose the remote distribution system (e-learning) which enable training according to each company's training content, individual's level and speed via the internet.

Education materials will digitalize the education materials on human resource development that has been used in Japan, and create videos of the lectures to remotely distribute as e-learning education material and video-on demand (VOD) contents. On this occasion, the education materials will be translated into Thai, to enhance the use of this program by employees without English education.

In addition, reflecting on how smart phones and tablets are already widespread among employees, this proposal will also promote the development of applications for these terminals. On this occasion, as an option, for employees without terminals, joint workshops, and moreover in order to further synergistic effect by the combination of e-learning and on-the job training, it is possible to set up a training room within the factory.

As the main point of the project, the application charges will be collected as a monthly fee from each industrial estate or factory according to the scale of the number of employees, the employees will be able to receive the e-learning service for free, and the learning conditions and achievements of each employees can be grasped centrally by the feedback to each factory, and can be used as reference for raise or employee assignment.

For the applications delivered to smart phones and tablets will be charged within the application, the company will not be established in Thailand, and will not receive certification based on the vocational education curriculum in Thailand, it is considered not to have any legal restrictions.

(4) Environmental Monitoring (air and factory drainage)

Among the target industrial estates, the project will target the proposal and implementation to the industrial estates that are managed by private entities [such as AMATA Corp. (Amata Nakorn Industrial Estate), Rojana Industrial Park PCL (Rojana Rayong Industrial Park), Pinthong Industrial Estate, etc.], the Map Ta Phut Industrial Complex with strict environmental monitoring conducted in compliance with the national environmental standards by IEAT are exempted from the project. Furthermore, Rojana Rayong Industrial Estate and Amata Nakorn Industrial Estate with mechanisms to report the Biochemical Oxygen Demand (BOD) contained in the factory drainage every 30 minutes to the MOI and water management systems by the industrial estate are assumed the proposal and implementation of the air quality field environmental monitoring efforts, Pinthong Industrial Estate that do not have these efforts developed are assumed the proposal and implementation of both air quality and factory drainage water quality field environmental monitoring efforts.

Based on the results of the interview with local Japanese experts, some of private industrial estates, beside the industrial estates under the jurisdiction of IEAT, has been identified not to have sufficient

measures for environmental monitoring (air, factory drainage) that complies within the environmental standards in Thailand. For this reason, targeting these industrial estates, propose a measure to act over the entire or parts of the environmental monitoring measure in air quality and water quality field, to constantly monitor whether the emission substances (smoke emission, wastewater, etc.) from the tenant companies in the target industrial estate complies with the standards set by the environmental law in Thailand. In addition, the status and results of the environmental monitoring measure will be reported to the industrial estate operators and related local stakeholders (local government environmental authorities, etc.), and to the residents of the local community through the PR media (electric bulletin board, warning broadcast) that industrial estate operator holds.

On the information and knowledge acquired from the environmental monitoring efforts, if there is risk of environmental quality deterioration by implementation of the project measures, it needs to be reflected to the review work of the industrial estate operator and related organization operation plan.

At implementation of this measure, the operators of each private industrial estate that complies with the environmental standards of Thailand will need to satisfy both considerations on accountability to the surrounding residents and necessary cost for implementation of the project, and acquire the approval of the Approval of Office of Natural Resources and Environmental Policy and Planning (ONEP) and Development of Industrial Work, the administrative department of the environmental field and factory operation.

Environmental Monitoring measures in-operation by IEAT

- The Environment Monitoring & Control Center (EMC^2) established directly under the IEAT headquarters conducts the monitoring of the air quality, water quality and toxic substances based on the Thai Environmental law of all industrial estate managed by IEAT.
- For information collection as EMC^2, the operation center was established within the IEAT headquarters in July 2014. According to the representative of this center, EMC^2 is set to establish 7 branch offices to hold jurisdiction over the eastern, western, southern, northern region of the country and place sub offices at each industrial estate throughout the nation in 2016.
- Among these, for the air quality, the data of NO_X and SO_X measured through the exhaust gas sensor placed at each factory are being transmitted. If the emission concentration reaches 80% of the reference value, EMC^2 will make a telephone query to the factory.

DIW's authorization process regarding the environmental monitoring will be identified based on the interview survey during further field survey. Such result will be summarized to study on the Environmental Monitoring Service including business concept.

(5) Local Contributions

Recently, due to the promotion of Eco-friendly industrial estate by IEAT and DIW, the companies located in the industrial estates of Thailand as showing a rapid spread of Corporate Social Responsibility (CSR) activities. IEAT developed the "CSR master plan 2556-2559", and has been promoting the CSR activities by IEAT and by companies located in the industrial estates managed by IEAT. As part of this

promotion, IEAT created the “White Flag-Green Star Award”, a certification on environmental monitoring by factories, and encouraging the aggressive environmental contribution of participation to the monitoring by residents, including the community evaluation committee, and the factory.

CSR activities by the companies located in these industrial estate has the effect to keep a friendly relationship between the surrounding community, who are the main stakeholder of industrial estate, and the industrial estate. In other words, by publicizing the achievements of the implemented CSR activities, such as factory tour, environmental monitoring, environmental improvement activities in the community, and donations to medical and educational organizations, in the CSR report will able to acquire the understanding of the residents in the community on the safety of the factory.

This kind of understanding of the companies towards CSR penetrated, and local contribution activities which focused on relationship-building with the local resident began to be carried out, and the catalyst of this was the lawsuit by the citizens in the Map Ta Phut Industrial Estate in 2009. At Map Ta Phut Industrial Estate, the cause of the health damages of residents was asserted at the exhaust and drainage from the industrial estate, and as a result of the lawsuit, the new development project was terminated by the orders of the court. At SCG Chemical, the major chemical group, believes to be beyond just the actual environmental pollution, and it was the lack of information sharing with the local community and management that neglected the local community as well. In other words, SCG Chemical recognizes that the lack of relationship with the community will increase the risk of doubt on safety and reliability of the factory, and if this leads to protest and lawsuit by citizens, it may greatly influence the management, and since then, SCG Chemical has established a department which specializes in CSR activities and increasing the budget on CSR activities.

As described above, CSR activities may seem to mainly aim to keep the friendly-relationship with the local community and mitigate risk such as lawsuits, however, it can anticipate side-effects such as increasing the name recognition of the company’s product and business, and improve the corporate image as well. Thus, building a friendly-relationship with the community through the CSR activities will as a result deliver a positive effect to the actual business of the company and contribute to the sustainable business management.

Many large companies and multinational companies, such as the previously described SCG Chemical, have in-house CSR activity designated department utilizing their rich fund and human resource, and conduct all implementation from the planning of CSR activities on their own. For example, the CSR designated department of SCG Chemical in Map Ta Phut are actively interacts with the local community and Non-Governmental Organization (NGO) by organizing events and participating public meetings, and making sure that the CSR activities are in line with the needs of these organizations. By the experience of such activities, SCG Chemical have accumulated know-how and network on the planning and implementation of CSR activities, and conducting distinctive CSR activities.

On the other hand, there are many cases that SMEs have not implemented CSR activities, due to the lack of human resource or fund for CSR activities. In addition, SMEs do not have the know-how or the network with the community for CSR activities like large companies, and do not know how to implement a distinctive CSR activity, or what kind of contribution is most beneficial for the community. For this

reason, many SMEs do not actively implement CSR activities, or often just dismiss by making financial donations.

In addition, the loss by the termination of the development due to citizen lawsuits will not only influence the company who manages the factory, it will influence the operators of the industrial estate as well. In other words, for industrial estate operator, the presence of such risks as citizen lawsuit will not only lead to inhibition of new tenants to the existing industrial estates, it will influence the development of new industrial estates as well. In such circumstances, not only the governmental organizations that manages the industrial estate such as IEAT and DIW, there is a certain rationality in other industrial estate operators to recommend CSR activities of tenant companies.

In the project, the business to provide "CSR Advisory Service" as one of the one-stop-service at the industrial estate will be proposed in collaboration with the industrial estate operator. The following indicates this conceptual diagram.

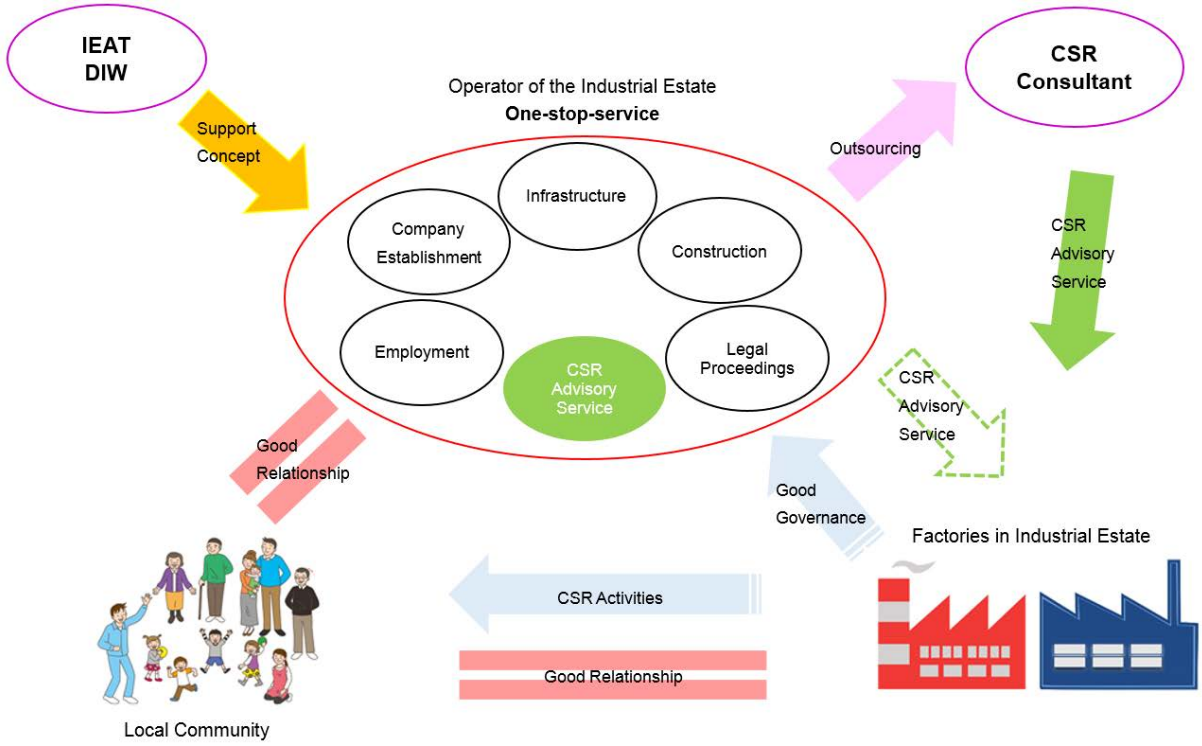


Figure 5-26 Conceptual diagram of the CSR Advisory Service CSR

The CSR Advisory Service indicated in Figure 5-26 conceptual diagram will be implemented as follows.

① The "CSR Advisory Service" will be included as one of the one-stop-services provided for the tenant companies by the industrial estate operators. The content provided in this service is assumed to comply with the CSR concept and guidelines of IEAT or DIW that has jurisdiction over the respective industrial estate.

② Provide the CSR Advisory Service based on the request from the tenant companies. However, it

is unrealistic for the industrial estate operator to provide the actual advisory service. As described in the diagram above, the CSR Consultant, the consulting firm that can provide professional consulting on CSR activities is assumed.

③ The expenses of this service should be borne by the industrial estate operator. However, since the promotion of CSR activities is preferred for IEAT and DIW, some kind of support should be provided, and needs to be encouraged to do so.

④ Tenant companies shall implement CSR activities based on the advice acquired by the CSR Advisory Service.

⑤ By implementation of CSR activities by tenant companies, local communities can receive a variety of benefits through the good environment conditions and CSR activities, and the industrial estate operator will be able to acquire good governance, such as compliance with the environmental standards by tenant companies, and CSR activities.

Thus, the proposed CSR Advisory Service can benefit all three parties, the local community, industrial estate operator, and tenant companies, at the same time.

Profound responses were received as a result of interviews conducted on the possibility of utilizing such CSR Advisory Service. In particular, Rojana, a developer of industrial estates with high occupancy of Japanese companies, has expressed that; more than few companies are interested in implementing an original CSR activities with the use of an advisory service such as proposed above, as whilst interests for CSR activities are increasing year on year, many companies are unsure of what activities should be implemented, consequently resorting to monetary donation. Furthermore, a division in charge of CSR at SCG Chemical, a large company, have mentioned that external human resources are sometimes used for planning new CSR activities, and that proposed advisory service would be considered if available. As such, demand for the CSR Advisory Service can be expected as a result of interviews with factories and developers.

6 Facilities Planning, Schematic Design and Cost Estimation

6.1 Planning Conditions

6.1.1 Energy Service

Menu for the On-Site Power Generation Service, the Air Conditioning Service, and the Factory Equipment Service in the Energy Service is shown below.

Table 6-1 Energy Service Menu

Item	On-Site Power Generation	Air Conditioning	Factory Equipment
Service Content	Supply electricity and power to factories as an alternative to Thai electricity companies.	Supply chilled water/air to facilities within a factory	Improve quality and stability of power supply.
Energy	Power, heat	Heat	Power, heat
Equipment	Cogeneration	Water-/Air-cooled chiller Turbo chiller Absorption chiller (related equipment) Boiler (renewal/fuel conversion) Gas turbine Cogeneration	Optimum Demand-Supply Control System Voltage Sag Countermeasure device
Area	Across a factory	Individual facility within a factory	Individual facility within a factory/ across a factory
Fee	Usage fee for electricity and heat	Usage fee for installed equipment	Usage fee for installed equipment
Related Service	O&M Service	Energy Conservation Service O&M Service	Energy Conservation Service

(1) Optimum Supply of Heat and Power through On-Site Power Generation

Thai power companies and SPP supply both power and heat to the customers. On-site power generation will provide heat and power to factories, as an alternative to Thai electricity companies and SPPs. For factories receiving heat and power supply, cost-merit in comparison to Thai electricity companies and SPP will be one of determining factors for the On-Site Power Generation Service.

An incentive to purchase gas for cogeneration at a reduced rate (BOI incentive) is currently available in Thailand, making it easier to introduce on-site power generation. However, there is a movement to revise this incentive, and therefore a possibility for introduction of the service to be limited as a consequence.

In some industrial estates where Thai local companies and national enterprises have been aggregated, there are several SPPs, and power supply have been stabilized. In such industrial estates, it may be difficult to introduce the On-Site Power Generation Service due to the existing relationship between factories and SPPs. On the other hand, in industrial estates without SPP where Japanese companies have been aggregated, or in industrial estates to be newly developed, it is thought the possibility for introducing the On-Site Power Generation Service is high.

(2) Air Conditioning Service

The Air Conditioning Service supplies chilled water/air against air-conditioning needs at each facility. Configuration of the equipment required will be adjusted depending on the client factory's demand. The Air Conditioning Service will target facilities where air conditioning is constantly used, such as an office and production line where employees are at work, or clean room where clean air is required. Package air conditioner in small offices and gate-houses will not be targeted. Furthermore, depending on the factory's demand, transfer from package air conditioner to central heating system will be targeted.

Introduction of the Air Conditioning Service will be timed for, replacement of existing air-conditioning system and/or layout rearrangement for air conditioning system at the time of switching production line, and will target facilities with equipment introduced over 10 years ago. At industrial estates surveyed during the study, rental factories where air-conditioning system installed at the time of construction were still used by tenants all year, with deteriorating equipment and frequent failure were found. These factories are thought to be potential client for the Air Conditioning Service.

Furthermore, industrial sectors in Thailand such as chemical, synthetic resins and plastics, iron, steel and non-ferrous metals and metal products, machinery, electrical and electronic equipment, transportation equipment are thought to be relatively easy to introduce the Air Conditioning Service. Other equipment related to energy supply could also be introduced at the time of beginning the Air Conditioning Service. Relationship between the Air Conditioning Service and related service equipment are shown in the figure below.

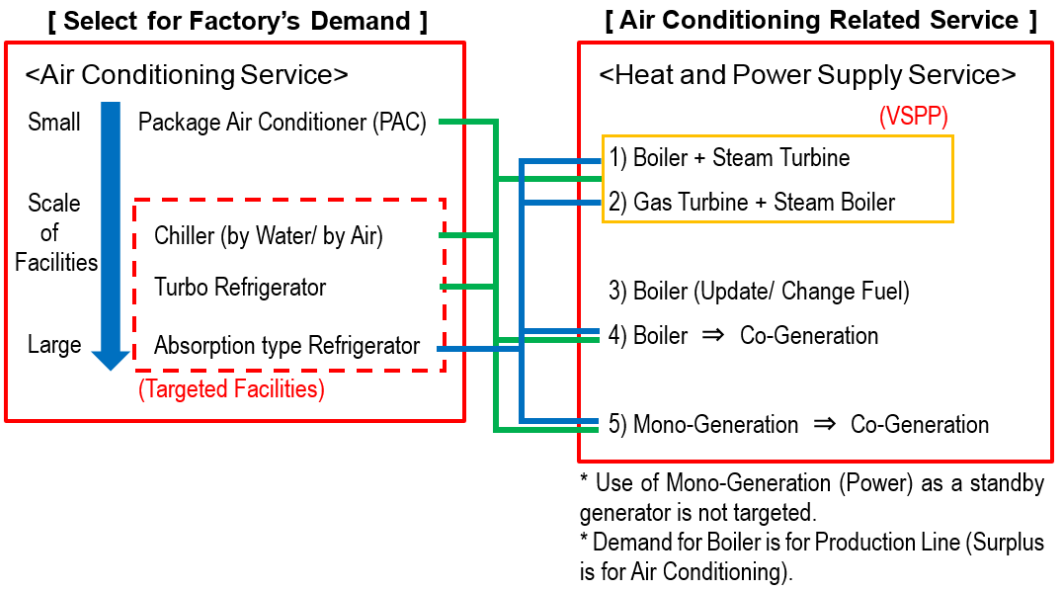


Figure 6-1 Relationship between the Air Conditioning Service and Related Service Equipment

(3) Factory Equipment Service

The Factory Equipment Service is intended to conduct the energy conservation of equipment used for the production line such as compressors and assist improving the quality and reliability of power through the use of countermeasure device for voltage sag. The service is therefore suitable for factories facing

high energy costs due to inefficient facilities which are directly related to the production and industrial estates and factories where power supply is unstable due to power outage and voltage sag, and where this is identified as an issue.

Therefore, factories which are interested in the energy conservation of the production facilities and hoping to deploy businesses where quality of power is important and/or required, located in industrial estates without SPPs would be targeted for confirming the demand for this service. Thus, this service is located in the middle between the Energy Conservation Service and the Power Supply Service.

6.1.2 Energy Conservation and O&M Service

Menu for the Energy Conservation and O&M Service; a lease of high-efficiency and energy saving equipment, total energy management service through use of the Cloud FEMS, and operation and maintenance (O&M) are shown in the table below.

Table 6-2 Menu for the Energy Conservation and O&M Service

Service	High-Efficiency and Energy Saving Equipment	Cloud FEMS	O&M
Contents	Replacement of equipment in existing factories, and lease of high-efficiency and energy saving equipment to new factories.	Collectively manage and control the use of electricity by the factory's equipment through introduction of Cloud FEMS.	Provide diagnosis, maintenance and replacement of factory equipment, as well as operation and maintenance of a back-up power source etc.
Energy	Power, Air	Power, Air	Power, Air Conditioning, Heat, Air
Equipment/Staff	Motor Invertor Motor Control Panel UPS Transformer LED Measuring Equipment	Cloud FEMS Equipment (Measuring and Control Devices)	Measuring Equipment (if required) Staff to operate and maintain target equipment
Area	Individual equipment within a factory	Across a factor./ individual equipment within a factory	Across a factor./ individual equipment within a factory
Energy	Lease fee for each equipment	Usage fee for the Cloud FEMS	O&M Service Fee
Related Services	Smart Service O&M Service	Smart Service O&M Service	Smart Service Energy Conservation Service

Possibility for the Energy Conservation and O&M Service in Thai factories identified in the field survey is shown in the following table.

Table 6-3 Conditions for introduction of the Energy Conservation and O&M Service by Company Category

Company Category	Current state of procurement and O&M	Barriers and Challenges	Business Opportunity
Thai Company (Group companies and foreign owned, excluding Japanese, companies)	Sufficient in-house resources or commissioned to group companies etc.	Investment decisions are made by external parties (parent company etc.,), and therefore lacks decision making power on site. As a consequence, business opportunity is low.	×
Thai Company (Other)	Inadequate in-house resources. Commissioned to a local contractor.	Management decision is required for outsourcing O&M and leasing energy saving equipment at the time of renewal. Introduction of the service will require previous records and quantitative effects of the service to be presented prior to the decision making.	△
Japanese Company (procurement and O&M carried out in-house or by a group company)	Sufficient in-house resources or commissioned to group companies etc.	Suppliers are chosen from the record of past transactions etc., and thus business opportunity is low. If the O&M is currently carried out in-house, considerations including the implementation structure is required, increasing the difficulty for introduction of the service.	△
Japanese Company (Other)	Inadequate in-house resources. Commissioned to a local contractor.	Current state including deterioration of the equipment needs to be investigated, and the cost-benefit compared, however, the possibility for introduction of the service is high.	◎

◎ : High business opportunity, △ : Some business opportunity, ×: Very little business opportunity

Planning condition for the Energy Conservation and O&M Service with reference to the findings from the field survey is summarized below.

(1) Lease of High-Efficiency and Energy Saving Equipment

For the high-efficiency and energy saving equipment leasing service, equipment anticipated to achieve energy saving at client factories needs to be selected. Installation of high-efficiency and energy saving equipment are expected at the time of constructing a new factory or replacing old equipment however, they key factor for installation is for anticipated energy-saving impacts to exceed the installation costs.

In Thailand, numerous industrial estates have been developed alongside the development of the eastern seaboard in the late 1980s, and many companies including Japanese companies have chosen to locate their factory in 3 industrial estates. Given the results of the field study, many of the factories are approaching the time for replacement of deteriorating facilities, with some companies identifying deterioration and decreased efficiency of equipment as challenges. The main target for this service will therefore target deteriorating equipment with increasing inefficiency in terms of energy consumption.

Furthermore, through the field study it was found that, whilst lease of construction machineries are readily available in Thailand, lease of power system equipment are uncommon. Request for information

on the details of the service and its effectiveness from numerous companies including Thai and Japanese companies showed the high novelty and needs for the service.

On the other hand, the field study also revealed that, in some cases, decision for installation of equipment and facilities in foreign owned enterprises were made at the parent company. In which case, the decision making process is complex, and contracts are frequently assigned to manufacturers who have connections with the parent company, resulting in numerous barriers for the new business to enter into service. Furthermore, although many companies showed interest in energy conservation itself, some companies are interested in replacing existing equipment with low-cost equipment after a breakdown rather as opposed to prior to a breakdown, even if the performance may be poorer.

Taking above points into consideration, it can be concluded that, from the field study, the service demand is high at Japanese manufacturing companies using advanced technologies and have understandings for high-efficiency and energy saving equipment, reaching the time of replacement due to deterioration of equipment after several years have passed since locating in Thailand. However, some Japanese companies deal with the entire process, from procurement to maintenance and operation of equipment in-house or within group companies. In which case, entry of the new business is difficult.

For the service, it is required that, potential clients are met, the situation of the equipment and its deterioration and the company's intention for energy conservation is understood, and equipment/company to provide the anticipated effect is chosen. In addition, a diagnosis on detailed service contents, its effect and costs needs to be carried out, service plan prepared for the specific case, terms agreed, and contracts drawn and signed before provision of the service can begin.

(2) Total Energy Management Service using Cloud FEMS

For Total Energy Management Service using the Cloud FEMS, substantial impact can be anticipated by continuously managing and optimizing the energy use within a factory. However, there is a need to take into consideration the entire facilities within the factory. Merit in terms of efficiency and cost of design and implementation can be enlarged by introducing the system at the point of construction rather than in an existing factory.

For above reasons, the possibility of sales and marketing at the time of construction of a factory in new industrial estate developments are thought to be high. In interviews conducted, operators of industrial estate and rental factories expressed opinions that demand for an integrated energy management across a factory or in some cases several factories are increasing.

On the other hand, the scale of capital investment for introduction of the service in comparison to the high-efficiency and energy saving equipment leasing service which can operate on per unit equipment basis is high. Consideration by industrial estate developers and factory owners from the planning stage is key, and it is thought vital to proceed detailed planning and consultations with potential clients alongside verification and implementation of other service, aiming for future deployment of the service.

(3) Operation and Maintenance Service

As indicated in the aforementioned case of high-efficiency and energy saving equipment, the Operation and Maintenance Service will target common equipment owned by generic factories, and

factories will collectively outsource planning, inspection, and repair of equipment subject to the service. In principle, it is assumed that the service will be provided cooperation with other smart services.

Factories of 10~20 years since construction and with deteriorated facilities are particularly suitable for the service, as the necessity for maintenance and the risk of breakdown is increased.

Given the results of the field study, demand for outsourcing is low in companies with operation and maintenance structure developed in-house. In some factories owned by large Japanese manufacturing industry interviewed in the study, inspection and repair were carried out in-house by stationing Japanese experts providing training for Thai technicians and establishing operation and maintenance structure. Furthermore in large-group companies in Thailand, many contracted the service out to maintenance specialists within the group. In which case the possibility of entering service is also low.

Moreover, it was observed that many Thai companies has a policy to repair and replace after failure occurred, and interests for pre-maintenance of equipment in comparison to Japanese companies are scarce.

For above reasons, as shown in the earlier mentioned table, possibility of providing the service to factories under the ownership of a Japanese company without an in-house procurement, operation and maintenance structure, or a company without a contractor in group companies are thought to be high.

Moreover, as the service will be provided at a fee adjusted to suit local needs, implementation structure in cooperation with local companies will be key.

Flow of the study for the Energy Conservation and O&M Service based on the findings from the field study is shown in the figure below.

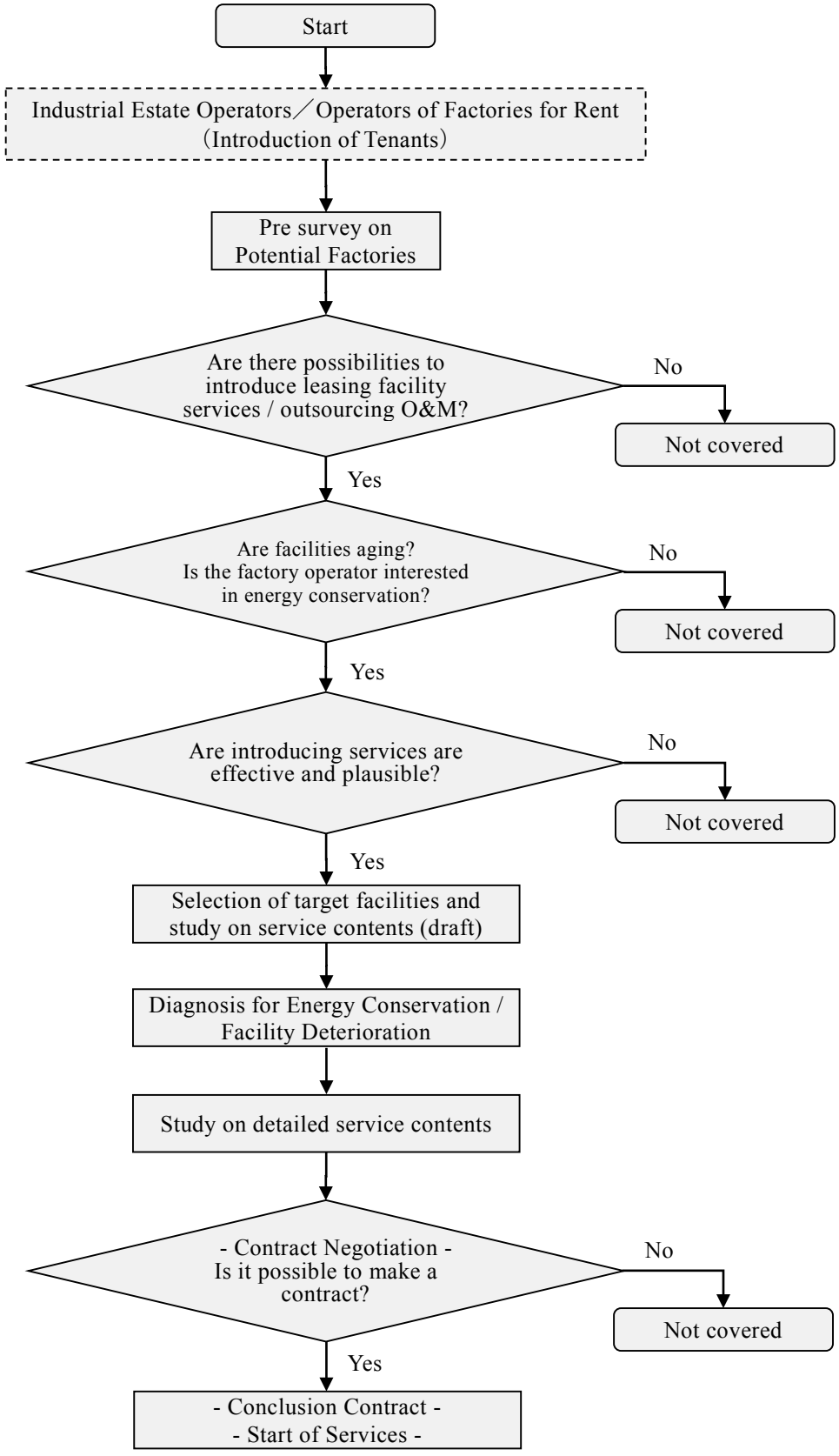


Figure 6-2 Study Flow for the Energy Conservation and O&M Service

6.1.3 Smart Services

(1) Transportation Service

As noted in prior sections, 3 services will be provided under the Transportation Service, under the following two concepts based on the result of the field study and interviews.

- Mitigation of traffic congestion and environmental impact through reduction of number of vehicles by provision of a commuter bus service
- Mitigation of environmental impact through improvement of energy efficiency in commuter buses

Table 6-4 Transportation Service

	Service1 Optimization	Service2 EV	Service3 FCV
Contents	Transportation optimization Signal optimization	Introduce EV bus services	Introduce FC bus services
Who?	Industrial estates where there are heavy congestion	Industrial estates where one stop services will be applied	Map Ta Phut Industrial estate
When?	Soon	At least from next year with framework of NEDO in Japan	At least from the year of 2020. Yet FC bus is not soled even in Japan
Merit	Easy to apply	Relatively easy to introduce, there are already EV bus in Thailand Energy conservation is so effective	Advanced Energy conservation is so effective
Demerit		Technical novelty for EV bus may not be enough for Nedo framework	So expensive Hard to introduce Problem for maintenance for bus maker

1) Breakdown of the Transportation Service

a) Optimization

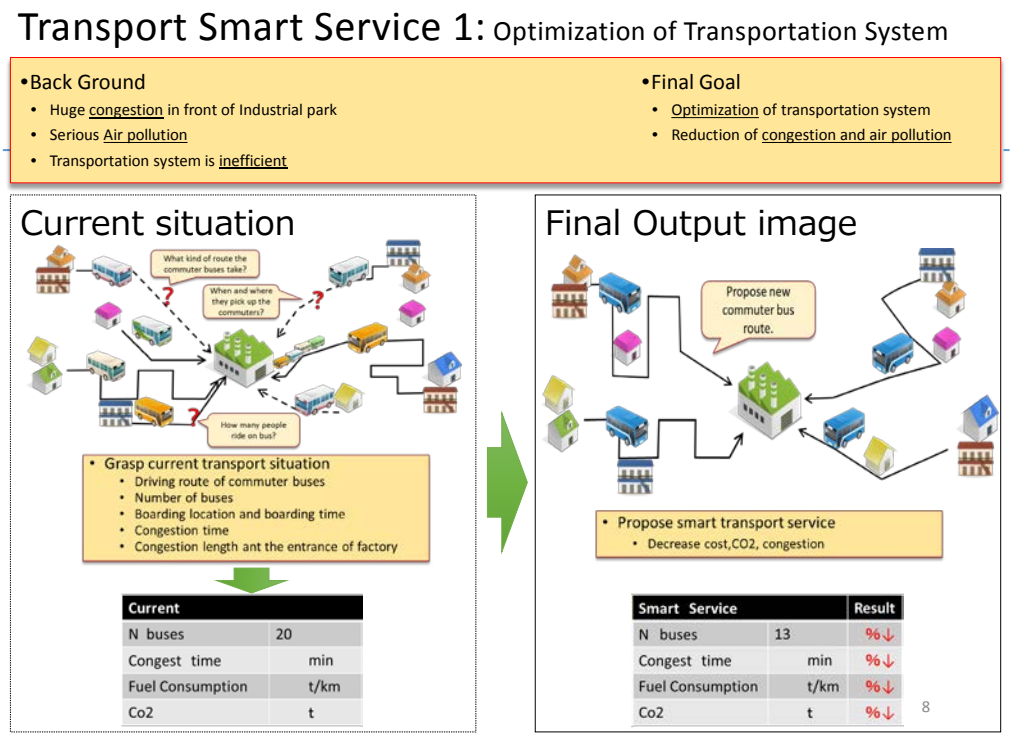


Figure 6-3 Service 1 (Optimization)

b) EV

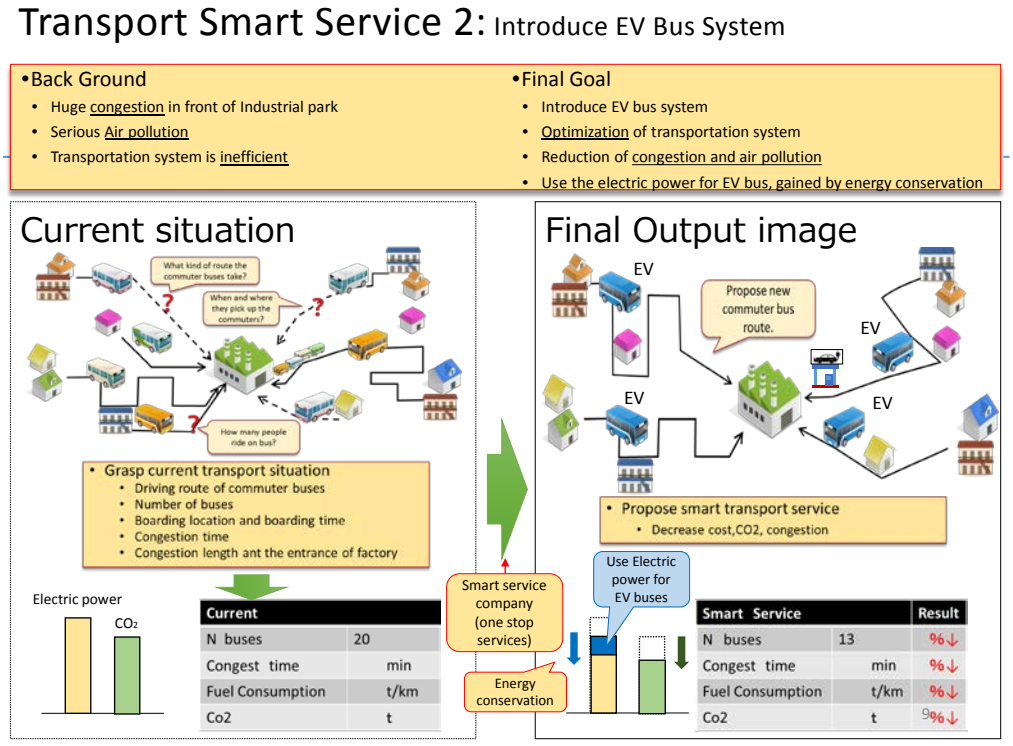


Figure 6-4 Service 2 (EV)

c) FCV

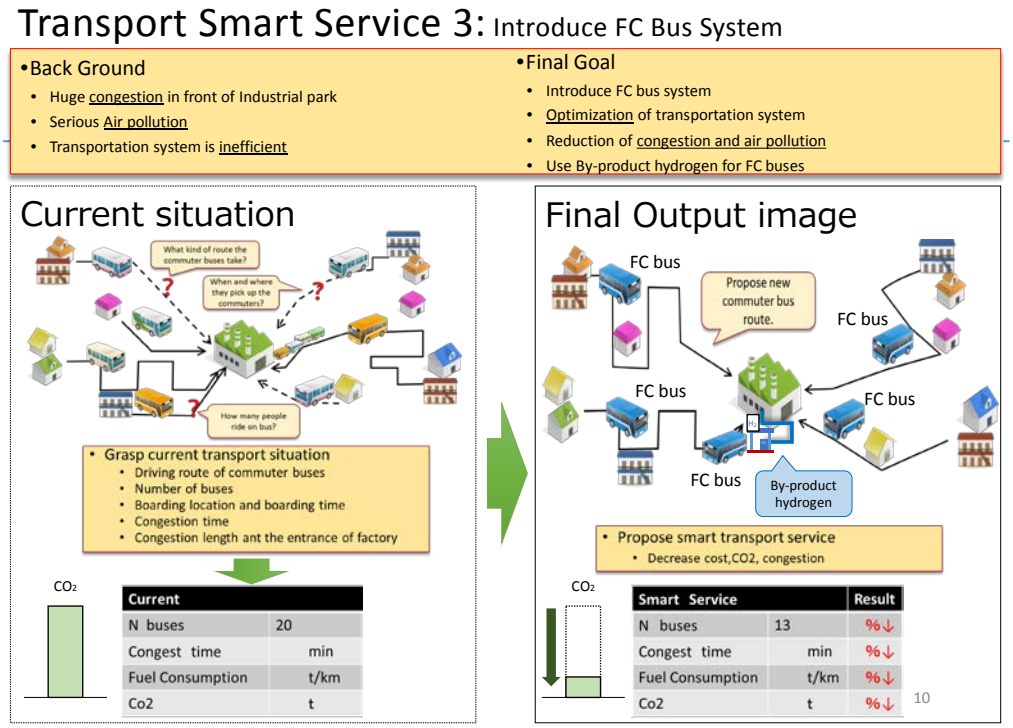


Figure 6-5 Service 3 (FCV)

2) Evaluation

From reasons summarized in Table 6-5, achieving profit from the Transportation Service on its own is thought difficult. However it was found that there are possibility for introduction of EV, depending on intensions of the Thai Government, as there are pilot project being carried out within Thailand, as well as certain demands from manufacturers and industrial estate operators.

As mentioned above, business reliability was not identified to run service business as a private business. Thus, analysis on demand forecast, design, cost estimation and cash flow was not conducted.

However, since the introduction of an EV bus has large potential to be a real project in near future, it is studied in the appendix (1) at the end of this report.

Table 6-5 Consideration on the Feasibility of the Transportation Service

	Service 1	**Service 2**	**Service 3**
Demand	· There are expression of interest from several companies, owing partly to increased traffic volume.	· There are positive interests from private companies proactive in CSR and government related organizations.	· There were interests from factories in Map Ta Phut Industrial Estate
Cost	· Cost is low as action required is an analysis of current operation of busses resulting in reduction in the number of busses.	· Cost of an EV bus is high at twice the amount for an usual bus however, cost for installation of station is relatively low (at approx. 2 million JPY.)	· Cost for construction of a station is currently at 4~5 million JPY, and the bus itself is also extremely expensive.

Concerns	・Commuter buses are operated by each company, with strong implications for job creation. ・Shared commuter busses may result in exchange of company information, with concerns that it may lead to job-hopping. ・Use of private vehicles by employees are increasing, who are unenthusiastic to go back to using public transport.	・There are no policy target for the introduction, and there are no incentives aside from 50% reduction in vehicle registration fee.	・There are no policy target for the introduction, and there are no incentives aside from 50% reduction in vehicle registration fee.
Regulations	・There are no issues as long as a license for shared transportation is obtained.	・There are no regulations on large-scale EV. Without regulations, vehicles may not operate in Thailand. As a consequence, operation is at present, not possible.	・There are no regulations on large-scale FCV. Without regulations, vehicles may not operate in Thailand. As a consequence, operation is at present, not possible.
Possibility	・As contracts are already signed between each companies and bus companies within existing industrial estates, with concerns that it may result in employment issues and job-hopping, there are possibility for the service in a new industrial estate.	・There is a possibility given that there would be a government-led incentives and support system, as well as introduction of relevant regulations, as there already is a pilot project in Thailand.	・At present, as awareness for a FC bus in Thailand is scarce, and as FC buses are commercially unavailable even in Japan, introduction would be in distant future. ・Without policy target, introducing expensive FC buses would be difficult.
Evaluation	・Introduction in a new industrial estate after a trial introduction in an existing introduction would be possible however, a scheme addressing concerns such as job-hopping and job creation is required.	・Introduction is possible given that there are government support however, achieving profitability would be difficult.	・Introduction in Thailand is unrealistic at present.

(2) Human Resources Development (Employees and Managers)

Service for Human Resource Development was studied to improve quality of human resource and to secure human resource in the chronic lack of skilled human resources, employees repeat career changes. Service for Human Resource Development through the remote distribution system (e-learning), which enable high quality training as same contents as training in Japan via the internet, was studied.

Target of this study were Japanese companies develop to Thailand and local companies related to Japan. This service targets on new staffs and managerial class workers.

Based on above, the survey team conducted the interview survey with Japanese-affiliated companies and major local companies. As a result, the Survey Team found that major companies has their own training programs, and such companies has total management system to operate headquarters and factories. Thus, development of service for Human Resource Development identified not feasible at this stage. Demand forecast, scheme, cost estimation, and cash flow were not analyzed as the service seems not feasible to start as a private business.

(3) Environmental Monitoring (Air, Industrial Waste Water)

Amongst the Smart Services, environmental monitoring component targeting private industrial estate operators are defined as follows. Results of EIA measurement on air and industrial waste water from each industrial estate will be made into a database, and provided to the operator of industrial estates and local stakeholders such as environmental agencies in national and local governments.

In addition, possibility of the information disclosure of measured result will be studied according to request from operator of the targeted industrial estates.

1. Measurement for air pollutants will be constantly taken by equipment installed on top of various service vehicles operated by the SPC, cruising within the industrial estate and its surrounding area including surrounding neighborhoods. Measurements will be analyzed to confirm compliance with the national air quality standard.
2. Measuring equipment will be installed on chimneys of tenant factories, taking constant measurements of SO_X, NO_X, Volatile Organic Compounds (VOCs), and malodorous substances etc., Measurements will be analyzed to confirm compliance with the national emission standard.
3. Measurements of waste water from each tenant factories will be taken constantly, and sample survey would be conducted.

Combination of 1. and/or 2. and 3. of above methods will be conducted depending on the action taken by each industrial estate operator.

Contents of the service will be decided based on consultation with the operator of the industrial estate, taking into consideration business activities of tenant companies, contents and frequency of monitoring by the local government, and emission standard for industrial wastewater imposed on tenant factories.

The feasibility of the above mentioned Environmental Monitoring Service is evaluated as follows.

- Constant measurement by vehicle-mounted measuring equipment as described in 1. can be installed on to SPC's service vehicles and part of the fleet of EV buses used in the aforementioned Transportation Service. Similar method of measurement using vehicles is currently carried out in Map Ta Phut Industrial Complex however, such measurement is not carried out in private industrial estates in the project's target areas. As a consequence, it is anticipated that there are demands for the SPC's service. However, as of November, 2015, there is no environmental act or regulations to obligate the industrial estate operators to conduct the environmental monitoring and comply with the standards (environment, drainage and emission) set by the environmental law in Thailand. Thus, the Environmental Monitoring Service seems not feasible.
- Private industrial estates in the project's target areas do not measure air quality, aside from measurements taken in certain locations by local governments. Certain demand for the monitoring service and aggregation of information by the SPC is therefore anticipated however, installation of measuring equipment on chimneys of all tenant factories would require substantial investment, and therefore, provision of the service under the project is unrealistic.
- For wastewater, there are system to report BOD in wastewater to BOD once a week however, there

are no environmental monitoring service covering entire industrial waste water standard in Thailand (refer table 6-8 below.) There also seems to be efforts to carry out sampling survey on wastewater once a month by an operator of private industrial estate located in the project's target area (ROJANA) however, it is hard to say that the majority of industrial estates do the same. Monitoring targets wastewater from each tenant companies, provision of service supplementing the efforts of each industrial estates and suited to the characteristics of industrial activities in each industrial estates is expected, and therefore, provision of the service under the project is unrealistic.

There were many positive comments and requests from related authorities including the counterpart on starting the Environmental Monitoring Service. However, the Environmental Monitoring Service will be not implemented as a part of the project due to lack in local law and regulations.

Table 6-6 National Air Quality Standard

Item[1)]	1hr avg.		8hrs avg.		24hrs avg.		1mth avg.		1yr avg.[2)]		Measurement Method
	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm	
CO	34.2	30	10.26	9							Non-Dispersive Infrared Absorption
NO_2	0.32	0.17									Gas Phase Chemiluminescence
SO_2[3)]	0.78	0.30			0.30	0.12			0.10	0.04	UV Fluorescence Analysis
TSP					0.33				0.10		Gravimetric Method
PM10					0.12				0.05		
O_3	0.20	0.10									Gas Phase Chemiluminescence
Pb							1.5				Atomic Absorption Spectrophotometer

Note: 1) at 1atm, 25℃ 2) Geometric mean value 3) 1hr Sulfur Dioxide Standard

Source: Ministry of Environment (http://www.env.go.jp/earth/coop/oemjc/thai/j/thaij1.pdf)

Table 6-7 National Emission Standard (Air)

Item[1)]	Emission Source	Standard
TSP	1. Boiler and Furnace − Using heavy oil as fuel − Using coal as fuel − Using other fuel 2. Steel/Aluminum Production 3. Other	 $300mg/Nm^3$ $400mg/Nm^3$ $400mg/Nm^3$ $300mg/Nm^3$ $400mg/Nm^3$
Sb	All emission source	$20mg/Nm^3$
As		$20mg/Nm^3$
Cu	Furnace or Refinery	$30mg/Nm^3$
Pb	All emission source	$30mg/Nm^3$
Cl		$30mg/Nm^3$
HCl		$200mg/Nm^3$
Hg		$3mg/Nm^3$
CO		$1,000mg/Nm^3$ or 870ppm
H_2SO_4		$100mg/Nm^3$ or 25ppm
H_2S		$140mg/Nm^3$ or 100ppm
SO_2	1. Sulfuric acid product	$1,300mg/Nm^3$ or 500ppm

Item[1)]	Emission Source	Standard
	2. Combustion using oil as fuel (*applied only to factories in Bangkok and Samut Prakan)	1,250ppm
NO_X	Boiler − Using coal as fuel − Using other fuel	 940mg/Nm^3 or 500ppm 470mg/Nm^3 or 250ppm
Xylene	All emission source	870mg/Nm^3 or 200ppm
Cresol		22mg/Nm^3 or 5ppm

Note: 1) at 1atm

Source: Ministry of Environment (http://www.env.go.jp/earth/coop/oemjc/thai/j/thaij1.pdf)

Table 6-8 National Industrial Wastewater Standard

Item	Standard
pH	5.5-9.0
TDS: Total Dissolved Solids	Maximum reference value 3,000 mg/liter, or by the decision of Pollution Control Committee, not exceeding 5,000 mg/liter. 1) When the inflow contains salt and TDS exceeds 2,000mg/liter 2) When discharged to the ocean
SS: Suspended Solids	Maximum reference value 50mg/liter, or by the decision of Pollution Control Committee, not exceeding 150mg/liter.
Temperature (℃)	Less than 40℃
Color & odor	Undetected
Sulfide (H_2S)	Less than 1.0mg/liter
Cyanide (HCN)	Less than 0.2mg/liter
Heavy metals Zn Cr^{6+} Cr^{3+} As Cu Hg Cd Ba Se Pb Ni Mn	 Less than 5.0mg/liter Less than 0.25mg/liter Less than 0.75mg/liter Less than 0.25mg/liter Less than 2.0mg/liter Less than 0.005mg/liter Less than 0.03mg/liter Less than 1.0mg/liter Less than 0.02mg/liter Less than 0.2mg/liter Less than 1.0mg/liter Less than 5.0mg/liter
Fat, Oil and Grease	Maximum reference value 5 mg/liter, or by the decision of Pollution Control Committee, not exceeding 15mg/liter
Formaldehyde	Less than 1.0mg/liter
Phenol	Less than 1.0mg/liter
Free Cl	Less than 1.0mg/liter
Pesticides	Undetected
BOD	Maximum reference value 20mg/liter, or by the decision of Pollution Control Committee, following industries not exceeding 60 mg/liter 1) Fur factory 2) Starch factory 3) Food products using starch 4) Animal food factory 5) Textile factory 6) Tannery factory 7) Pulp and paper factory 8) Chemical factory 9) Pharmaceutical factory 10) Frozen food factory
TKN	Maximum reference value 100 mg/liter, or by the decision of Pollution

Item	Standard
	Control Committee, following industries not exceeding 200mg/liter 1) Food factory 2) Animal food factory
COD	Maximum reference value 120mg/liter, or by the decision of Pollution Control Committee, following industries not exceeding 400mg/liter 1) Food factory 2) Animal food factory 3) Textile factory 4) Tannery factory 5) Pulp and paper factory

Source: Ministry of Environment (http://www.env.go.jp/earth/coop/oemjc/thai/j/thaij1.pdf)

(4) Regional Contribution

The CSR Advisory Service was studied to promote CSR activities by the companies located in industrial estates for the surrounding community. The CSR Advisory Service also aims to bring benefit and to improve a friendly relationship between industrial estate and the surrounding community.

In this study, interview survey with operator of industrial estates such as IEAT, DIW and major developer, and companies located in industrial estates.

During the interview survey with IEAT and DIW, the Survey Team searched for their activities to promote dissemination of CSR and incentive program (subsidy scheme) for the CSR Advisory Service. DIW has CSR promotion project named “CSR-DIW”; and the project contains followings:

- Development of CSR roadmap (Guideline of CSR activities for industry, and Good practice)
- CSR-DIW Award (Award to excellent activities by companies)
- Subprime lending for SMEs
- CSR training for factories
- Monitoring system to secure CSR activities by factories
- Registration system of trainer for CSR training for labours in factories

DIW aims to promote CSR which connects surrounding community and SMEs as a tool for SMEs. DIW’s CSR training for factories is held at approximately 200 factories/ year. DIW planned to expand such training; and for expansion, DIW studied to outsource the training to 3rd party.

As described above, DIW promotes to prevail CSR activities. In addition, DIW plans to expand training for factories and seek for expansion by outsourcing. Thus, it seems that the CSR Advisory Service planned in the project is feasible in future. However, at this stage, there is no subsidy scheme which can be used for implementation of the CSR Advisory Service.

On the other hand, during the interview survey with companies located in the industrial estates, reaction by large companies and SMEs was polarized.

Most large companies has high intention to CSR activities and they have their own division for CSR; however, there is few chance to utilize the CSR Advisory Service from 3rd party. Only SGC Chemical showed positive intention to have the CSR Advisory Service to have idea for new activities.

Comparatively, most SMEs has positive intension to the CSR Advisory Service; however, they were yet to implement CSR activities due to reluctance to owe additional payment.

Most large companies plan and conduct CSR activities by themselves, and most SMEs are reluctant to conduct CSR activities. As a result, implementation of the CSR Advisory Service seems difficult due to current situation. However, feasibility of business implementation will be increase in case IEAT and DIW start subsidy scheme for CSR activities or in case social interest to CSR activities increases much.

6.2 Facilities Planning

6.2.1 Energy Service

For the Energy Service, interview survey of the facility operation status, walkthrough survey at the factories, and proposal on improvement of the energy conservation were conducted targeting on Japanese companies in Thailand.

The Energy Service mainly targets on the On-Site Power Generation, air conditioning system, and stabilization of energy supply for factories. However, Japanese companies in Thailand have demand for energy saving equipment for compressors for the production line, and stable energy supply to the main line of the production line rather than to entire factory ("Crisis Management Service for Facilities in Factories"). Thus, the Energy Service will have advantages over further business development by including such the Crisis Management Service for Facilities in Factories.

Table 6-9 Current Status of Facilities in Factories of Japanese Companies in Thailand and Applicable Energy Service

	Current Status of Facilities in Factories of Japanese Companies in Thailand	Equipment Scale	Applicable Energy Service
Japanese company A	Faced deterioration of plant air conditioners	1,529,000 BTU/H (2 sections: 1,085,000BTU/H, 444,000BTU/H)	Air Conditioning Service
Japanese company B	Currently using compressors with constant speed	630 kW (Integrating small compressors (55kW*6) & Inverter (100kW*3)	Factory Equipment Service
Japanese company C	Replacement of air conditioners for facilities is under process	1,916,865 BTU/H (3 sections: 440,500 BTU/H, 636,365 BTU/H, 840,000 BTU/H)	Air Conditioning Service
Japanese company D	Faced deterioration of plant air conditioners	2,760,000 BTU/H (120,000BTU/H*23)	Air Conditioning Service

Focusing on the Air Conditioning Service as a part of the Energy Service, although installation of air conditioner with inverter or replacement of air conditioner with alternative CFCs make steady progress in Japan; air conditioner with constant speed by fluorocarbon refrigerant (R22) is prevailed in Thailand. Replacement of air-conditioning equipment from constant speed type to inverter type can save 10% of

energy consumption. Thus, current situation in Thailand will serve as a tail wind for the Air Conditioning Service.

On the other hand, there are some Japanese companies in Thailand which management and maintenance person is not Japanese. Policy change of such person toward installation of inverter type air conditioner and/or improvement of environmental awareness are important factors for development of the Air Conditioning Service.

Facility plan of the Energy Service is as shown below table. As a result of interview surveys and walk through surveys with Japanese companies in Thailand which the survey team visited in this study, it was found that there is few demand for heat even there is demand for energy; no potential clients were found which were suitable for study on the Energy Service such as on-site power generation, UPS and/or Trans. Thus, the study on the facility plan was conducted considering mainly the Air Conditioning Service and the Factory Equipment Service.

Table 6-10 Facility Plan for the Energy Service

	Current Status	Equipment Scale	Facility Plan
Japanese company A	Faced deterioration of plant air conditioners	1,529,000 BTU/H (2 sections: 1,085,000BTU/H, 444,000BTU/H)	Air Conditioning Service ・Integrated air conditioner for facilities ・Inverter type air conditioner
Japanese company B	Currently used compressors with constant speed	630 kW (Integrating small compressors (55kW*6) & Inverter (100kW*3)	Factory Equipment Service ・Inverter type compressor ・Integrated compressor
Japanese company C	Faced deterioration of plant air conditioners; currently being updated	1,916,865 BTU/H (3 sections: 440,500 BTU/H, 636,365 BTU/H, 840,000 BTU/H)	Air Conditioning Service ・Integrated air conditioner for facilities ・Inverter type air conditioner
Japanese company D	Faced deterioration of plant air conditioners	2,760,000 BTU/H (120,000BTU/H*23)	Air Conditioning Service ・Inverter type air conditioner

This facility plan was proposed as the most applicable plan to solve challenges of each factory which was collected based on information provided by each factory. However, installation of the inverter type air conditioners and integration of the compressor is generally effective to factories facing challenges of the high energy costs from using deteriorated air conditioners and compressors with constant speed. In addition, the On-Site Power Generation Service and the function supply service for UPS and Trans which are planned in the project are general plan which are proposed to the factories facing situation described in the table below.

Table 6-11 Facility Plan for Other Energy Services

Situation of Factories and Facilities	Facility Plan
- High Expense due to using high electricity and steam - Unstable supply of electricity and steam	Energy Service (On-Site Power Generation) - Installation of the cogeneration or gas engine generation
- Damage to the production line, equipment, and low materials due to momentary power interruption	Energy Service (Factory Equipment Service) - Installation of the UPS
- Inefficient power use with low performance Trans	Energy Service (Factory Equipment Service) - Upgrade to the high efficiency Trans

6.2.2 Energy Conservation and O&M Service

The Energy Conservation and O&M Service is to provide high efficiency energy conservation equipment, Cloud FEMS, and operation and maintenance service. Japanese companies in Thailand which the survey team visited in this Study has not conducted monitoring on the air-conditioning equipment and the voltage converter. However, there were some companies showed interest in the Energy Conservation and O&M Service. Thus, it seems that there is possibility of the Energy Conservation and O&M Service.

Accordingly, facility plan for the Energy Conservation and O&M Service based on the facility plan for the Energy Service was proposed. In addition, facility plans for 4 companies are as shown in the table below; those plans as well as the facility plan of Energy Service are generally effective to the factories facing situation similar to these 4 companies.

Table 6-12 Facility Plan for the Energy Conservation and O&M Service

	Energy Service	Equipment Scale	Facility Plan
Japanese company A	Air Conditioning Service ・Integrated air conditioner for facilities ・Inverter type air conditioner	1,529,000 BTU/H (2 sections: 1,085,000BTU/H, 444,000BTU/H)	Cloud FEMS
Japanese company B	Equipment Service Service ・Inverter type compressor ・Integrated compressor	630 kW (Integrating small compressors (55kW*6) & Inverter (100kW*3)	Cloud FEMS O&M Service
Japanese company C	Air Conditioning Service ・Integrated air conditioner for facilities ・Inverter type air conditioner	1,916,865 BTU/H (3 sections: 440,500 BTU/H, 636,365 BTU/H, 840,000 BTU/H)	Cloud FEMS O&M Service
Japanese company D	Air Conditioning Service ・Inverter type air conditioner	2,760,000 BTU/H (120,000BTU/H*23)	Cloud FEMS

6.3 Schematic Design

6.3.1 Energy Service

The Air Conditioning Service and the Factory Equipment Service for compressors were planned in the facility plan. The Energy Service for those facility plans were designed according to following process. In addition, the schematic design is strongly affected by situation of each factory. However, information based on detailed factory diagnosis and cost estimation was not collected in this survey. Thus, the schematic design for UPS and Trans was not conducted. The schematic design was planned only for the Air Conditioning Service and the Factory Equipment Service (for compressors) which detailed information was collected.

(1) Survey of Facilities Need to be Replaced

Facility operational status as well as current status of existing facilities were surveyed by the interview survey and the walk through survey. Facilities need to be replaced and large scale facilities which replacement may bring positive impact to the energy conservation were identified. In addition,

essential information for a facility replacement plan, specification, and location of the equipment were identified by the interview survey and the walk through survey.

(2) Facility Replacement Plan

The facility replacement plan was proposed based on the information corrected by above mentioned process. For the Japanese companies in Thailand which the survey team visited in this Study, energy conservation effect by facility replacement was planned to be improved by integrating existing facilities which are currently operated independently.

1) Air Conditioning Service

The Air Conditioning Service is to provide air conditioning function itself and energy saving effect by replacement and integration of deteriorated air conditioning system.

The factory diagnosis was conducted at each factory; and location of facilities which have aging problem and which need to be replaced was identified. Additionally, existing facilities which replacement effect seems high were selected as the target of replacement; and the integrated air conditioning plan with inverter type equipment was planned. Design was shown in the simplified form in the figure below as actual design drawings contain confidential information of companies.

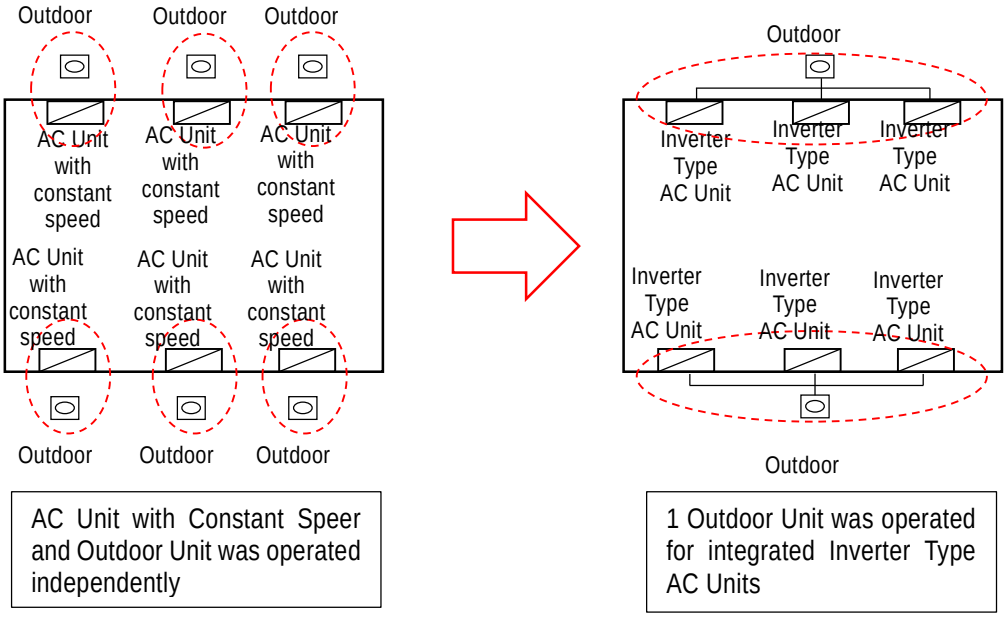


Figure 6-6 Image of the Integrated Air Conditioning System

2) Factory Equipment Service

Compressor is the equipment to provide compressed air to the production line. Replacement of current compressors with constant speed to the inverter type compressors brings large positive impact to the energy conservation.

Operation of the compressor is changed according to operational status of the production line. Therefore, the energy conservation diagnosis should be conducted at each factory; however, applicable scale of the compressor was not identified during the Survey due to lack of the energy diagnosis.

There were multiple compressors with various capacities, thus, 2 plans were developed as the schematic design. One plan was with integrating some parts of compressors to enable operation at partial load; and another plan was with integrating all compressors. Additionally, new compressor was planned with inverter type.

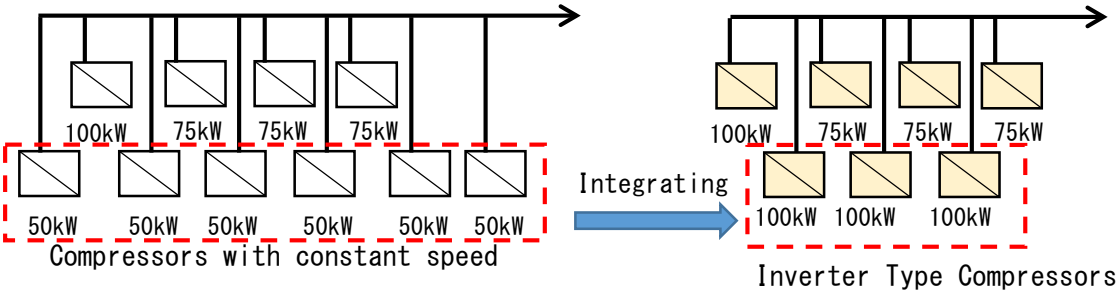


Figure 6-7 Image of Integrating Compressors and Inverter Type Compressors

6.3.2 Energy Conservation and O&M Service

The Energy Conservation and O&M Service is to provide remote monitoring by the Cloud FEMS and periodical O&M service. Accordingly, schematic design of the Cloud FEMS was planned as shown in below:

The Cloud FEMS enables to monitor on operation status of air conditioners, compressors, UPS, and Trans; and such monitoring enables to conduct a preventive maintenance. The proposed system with the Cloud FEMS enables to find facility errors and equipment errors promptly by real time monitoring on operation status and to conduct appropriate maintenance.

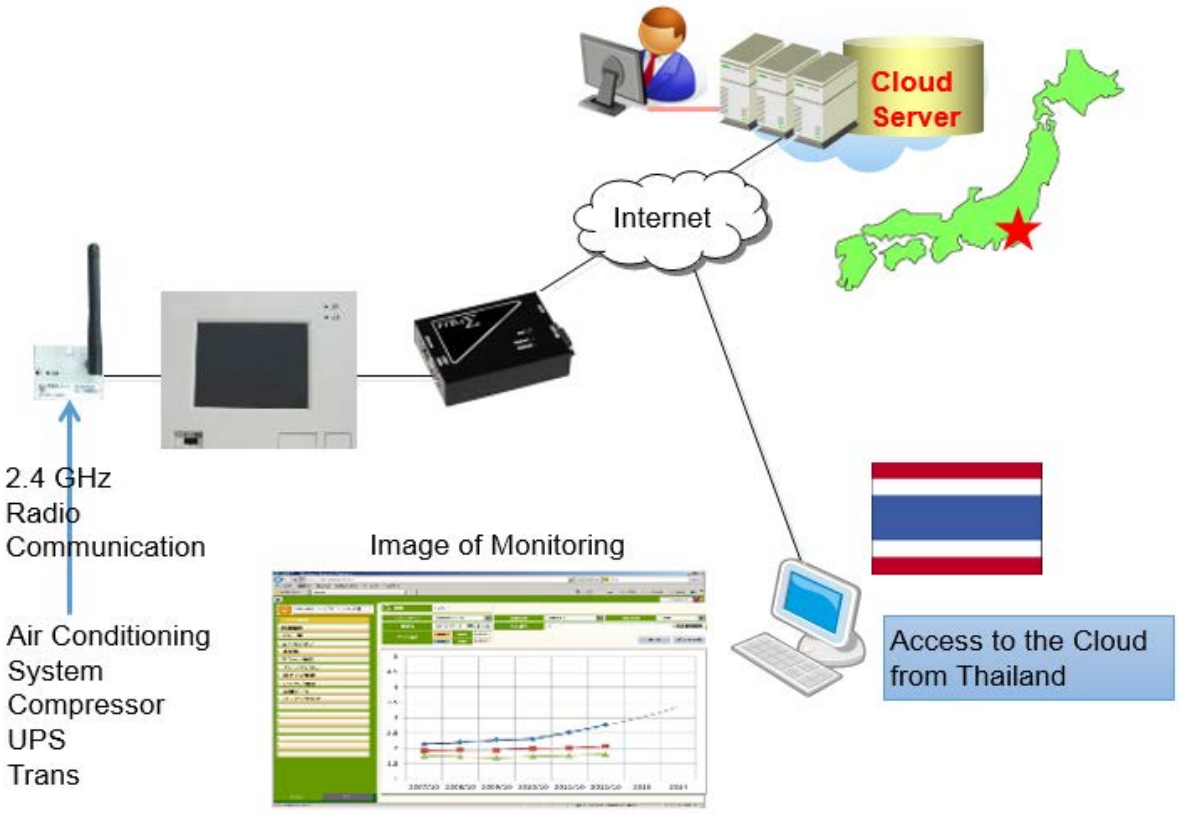


Figure 6-8 Image of the Cloud FEMS (Remote Monitoring)

6.4 Cost Estimation

To estimate construction cost for replacement, detailed survey is required to identify a tentative plan, equipment and facilities such as piping, ducting, and change in electric facilities. Thus, cost estimation was conducted only based on the equipment cost.

6.4.1 Energy Service

It was found that cycle of the rental factories in Thailand was basically 3 years; and companies in the rental factories need to select contract renewal for next 3 years or move to own factory at 3rd year and 6th year. Additionally, small and medium factories which build their own factories from the very beginning of their advance into Thailand examine continue of production or withdrawal from Thailand at 3rd year or 6th year. Therefore, basic service period of the Energy Service was set 6 years; and optional period 3 years and 9 years were also set. Scale of facilities is depends on each factory; and it is difficult to set standard scale. Thus, the scale of facilities was set based on assumable supply scale to the 4 companies in Table 6-10, 1,529,000 ~ 2,760,000 BTU/H.

Concerning cost estimation on the project based on the schematic design, annual service fee that will be paid by factories to the services was estimated as shown in the tables below. In addition, optional service period 9 years has 3 types of the service fee set by every 3 years considering capital collection.

Table 6-13 Cost Estimation (Air Conditioner)

Option	Service fee
3 years	93,000THB/ year - 202,000THB/ year
6 years (basic plan)	51,000 THB/ year - 110,000THB/ year
9 years	First 3 years 42,000 THB/ year - 130,000THB/ year Next 3 years 36,000 THB/ year - 113,000THB/ year Last 3 years 38,000 THB/ year - 98,000THB/ year

Table 6-14 Cost Estimation (Compressor)

Option	Service fee
3 years	311,000THB/ year - 965,000THB/ year
6 years (basic plan)	167,000 THB/ year - 525,000THB/ year
9 years	First 3 years 139,000 THB/ year - 430,000THB/ year Next 3 years 121,000 THB/ year - 374,000THB/ year Last 3 years 104,000 THB/ year - 324,000THB/ year

6.4.2 Energy Conservation and O&M Service

In the Energy Conservation and O&M Service, the service fee is set 49,000 – 77,000 THB/ year, including service fee for energy monitoring through the Cloud FEMS and rental fee for remote monitoring device for the air conditioning system. Such service fee will be added to an annual service fee for the Energy Service. In addition, initial cost for the Cloud FEMS is included in the Energy Service.

7 Development of the Business Plan

7.1 Business Concept

Business concept in the project is as shown in Figure 7-1.

The project aims to implement the Energy Service and the Energy Conservation and O&M Service as outsource business forms one-stop-service for basic utility facilities (facilities for power, heat and steam, air, and air conditioning) which was currently prepared by company located in the industrial estate. The project also aims to implement the Smart Service such as transportation and HRD, and the environmental monitoring.

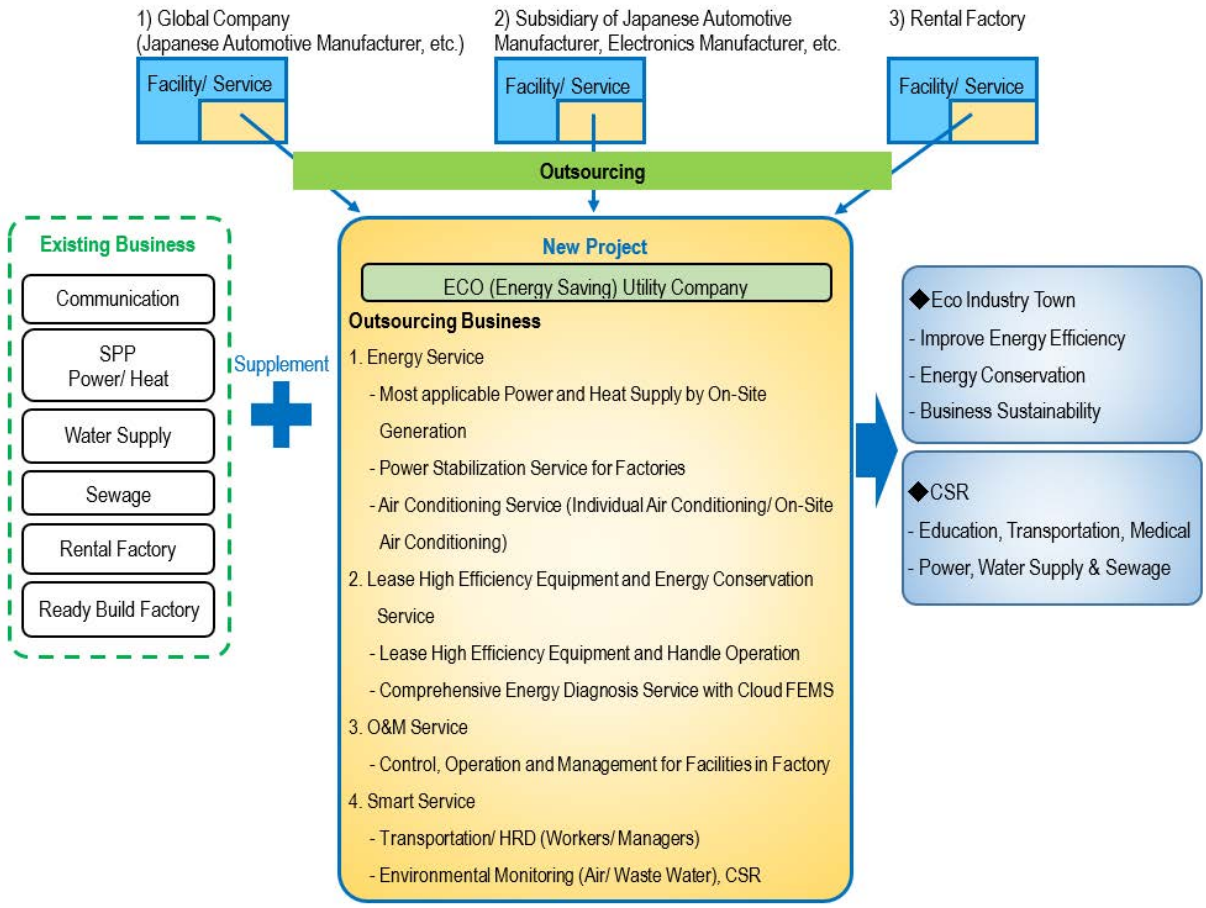


Figure 7-1 Business Concept

7.2 Business Model

Business model in the project is as shown in Figure 7-2.

Service provider receives supplier's products; and such service provider provides supplier's products with various kinds of service provided to factories (customer) as one-stop-service. This is basic scheme of the project.

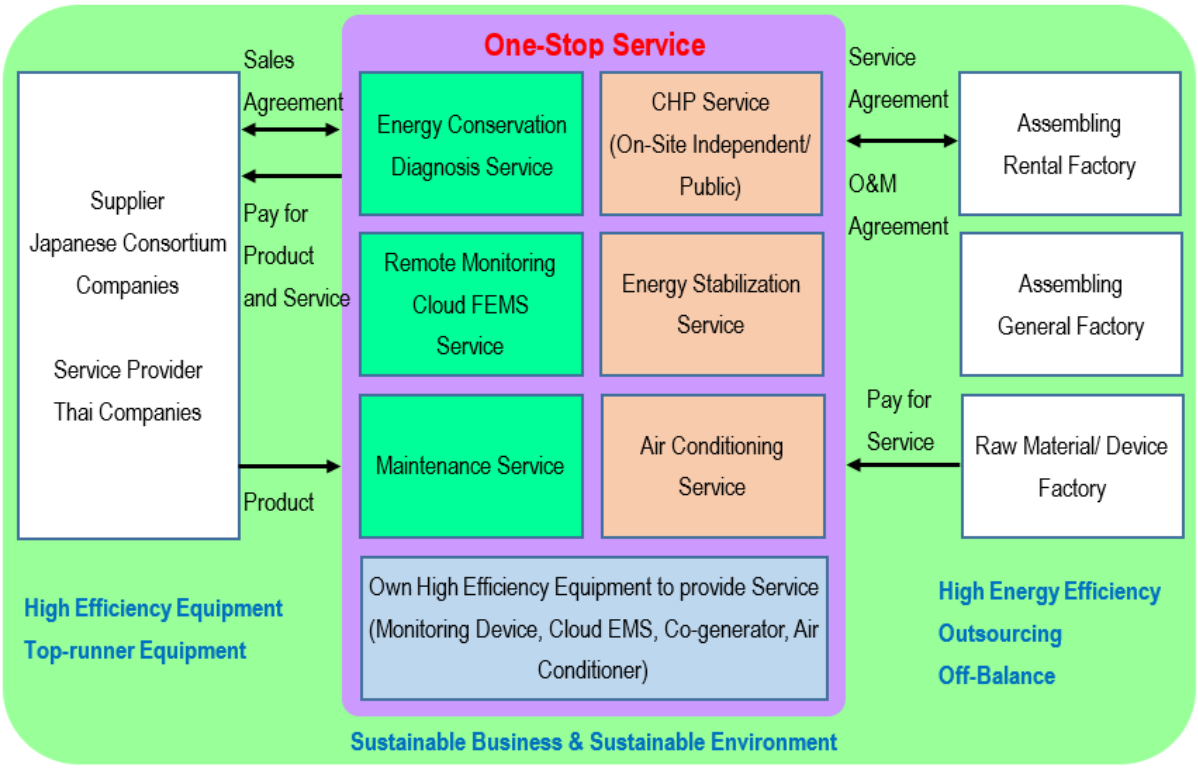


Figure 7-2 Business Model

7.3 Details of the Business

The project was planned to study business feasibility of the project which aims to provide the high quality Energy Service, the Energy Conservation and O&M Service, and the Smart Service by outsourcing or by providing function which does not require initial investment; and the project was started from January, 2015. At the beginning, the targets of the services were large scale factories located in Rojana Prachinburi Industrial Estate or Map Ta Phut Industrial Complex and which consume large quantity of electricity and steam, factories facing unstable power supply problem such as momentary power failure, and factories which did not have maintenance function by themselves.

However, in process of the survey with planned targets and industrial estates, it was found that economic status in Thailand, infrastructure status in industrial estates and their surroundings, and factories' consciousness on maintenance has changed from the period of project planning; even though many factories and industrial estates had potential demand for installation of the on-site power generation. Slowdown in Thai economy brought decrease in number of Japanese companies advance into Thailand, such decrease caused power demand reduction in industrial estates. Frequency of momentary power failure was decreased due to improvement of the infrastructure. Some companies had its own maintenance department. Thus, it seemed that it was difficult to find factories meet with planned targets.

On the other hand, during the survey, it was found that some factories were planning to replace its deteriorated air conditioning facilities even such plan was small scale, and some factories had demand for the energy saving by replacement of compressor with inverter type or by integration of compressor.

Most of such factories were Japanese-affiliated factories. Furthermore, Japanese-affiliated companies which were located in the rental factory and which were newly planning to advance into Thailand showed positive response to the point of “no need for the initial investment” in function provide type services.

There is no services which provide function by a fee-for-service delivery system in Thailand; thus, there is no competitors. Additionally, it was found as a result of the negotiation with specific factories that the service would have much advantage than procurement of reasonable Thai equipment if the service could provide high quality Japanese equipment without initial investment. Moreover, some companies welcomed the point that the service could provide maintenance service as well as function service by providing air conditioning systems and compressors. Thus, it seems that the key element of customer acquisition is to propose entirely attractive proposals through combination of various services.

Based on the above conditions, it was identified that small start-up focusing on comparatively small scale projects was effective to start business in current situation and to establish the SPC in future. Such small start-up will have form to target on mainly Japanese-affiliated small and medium factories. Business contents of such small start-up will be to provide some parts of the planned service programs, the Energy Service and the Energy Conservation and O&M Service, such as supply of reasonable and stable equipment based on the function supply service for air conditioners and compressors, implementation of the energy saving, and the O&M service with the Cloud FEMS (etc.) which will be provided as a packaged service.

However, business plan and details mentioned above are only for current situation when the services are planned to be provided previously to the establishment of the SPC. In other words, the schematic design for the On-Site Power Generation Service and the Factory Equipment Service such as UPS and Trans was not conducted at this stage as it was difficult to find positive clients for specific study. However, the On-Site Power Generation Service and the Factory Equipment Service would remain on the list of the service programs as demand was identified during the interview survey with factories. In particular for the on-site power generation, UPS and Trans, as analyzed in Chapter 5, advance into Thailand has been increasing as a big trend; major reasons of such big trend was caused by decrease in investment trend and improvement of power supply stability. In addition, it was found during the survey that frequency of the momentary power failure tends to decrease, however, it is not completely disappeared; and there is difference in frequency of the momentary power failure among industrial estates. Therefore, it seems that there is a business possibility depends on recovery of Thai economy and expansion of the business formation.

Furthermore, it seems that possibility of customer acquisition not only with Japanese-affiliated companies but also with Thai companies will increase according to increase of service reliability by achieving projects. It was identified that Thai companies as well as Japanese-affiliated companies have potential demand for the On-Site Power Generation Service and the Factory Equipment Service such as UPS and Trans. Therefore, listing the On-Site Power Generation Service and the Factory Equipment Service such as UPS and Trans in the service programs seems effective business strategy for future business with Thai companies; even though such services are yet to be studied specifically.

7.4 Service Structure

Concerning to the service structure, following 3 structures are studied based on business implementation period after the start of business, business scale, number of clients, etc.

(1) Business by Alliance Agreement

Business by alliance agreement is to seek for business chance through strong points of each member company based on discussion among members centering companies which studied business operation in this Survey (called “Local Consortium Members”, on the contrary, Japanese companies participating in this Study is named “Consortium Members in Japan”).

Challenge is how to sustain the alliance agreement despite the fact that it is yet to be clarified where the risk and responsibility lies.

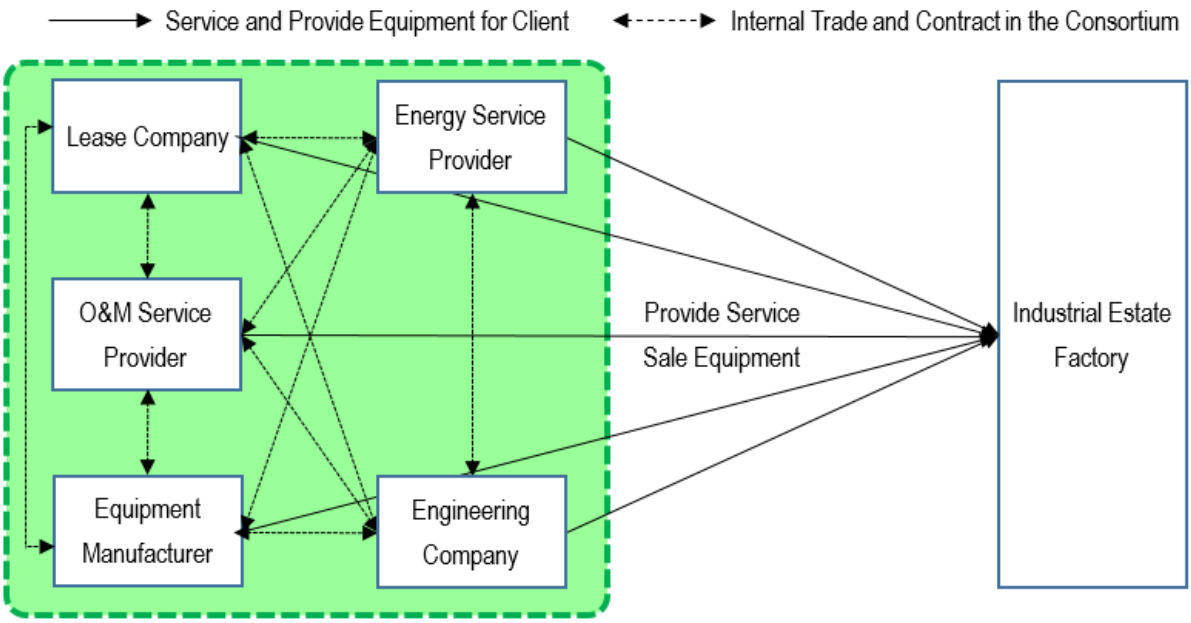


Figure 7-3 Business by Alliance Agreement

(2) Business by Agency Agreement

Business by Agency Agreement is to find agency among the Local Consortium Members; and construct business by cooperation among member companies with setting the agent company as a contact person.

In this type, demarcation of risk and responsibility, and cooperation scheme seem much clear than the business by alliance agreement to clarify role of each company. However, the company which roles as the agent needs to handle concentrated risks such as marketing, contract, etc. Thus, challenge is how to manage diversification.

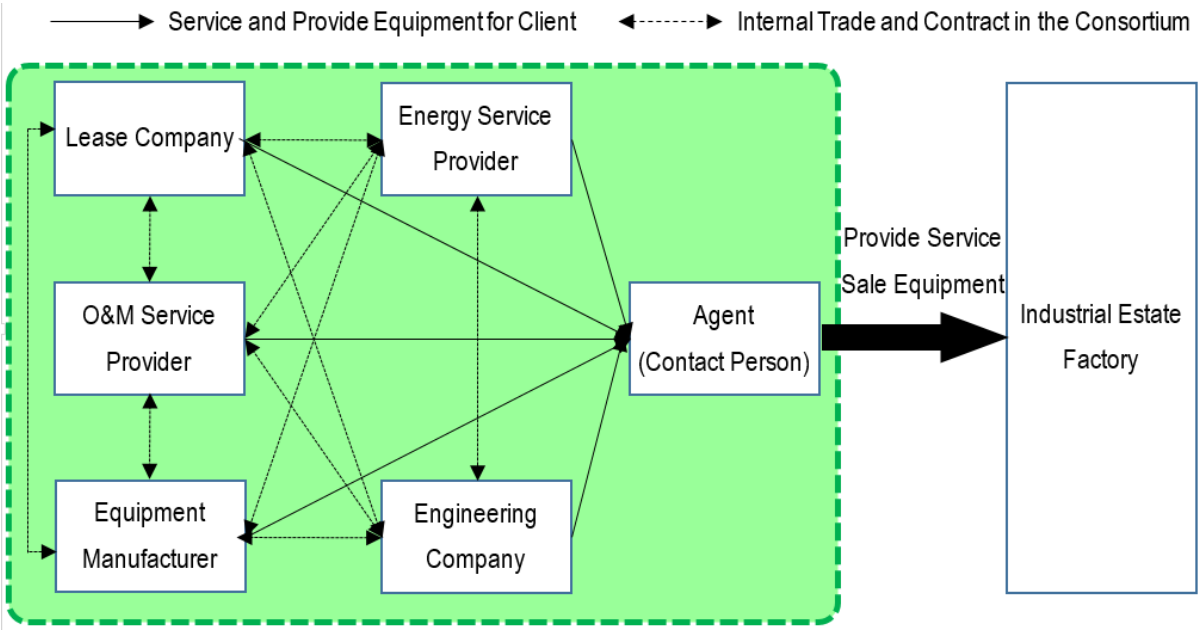


Figure 7-4 Business by Agency Agreement

(3) SPC Model

SPC Model is to establish a SPC for the project; and member companies have right to vote according to their equity. The SPC can promote project depends on stakeholders' priority. JICA and IEAT also can be the stakeholder of such SPC. Additionally, such SPC can be a core of the smart business in Thailand aiming further business development.

On the other hand, actual demand and business scale at a constant level are required to establish the SPC. This point may be a big challenge.

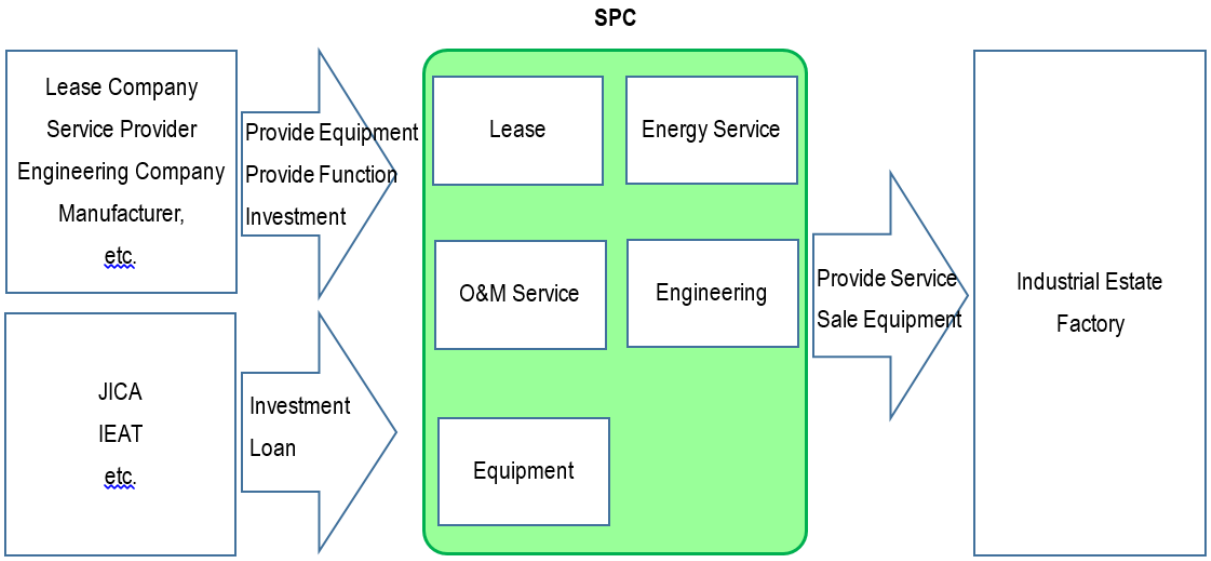


Figure 7-5 SPC Model

7.5 Business Implementation Schedule

Business will be developed by the Alliance Agreement and by the Agency Agreement, centering the Local Consortium Members, for the first 3 years; and the SPC is planned to be established approximately in 4th year.

Concerning the SPC establishment, customer acquisition, business development plan, development of business scheme, and pre-discussion with related authorities such as BOI will be conducted in the first 3 years; and the SPC establishment and obtaining business license will be conducted approximately in 4th year.

In addition, for the period until the SPC establishment, the Air Conditioning Service, the Factory Equipment Service (for compressor, UPS, Trans, etc.), and the Energy Conservation and O&M Service will be developed by the Alliance Agreement and by the Agency Agreement. The SPC establishment will be implemented at the stage when constant clients were acquired. For the period after the SPC establishment, the SPC will be evaluated by the financing body and receive funds to purchase and install assets and facilities for lease in the Energy Service; and then, the SPC will start the On-Site Power Generation Service for the clients.

Table 7-1 Business Implementation Schedule

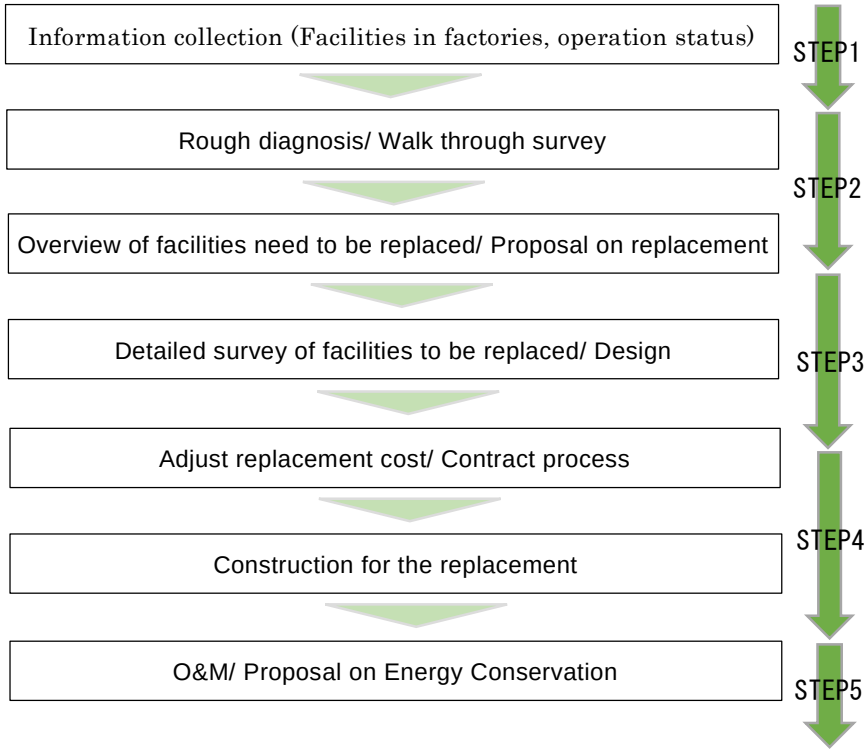
Items	Year				
	1st year	2nd year	3rd year	First half of 4th year	Second half of 4th year
Preparation for the SPC establishment	Customer Acquisition →				
		Business Development Plan Development of Business Scheme →			
			Pre-discussion with related authorities such as BOI →		
				SPC Establishment Obtaining Business License →	
					Financing →
Energy Service (On-Site Power Generation)					Purchase and Install properties and facilities for lease →
					Start of Business →
Energy Service (Air Conditioning Service and Factory Equipment Service (compressor, UPS, Trans, etc.))	→	Start of Business →	→	→	→
	Marketing/ Purchase and Install air-conditioning equipment				
Energy Conservation and O&M Service	→	Start of Business →	→	→	→
	Marketing/ Purchase and Install facilities for Energy Conservation and O&M Service				

(Developed by the Survey Team)

7.6 Operation and Performance Indicator

One-stop-service from consulting service to facility installation and O&M is prevailed in Japan. However, in Thailand, the Air Conditioning Service and the Factory Equipment Service, except the On-Site Power Generation Service by direct collaboration with factories, are yet to be implemented.

In the project, service will be provided to the factories based on below flow chart. Capital collection by the service will be started from STEP 5.



STEP1 - STEP2	:	Prospect Clients at Industrial Estates (Companies in Industrial Estates)
STEP 3	:	After client acquisition to contract process (Conclusion of contract)
STEP 4	:	Replacement construction (Installation of facilities)
STEP 5	:	Start operation such as proposal on Energy Conservation and O&M Service (Capital collection: Sales revenue)

Operation and performance indicator, as shown in below table, is set to identify operational status of the business plan and to evaluate ripple effect by the project after the operation start.

Table 7-2 Operation and Performance Indicator

Index	Operation Indicator	Performance Indicator
Number of Companies in the Industrial Estate	○	
Scale of the Service (BTU/H, kW, etc.)		△

Number of Clients	○	
Sales Revenue	○	
Improvement in Energy Efficiency by using the Service		△

○: Periodical Measurement, △: Measurement based on Collected Information

(Developed by the Survey Team)

For the operation indicator, number of companies in the industrial estate, number of clients, and sales revenue are set.

The number of companies in the industrial estate is essential indicator to forecast demand for the service at the targeted industrial estate. Based on this indicator, detailed demand will be forecasted. Thus, this indicator will be a basic indicator to select preferable industrial estate for service development, and select type of resources to be invested and service to be provided in such preferable industrial estate.

The number of clients is to show achievement of the service after the implementation of the service. This index is required to be analyzed as an important operation indicator such is for study on target number of clients for next term.

The sales revenue is to show achievement of the service as well as the number of clients. The sales revenue is most clear indicator to show operation indicator showing most important target of the service such as sustenance and expansion of the sales revenue.

However, the project is to provide multiple services different in details, function, scale and effectiveness. Thus, analysis should be conducted not simply based on the number of clients and the sales revenue. Analysis based on collaboration among various services by factory unit and by sales revenue for each service should be required.

Secondly, the scale of the service and the improvement in energy efficiency by using the service are set as the performance indicator.

The 1st target of the project is to provide basic utility function to the factories through providing function of high quality utility equipment, and selling (installation or replacement) high quality utility equipment. The project is also to provide the Energy Conservation and O&M Service after installation of the equipment to provide proposal on further improvement during the leasing period and to minimize equipment based problems such as equipment failure due to lack of maintenance. Therefore, the scale of the service seems appropriate as the performance indicator which shows utility providing function such as BTU/H for the air conditioner and kW for the compressor.

In addition, the improvement in energy efficiency by using the service is set as the performance indicator besides the scale of the service. In the project, energy efficiency at factories will be improved by various services; and such effect leads optimization in production and management and cost saving. Moreover, energy conservation and CO2 emission will be listed as upper level of the environmental effect. However, measuring such upper level of effect by each factory seems difficult. Thus, the improvement in energy efficiency by using the service is set as the performance indicator.

8 Environment and Social Consideration

8.1 Review of the Approved Environmental Impact Assessment Report

Environmental Impact Assessment Report submitted by target industrial estates for the project, and approved by the Ministry of Natural Resources and Environment (MONRE) ONEP Environmental Impact Evaluation Bureau (EIEB) have been obtained

① Amata Nakorn Industrial Estate
② Pinthong Industrial Estate
③ Rojana Rayong Industrial Park
④ Map Ta Phut Industrial Complex

8.2 Current Environmental Conditions

8.2.1 Land Use

This section describes the land use plan of the area surrounding industrial estates targeted by the project.

(1) Amata Nakorn Industrial Estate

Amata Nakorn Industrial Estate is located in Chonburi province in southeast Thailand with a total of 6,630.8 acres (16,577 rai[11]). The breakdown is as described below.

- Industrial area: 3,600 acres (9,000 rai)
- Residential/Commercial area: 140 acres (350 rai)
- Infrastructure/public space: 640 acres (1,600 rai)
- Green space: 340 acres (850 rai)
- Undeveloped area: 640 acres (1,600 rai)

[11] 1 Rai ≒ 0.4 acres ≒ 0.0016 km^2

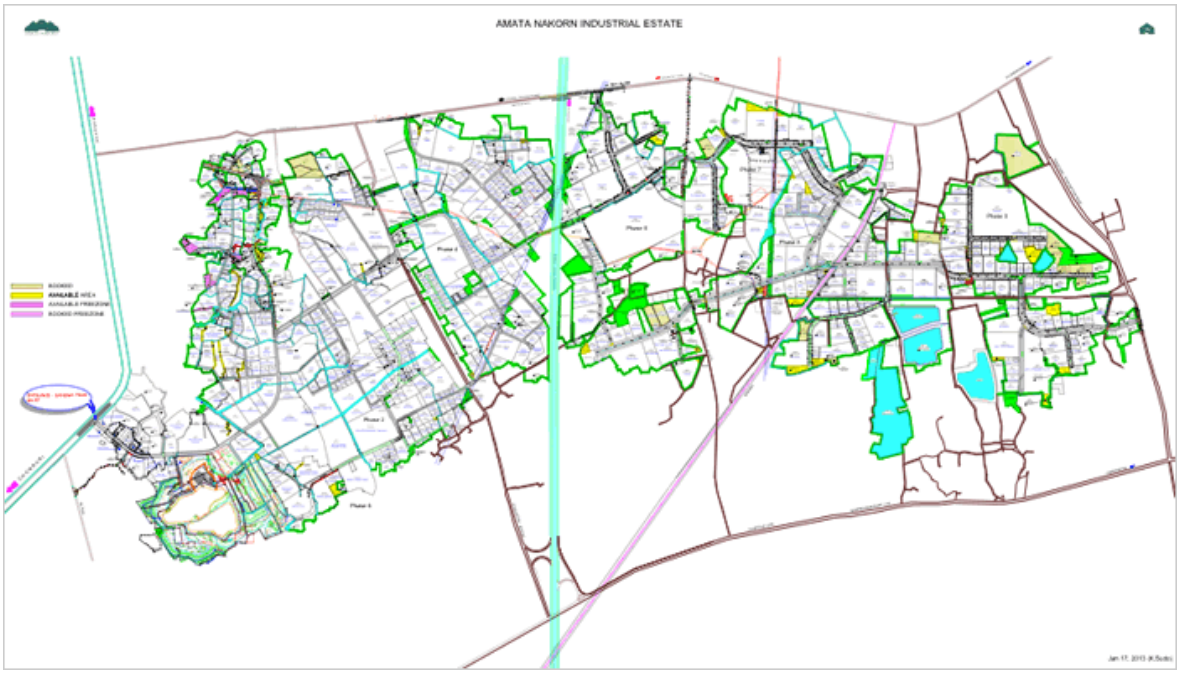


Figure 8-1 Master Plan of the Amata Nakorn Industrial Estate

Source: ITOCHU Corporation website (http://www.itochu.co.jp/ja/business/general/itochu-realty/solutions/industrial_park/amata_nakorn/)

(2) Pinthong Industrial Estate (Pinthong Industrial Estate -1~5. 3~5 are under development.)

Similar to Amata Nakorn Industrial Estate, Pinthong Industrial Estate is located in Chonburi province with a total site area of 1,987,200m^2 (496.8 acres).

Figure 8-2 Map of Pinthong Industrial Estate (Pinthong 1~3)

Source: Tokyo Development Consultant Website (http://www.pipestate.com/)

(3) Rojana Rayong Industrial Park [Rayong 1 (Ban Khai), Rayong 2 (Pluak Daeng)]

The total areas of Rojana Rayong Industrial Park located in Rayong province is 1,200 acres (3,000 rai) at Rayong 1 – the first project, and 600 acres (1,500 rai) at Rayong 2 – the second project.

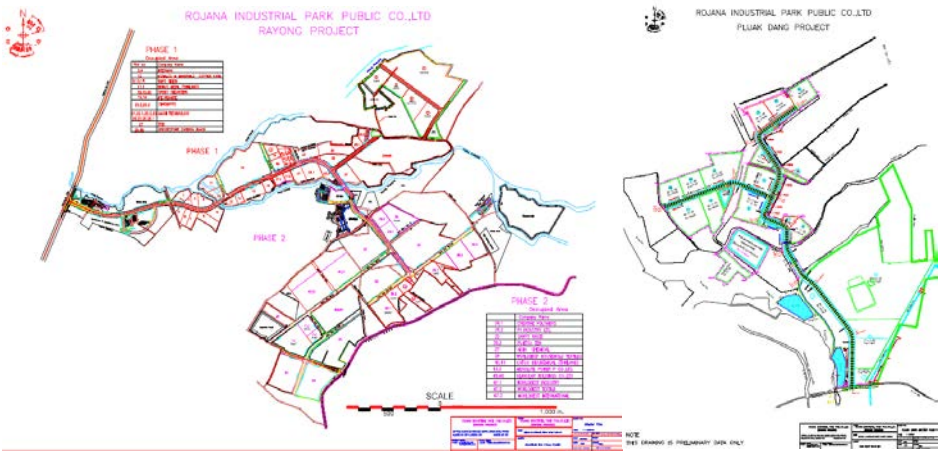


Figure 8-3 Master Plan of the Rojana Rayong Industrial Park (Rayong 1, Rayong 2)
Source: Thai-koujyo.com website (http://www.thai-koujyo.com/)

(4) Map Ta Phut Industrial Complex

"Thailand National Spatial Development Plan", a regional plan published in 2057 in Buddhist calendar propose to develop southeastern Thailand, where Rayong province is located, as the industrial center and world-class advanced port city, to reinforce its function as an economic gateway and a focal point of transportation/logistics in the Asian region. In the plan, Rayong city, the major city in the southeast region, is placed as an economic center that ensures the expansion of the metropolitan area.

The following indicates the land use plan stated in the provincial development plan "Rayong Comprehensive plan".

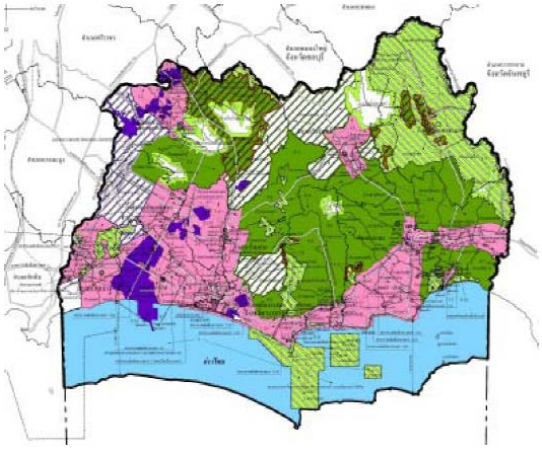


Figure 8-4 Land Usage Plan based on the Rayong Comprehensive Plan
Source: Ministry of Land, Infrastructure, Transport and Tourism[12]

[12] Ministry of Land, Infrastructure, Transport and Tourism, "Shogaikoku no seichousenryaku, chiiikishinkoutou ni kakawaru kokudo seisaku bunseki chosa (Analysis on national policy on regional development and growth strategies in various nations)" (http://www.mlit.go.jp/kokudokeikaku/international/spw/report/1303_thailand.pdf)

8.2.2 Natural Environment

(1) Amata Nakorn Industrial Estate

(2) Pinthong Industrial Estate (Pinthong Industrial Estate-1~4)

Chonburi province is located in the midlands of Thailand. Its western coastal area is adjacent to the Gulf of Thailand, Khao Kaew massif stretches from northwest to the southeast, and has fertile plain in the north. The area has a tropical climate; the average annual rainfall between 1981~2010 is 1,295.6mm, and annual average number of rainy days is approximately 120 days. Southwest region of the province is a harbor district centered on the Laem Chabang deep-sea port, and is also a tourist resort focused around the tourist destination Pattaya.

(3) Rojana Rayong Industrial Park [Rayong 1 (Ban Khai), Rayong 2 (Pluak Daeng)]

(4) Map Ta Phut Industrial Complex

Rayong province consist of numerous islands, including the Indochina peninsula adjacent to the Gulf of Thailand, and Koh Samet -a tourist destination floating in the gulf. Northern region of the peninsula has a range of hills, however most of the other areas are flatland. The area has a tropical climate; the average annual rainfall between 1981~2010 is 1,383.2 mm, and average annual number of rainy days is approximately 110 days. The area facing the peninsula of the Gulf of Thailand is a beach resort, and the environmental awareness of the residents are high.

8.2.3 Economy

Major industries of Chonburi and Rayong provinces are agriculture, tourism and manufacturing.

For tourism in Chonburi province, Pattaya was originally a recreation area for the US military in the 1970s Vietnam War, and flourished as one of the nation's most popular tourist resort.

Numerous industrial estates are located in Chonburi province taking advantage of the easy-access to the Laem Chabang deep-sea port in the west, where as the industry in Rayong province consists of 13 large-scale industrial estates developed since the 1990s, including the Map Ta Phut Industrial Complex centered on heave-industry. Both Chonburi and Rayong province have flourished as one of the country's leading industrial provinces.

Industrial estates in Rayong province can be roughly divided into industrial estates located on the southern coastal area that faces the Gulf of Thailand and the hinterland approximately 160 km away from Bangkok, and industrial estates located near the northern border of Chonburi province, approximately 120 km from Bangkok. Among these industrial estates, those located in the northern area are adjacent to industrial estates in Chonburi province which mainly focuses on mechanical systems. GM, Isuzu automobile industry, and its related industries are located in the northern region. On the other hand, the southern coastal region is a heavy chemical industrial district, including petrochemical complex which uses natural gas, and 66 factories funded by local capital, Japanese companies, and joint ventures, and the Map Ta Phut Industrial Complex with a large harbor (Map Ta Phut port).

8.2.4 Environmental Issues Related to Economic Development

Map Ta Phut Industrial Estate in Rayong province began to have conflict with the local residents in the late 1990s. There has been a case of an elementary schools near the industrial estate having have to relocate due to odor, and experts and scholars have pointed out hazardous substances in the air (VOC, etc.) and the rise of carcinogenic rate. For this reason, surrounding residents and NGO workers filed a lawsuit on the operation of the Map Ta Phut Industrial Estate to the Administrative Court of Thailand against the government for infringement of the Constitution of the Kingdom of Thailand B.E. 2550 (2007) Article 67 Clause 2 that states for "any project or activity which may seriously affect the community in the quality of environment, natural resource, and health shall not be permitted, unless its impact on the quality of environment and people's health in the community have been studied and evaluated and the public hearing process to obtain the opinion of people and interested parties has been held."

On March 2009, the Central Administrative Court, that conducted the trial of the lawsuit by the residents, ordered the provisional disposition of injunction against 76 businesses operating in the relevant industrial estate, until the final judgement concerning the security of Map Ta Phut district and its surrounding community is made, or until the court changes the order.

On December 2009, among businesses subject to injunction, the Supreme Administrative Court of Thailand approved the resumption of 12 businesses that had been determined as no serious impact to the environment.

Due to the occurrence of the these issues, the region that includes the Map Ta Phut district was specified as the designated pollution prevention area based on the Thailand Environmental Quality Preservation Act.

In relation with these movement, currently there is a campaign led by ONEP to specify the northern region of Rayong province as an area of pollution control in 2016. Under such circumstances, there is a need to pay close attention to the discussions evolving around related movements in Thailand.

8.2.5 Current Situation of the Regional Environment

(1) Air Quality

As of 2013, the Thai government has installed automatic measuring instruments for air pollution in 62 locations across Thailand, conducting monitoring.

According to "Thailand State of Pollution Report 2013" issued by the MONRE Environment Pollution Control Division (PCD), monitoring result at the observation point closest to the project site in Rayong, 2 recorded 34 days in 2013 in which PM2.5 concentration reference value (50 $\mu g/m^3$) was exceeded. Although the average annual concentration of VOC in the atmosphere at the surrounding community of Rayong industrial district between 2011~2013 is lower than the level observed on roadside in Bangkok metropolitan area, it exceeded the reference value (1.7 $\mu g/m^3$) at 3～4 $\mu g/m^3$.

(2) Noise

As of 2013, the Thai government are operating 30 automatic noise monitoring stations on roadsides and other necessary regions across the nation. In addition, noise level measurements are taken at

automatic roadside monitoring station, comprehensive automatic monitoring station, temporary roadside monitoring stations, and comprehensive monitoring stations installed at 33 locations nationwide including the Bangkok metropolitan area experiencing significant increase in noise level due to increased number of automobiles, and at seven northern and southern provinces. According to PCD's "Thailand State of Pollution Report 2013", the state of installation of monitoring stations and measurement results in Chonburi and Rayong province are as follows.

In Chonburi province, there is one comprehensive automatic monitoring station in the north, and a total of two automatic roadside monitoring station at west and southwest region. The measurements at the north station is at 70.1~80.0 dB which is at the same level of noise as the center of Bangkok. The measurements at west and southwest is 60.1~70.0 dB, which is at the same level of noise as some parts of Bangkok.

In Rayong province, there are two automatic roadside monitoring stations, which measures approximately the same level as west and southwest stations in Chonburi province.

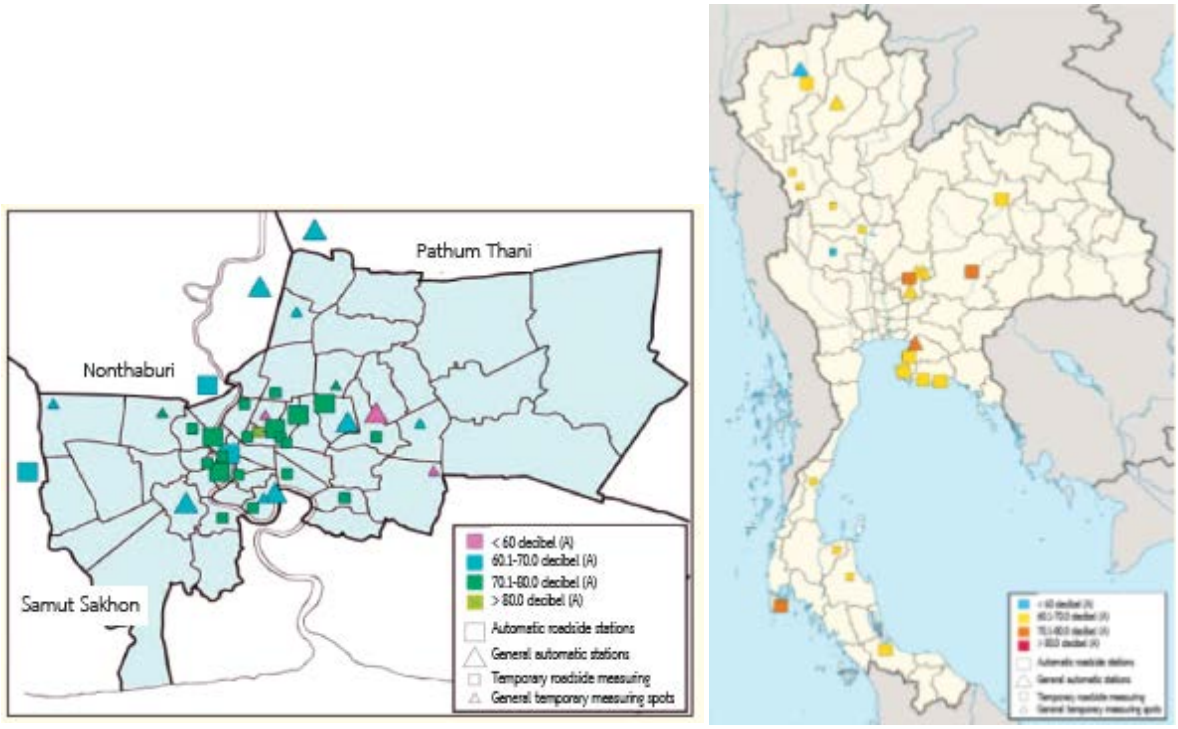


Figure 8-5 Noise Level in Bangkok and Thailand
Source: PCD "Thailand State of Pollution Report 2013"

(3) Water Quality

As of 2013, the Thai government is implementing water quality monitoring in river, lakes and swamps at 52 locations nationwide, and collects water samples at 366 monitoring stations. According to the PCD's "Thailand State of Pollution Report 2013", the Water Quality Index (WQI) of upper and lower Rayong of the Rayong province in 2013 are both either "poor" or "very poor", and substances such as Trichlorobenzene (TCB), fecal coliforms (FCB), and ammonia nitrogen (NH3-N) has been detected in

Rayong River that flows through the Rayong province. (Chonburi province has been omitted due to the lack of specific information.)

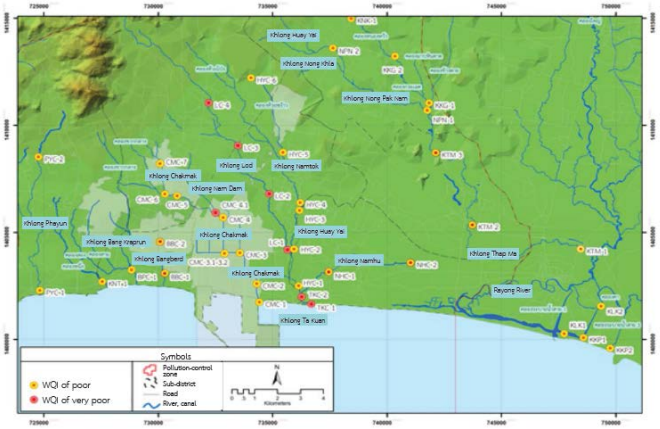


Figure 8-6 Water Quality in Rayong Province Designated Pollution Prevention Area
Source: PCD "Thailand State of Pollution Report 2013"

Furthermore, the water quality level of the canal that flows through the Map Ta Phut district and neighboring district within the designated pollution prevention area of the Rayong province observed to be at "Type 5". In addition, although the indicators that cause genetic problems such as TCB, FCB, NH3-N, and heavy metals such as arsenic, manganese, and zinc, etc., has been detected, the water quality within the relevant area, apart from some exception, are over all, thought to be improving as of 2013.

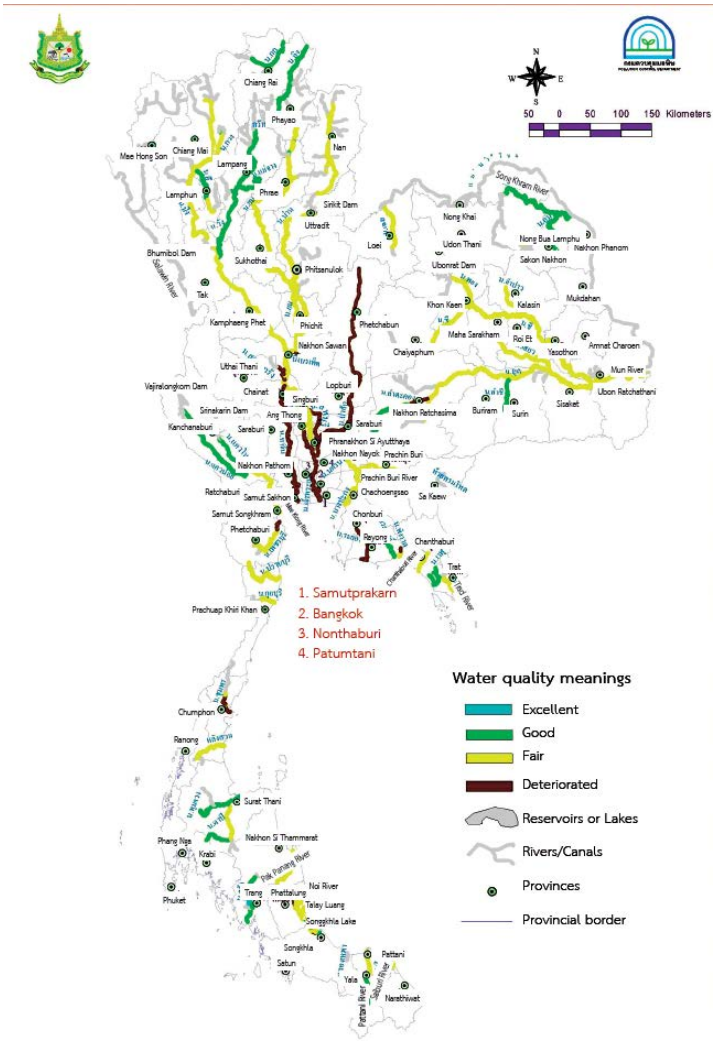


Figure 8-7 Surface Water Conditions (2013)
Source: PCD's "Thailand State of Pollution Report 2013"

(4) Local Environmental Monitoring Initiatives

At Amata Nakorn Industrial Estate and Rojana Rayong Industrial Park, Rojana Industrial Park PCL, the operator of the industrial estates conduct the water quality inspection of wastewater from each factories once a month. At Rojana Rayong Industrial Park, under the contract agreed with the tenant factory, Rojana Industrial Park PCL is given the rights to terminate the water supply upon violation of the rules by the factory, however, Rojana Industrial Park PCL do not possess the power to enforce the tenant factory to vacate.

According to the interview with the Map Ta Phut city authorities located in the Map Ta Phut Industrial Complex and EMC2 representatives, since some of the environmental pollutant exceeds the reference value as described previously, the city conducts environmental monitoring along with investigation of the cause. Furthermore, in Map Ta Phut Industrial Estate, following organizations conduct measurement activities related each block in industrial complex and environmental quality at road, and inspections of

the environmental management status of tenant companies based on the law. Consequently, those organizations pay close attention to control environment in the greatest heavy industry hub in Thailand.

- Inspection and measurement by EMC^2, a subsidiary of IEAT Map Ta Phut Industrial Estate office
  - An organization for that conducts inspections related to land use, business transaction, and pollution control in wastewater treatment / air pollution control / waste treatment etc. at tenant factories
  - Central monitoring by EMC^2 with monitoring equipment and necessary communication equipment related to the following air quality/water quality management and database management
    - Air quality: Air Quality Management System (AQMS), Continuous Emission Monitoring System (CEMS), SODAR/RASS, Air Model
    - Water quality: Water Quality Management System (WQMS)
    - Database management: VOCs inventory, GIS
    - Communication equipment: CCTV, Display Board, Alarm Transmitting department
- Omnidirectional monitoring of air quality by the 4 observatory (Wat Map Chalood observatory, Wat Krog Yai Char observatory, Wat Nong Fab observatory, Map Ta Phut New Town observatory)
- Batch wastewater (activated sludge) treatment system operation (treatment capacity 4,000m3/day) by the Global Utility Service Co., Ltd.
- Water sample collection and inspection by a certified research institution (daily inspection)
- Final water quality inspection before drainage to the Gulf of Thailand, and periodic transmission of the measurement results to EMC2 from the wastewater quality monitoring station
- Interviews on the third-party opinions concerning the current conditions of the environment and environmental management, and considerations of environmental inspection criteria by a tripartite organization consisting of following Thai government organizations, local government agencies, and resident representatives (meeting every one or two months).
  - Thai government: DIW, MONRE ONEP, MONRE Prevention Control Department (PCD), IEAT
  - Local government agencies: Rayong provincial government, Map Ta Phut city government
  - Resident representative: Representatives of community and teachers

In addition, tenant factories in Map Ta Phut Industrial Complex have installed air quality monitoring equipment on chimneys, reporting the emission to IEAT.

(5) Social Environment

1) Amata Nakorn Industrial Estate

2) Pinthong Industrial Estate

Both above industrial estates are focused on manufacturing business, located close to the Laem Chabang deep-sea port.

Amata Nakorn Industrial Estate is surrounded by flat lands, scattered with towns and residential areas which may be affected by the development project. The industrial estate is closely located to the Bang

Na=Chonburi Highway that connects Bangkok to Pattaya, along which residential developments are under way.

On the other hand, Pinthong Industrial Estate is partially located in the mountains, with agricultural land scattered in the surrounding area which may be affected by implementation of the project. The industrial estate is located close to the Chonburi=Pattaya Highway which connects Chonburi province with Pattaya along which residential developments are under way.

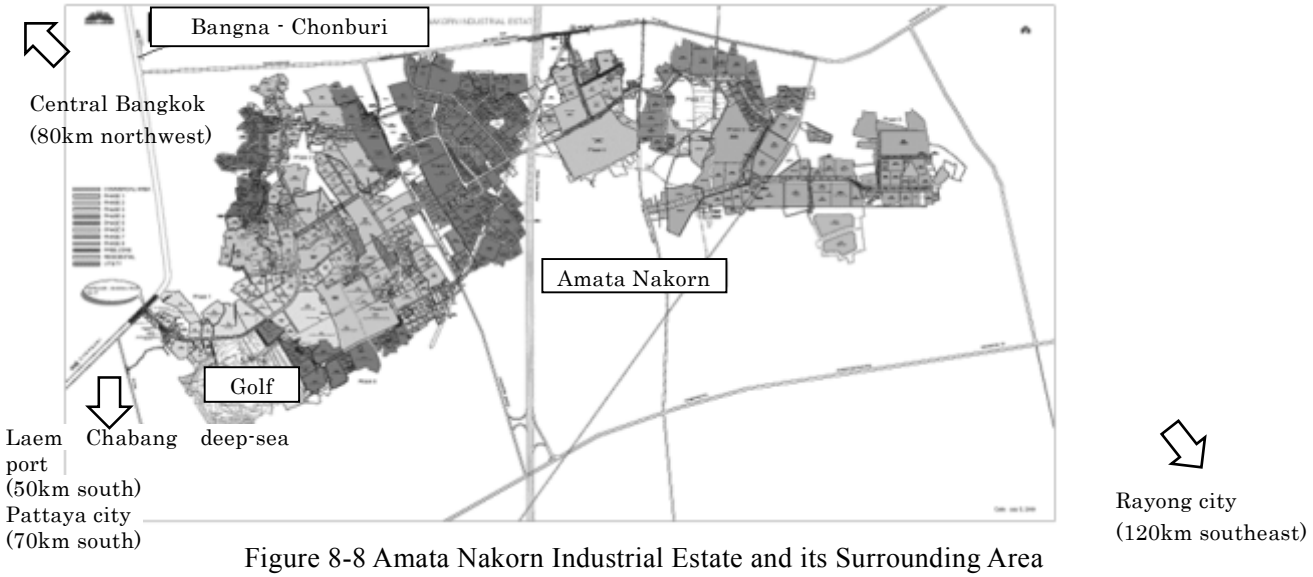


Figure 8-8 Amata Nakorn Industrial Estate and its Surrounding Area

Source: Prepared by the Study Team based on the Master Plan

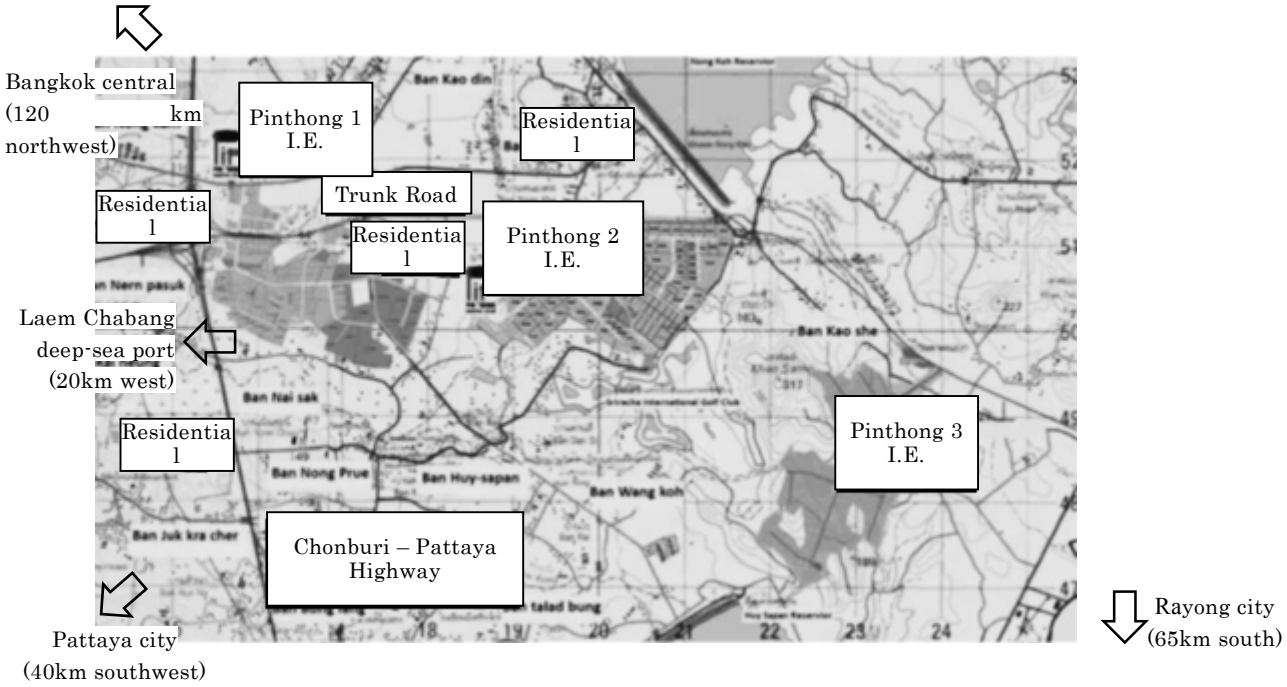


Figure 8-9 Pinthong Industrial Estate and Its Surrounding Area

Source: Prepared by the Study Team based on the Pinthong Industrial Estate HP

3) Rojana Rayong Industrial Park (Rayong 1, Rayong 2)

Rojana Rayong Industrial Park is a small-scale industrial estate which mainly focuses on manufacturing. Rayong 1 is located in northern Rayong province, and Rayong 2 is located in northwestern Rayong province. Both of the industrial estates are located inland; Rayong 1 is located along the highway that connects the Chonburi province with Rayong city south to north (route 3138), and Rayong 2 is located slightly away from the highway (route 36) and immediate east of the Amata City Industrial Estate. Residential areas located along the highway southeast of Rayong 1 and surrounding Rayong 2 may be affected by implementation of the project.

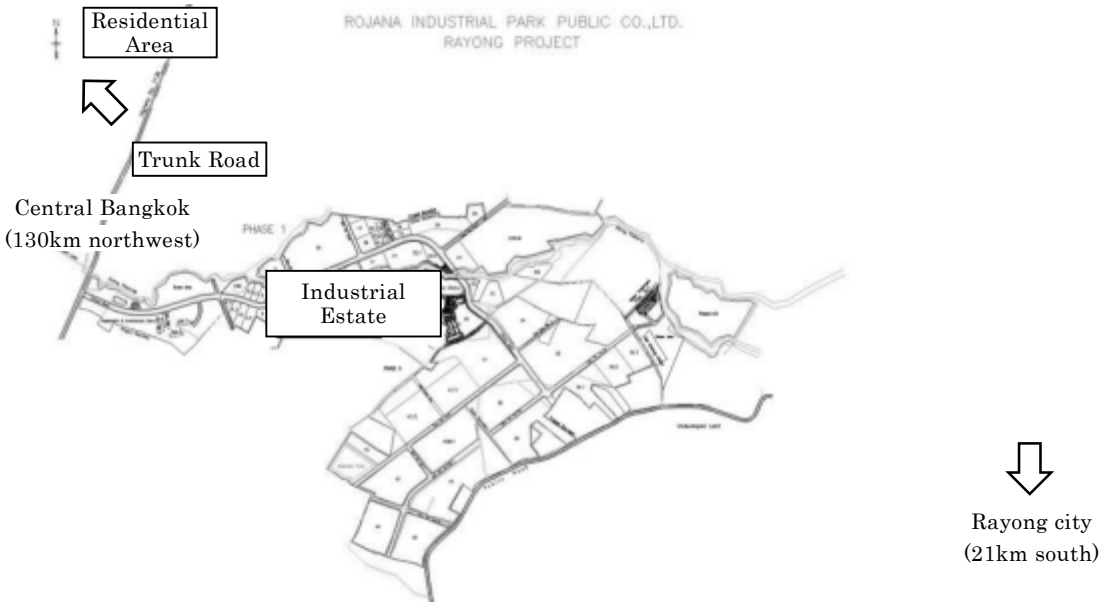


Figure 8-10 Rojana Rayong Industrial Park (Rayong 1) and its Surrounding Area

Source: Prepared by the Study Team based on the Rojana HP

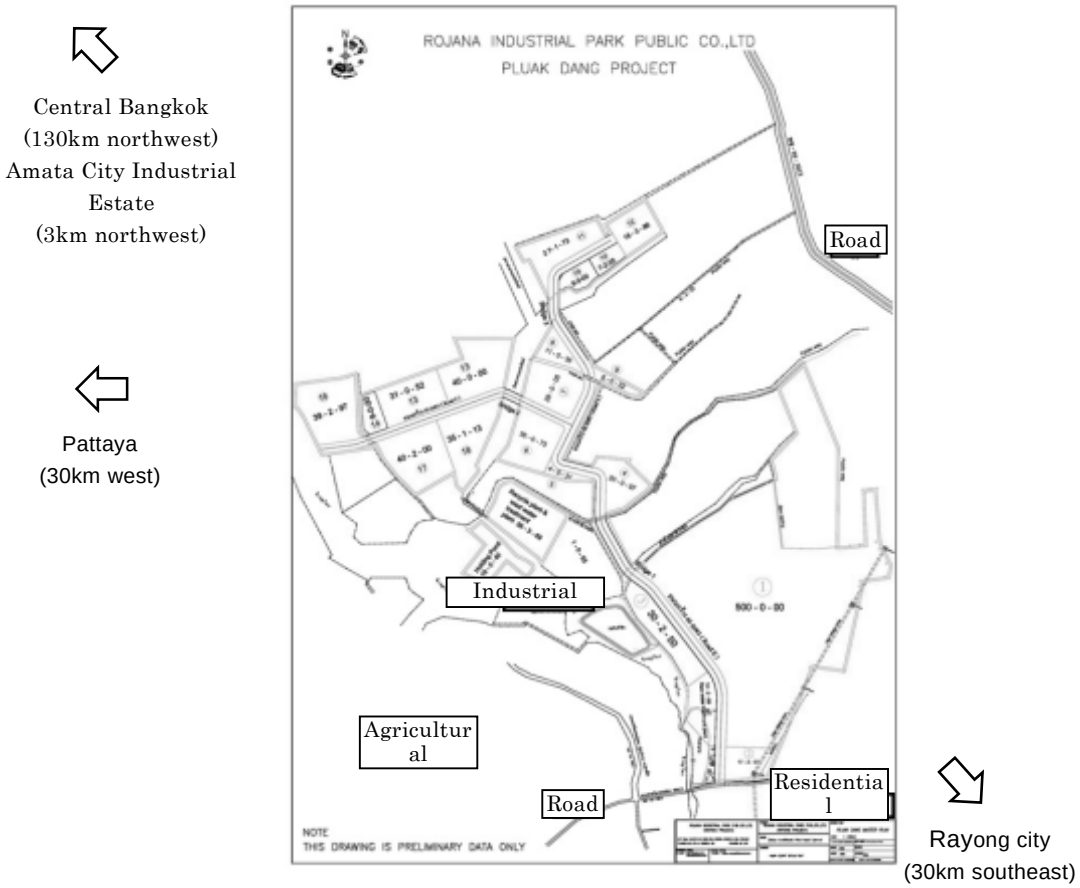


Figure 8-11 Rojana Rayong Industrial Park and its Surrounding Area

Source: Prepared by the Study Team based on the Rojana HP

4) Map Ta Phut Industrial Complex

Map Ta Phut Industrial Complex is adjacent to a heavy chemical complex, and is focused on heavy industries such as chemical, petrochemical, and metal, etc. as shown in section 3-1-3.The industrial complex is managed by the IEAT Map Ta Phut Office.

Map Ta Phut Industrial Estate is surrounded by flatland, facing the Gulf of Thailand to the south. There are apartment blocks scattered in the employee residential district adjacent to the industrial zone which may be affected by implementation of the project. Since this target site is located close to Rayong city, the center of Rayong province, residential development are progressing along the highway.

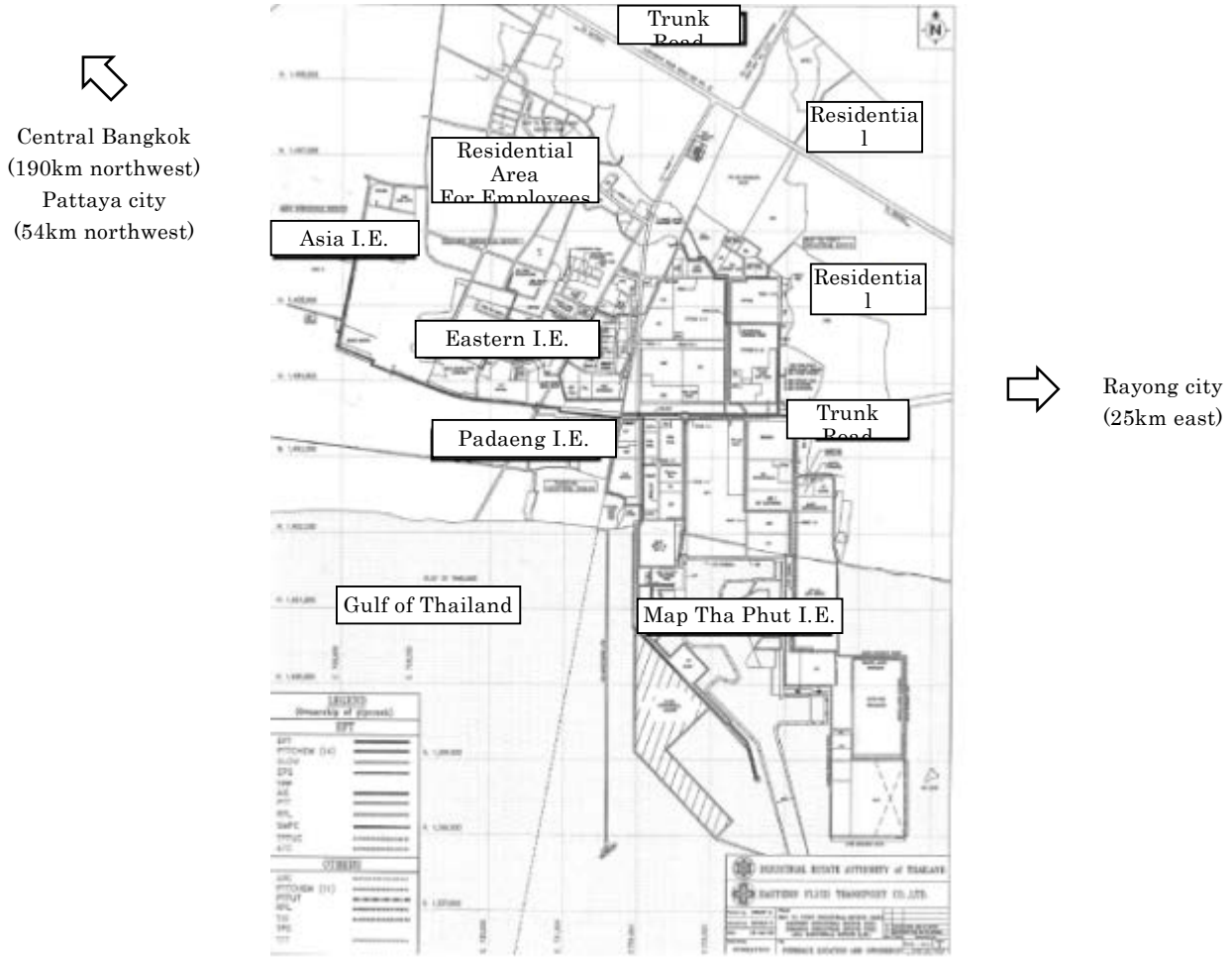


Figure 8-12 Map Ta Phut Industrial Complex and its Surrounding Area

Source: Prepared by the Study Team based on Information from IEAT Map Ta Phut

8.3 Environmental Social Consideration in Thailand

8.3.1 Thai Environmental Law

(1) National Environmental Preservation Promotion Act

1) General Description

Thai "Enhancement and Conservation of Natural Environmental Quality Act [B.E. 2535 (NEQA, 1992)] states the Environmental Impact Assessment System.

This act is administered by the EIEB under ONEP of the MONRE. The structure of the act is as follows.

Chapter I	National Environment Board
Chapter II	Environmental Fund
Chapter III	Environmental Protection
Chapter IV	Pollution Control
Chapter V	Promotional Measures
Chapter VI	Civil Liability

Chapter VII Penal Provisions

Provision for EIA can be found in Chapter III Section 4 Article 46~51. Chapter III Section 1 prescribes the environmental standard for air, noise and vibration, water quality in rivers and coastal regions, underground water, etc., Section 2 prescribes the environmental standard management plan, and Section 3 prescribes regulations related to environmental preservation and protected area.

2) Projects Subject to EIA

The type and scale of projects which require the submission of an EIA report can be roughly categorized as below.

- Projects and activities prescribed in the Thai Enhancement and Conservation of Natural Environmental Quality Act Section 46
- Projects and activities that requires the EIA (34 types)
- Projects and activities that requires the Environment Health Impact Assessment (EHIA) (11 types)
- Projects and activities prescribed by the notice of the environment protected area based on the Enhancement and Conservation of Natural Environmental Quality Act Section 44 (3)
- Projects and activities at Forest Preservation area
- Projects and activities that may affect the ecosystem of internationally/domestically significant river basin

The following are the 34 types of projects and activities that requires the EIA based on the Enhancement and Conservation of Natural Environmental Quality Act Section 46. The project considered in this report do not fall in any of the following projects and activity as the capacity of generation by the Energy Service is planned to be 6MW , therefore will not be subject to the EIA regardless of the scale.

- Mining defined by the Mineral Act
- Petroleum Industry
- Petroleum and Fuel Pipeline System Project
- Industrial Estate as defined by the Industrial Estate Authority of Thailand Act or Projects with identical feature or Land Allocation Project for Industrial development
- Petrochemical Industry using chemical process in production
- Petroleum Refining Industry
- Natural Gas Separation Industry or Natural Gas Reforming Industry
- Chlor-alkaline Industry that required Sodium Chloride as raw material to produce Sodium Carbonate, Sodium Hydroxide, Hydrochloric Acid, Chlorine, Sodium Hypo-Chloride and Bleaching powder
- Cement Industry
- Pulp Industry
- Pesticide Industry or Industry producing active ingredient by chemical process

- Chemical Fertilizer Industry using chemical process
- Sugar Industry
- Iron or Steel Industry
- Mineral Smelting Industry, Mineral Dressing Industry or Metal Melting Industry except Iron or Steel
- Liquor and Alcohol Industries including beer and wine
- Central Waste Treatment Plant defined by the Factory Act
- Thermal Power Plant (capacity greater than 10 MW)
- Expressway as defined by the Expressway and rapid Transit Authority of Thailand Act or other projects alike
- Highway or road which defined by the Highway Act, passing through the following areas
- Rail-Type Mass Transit System
- Port
- Recreational Port
- Land Reclamation
- Construction or Expansion of Structures close to or in the sea
- Aviation Transportation System
- Building which defined by the Building Control Act
- Land Allocation for residential or commercial purposes which defined by the Land Allocation Act
- Hospitals or Nursing Homes that defined by the Medical Services Act
- Hotel or Resort which defined by the Hotel Act
- Residential Building which defined by the Building Control Act
- Dam or Reservoir
- Irrigation
- All projects located in the area classified as Class 1 watershed area by the cabinet resolution

Based on this section, the following are the 11 types of projects and activities that require the EHIA. Industrial Estate Smart Community Development Project will not be subject to implementation of the EHIA.

- Lank reclamation in the sea or lake in the external existing coastline
- Mining with defined by the Mineral Act
- Industrial Estate in accordance to Industrial Estate Act
- Petrochemical Industry
- Mineral Smelting Industry or Melting Metal Industry
- Manufacturing, disposal or modification of radioactive substance
- Central Waste Treatment Plant or buried garbage or unused material manufacturer as defined by the Factory Act
- Project of aviation transportation system
- Port
- Dam or reservoir

- Thermal Power Plant (Coal power plant with capacity greater than 100 MW, cogeneration plant with capacity greater than 3,000 MW, generation with natural gas, etc.)

3) EIA Procedure and Schedule

EIA procedure is categorized in to the following 4 types according to content of project activities.

- Approval process for projects activities which are required by law and projects or activities which as not required the approval of the cabinet
- Approval process for projects or activities required the approval of the cabinet
- Approval process for projects or activities which may seriously affect community which respect to Environment, Natural Resources and Health and are required permission by law and projects or activities which are not required the approval of the cabinet
- Approval process for projects or activities which may seriously affect community and required the approval of the cabinet

The following diagram describes the above "Approval process for projects activities which are required by law and projects or activities which are not required the approval of the cabinet".

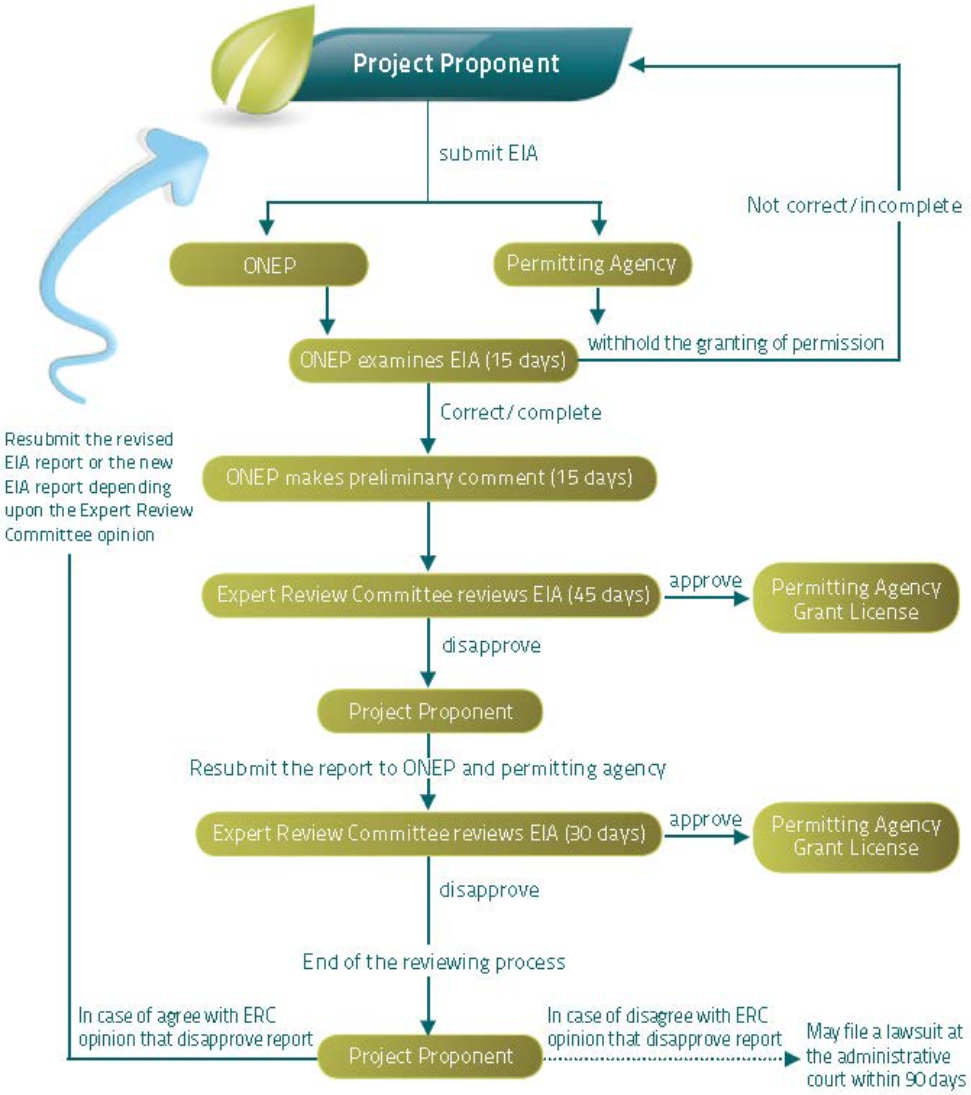


Figure 8-13 Approval Process for Project Activities Which are Required by Law and Projects or Activities Which are Not Required he Approval of the Cabinet

Source: ONEP "Environmental Impact Assessment guideline for Japanese Investors"

Upon implementation of an EIA, an EIA report will need to be submitted to ONEP ("Agency for Policy and Planning" in the diagram above) and permitting agencies. The EIA report shall specify the general description of the project activities (location, plan, etc.), the environmental data of the target site and EIA result, additional measures for environmental preservation, measures to mitigate the damages by the environmental impact, and environmental monitoring plan.

Once ONEP receives a report, an audit will start within 15 days, and an initial statement will be prepared within the next 15 days. Taking the initial statement into consideration, the Expert Review Committee (described in the diagram above) shall start an audit within 45 days, and once it is approved by the Committee, a permit shall be granted by the Permitting Agencies. If it is not approved, the project operator shall resubmit the report to ONEP and Permitting Agencies, and will need to follow the same procedure.

4) EHIA Procedure and Schedule

The EHIA will be an additional feature to procedure for EIA described in 3) , and will need an initial statement from an external independent agency (environment and welfare related agencies, academic experts), a stringent study concerning the health impact assessment, a focus group for the preparation of an EIA report, and a public hearing held by the Permitting Agencies for the final decision on issuance of a permission.

The following diagram indicates the EHIA approval process for "projects activities which are required by law and projects or activities which as not required the approval of the cabinet.

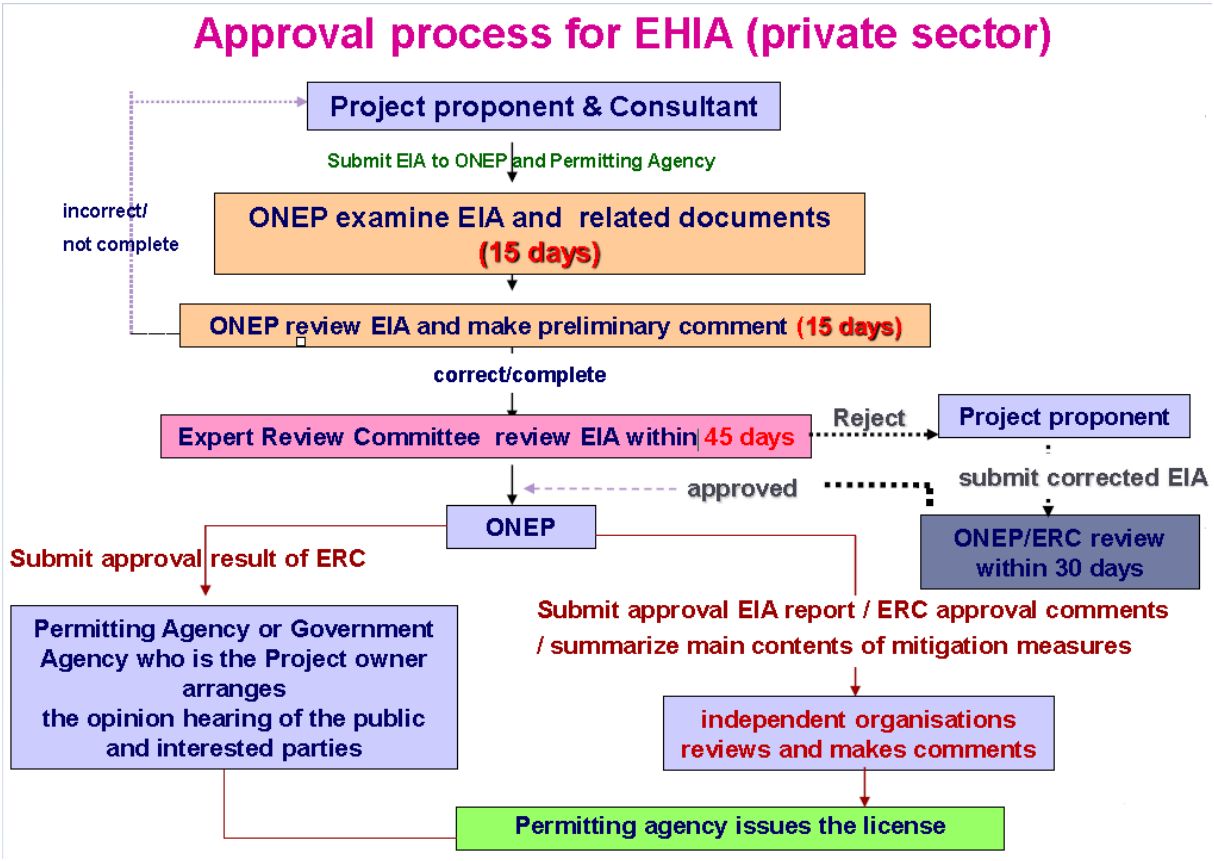


Figure 8-14 EHIA approval process for "projects activities which are required by law and projects or activities which as not required the approval of the cabinet

Source: ONEP

For implementation of the EIA, an EIA report will need to be submitted to the ONEP ("Agency for Policy and Planning" in the diagram above) and Permitting Agencies. The EIA report shall specify the general description of the project activities (location, plan, etc.), the environmental data of the target site and environmental impact assessment result, additional measures for environmental preservation, measures to mitigate the damages by the environmental impact, and an environmental monitoring plan. The EIA report will need to be prepared by an expert consultant certified by the ONEP.

After the EIA report is received, an audit will start within 15 days, and an initial statement will be prepared within the next 15 days. Taking initial statement into consideration, the Expert Review Committee shall start an audit within 45 days, and once it is approved by the Committee, a permit shall be granted by the Permitting Agencies. If it is not approved, the project operator shall resubmit the report to ONEP and Permitting Agencies, and will need to follow the same procedure.

(2) Local Regulations on Implementation of New Services at Existing Industrial Estates

1) General Description

A development and management body of industrial estates in Thailand can be categorized into two types: IEAT and a private company. Map Ta Phut Industrial Estate, one of the target site for the project, is developed and managed by IEAT. Industrial estates developed by foreign capital will be required to comply with various laws and regulations, such as the Foreign Business Act. Various environmental and social consideration-related laws and regulations will also be applied depending on the type of a project.

Industrial Estate Smart Community Development Project aims to provide the Energy Services such as cogeneration, installation, operation and maintenance service of an energy saving equipment, and Transportations Services using EV buses for tenants in an existing development area of an existing industrial estate, and also to provide new services for the management entity of the industrial estate, such as environmental monitoring-related services. Doing so will require close attention to various laws and regulations mentioned above.

2) Descriptions of Local Regulations Concerning Implementation of New Services

For implementation of the services proposed in the project such as the Energy Service and the Environment Monitoring Service, there is a need to obtain certifications according to the Factory Act which specifies safety and environmental standards in factories at an industrial estate. These services fall under the Category-3 of businesses in the Factory Act, and will require an approval from DIW who holds jurisdiction over the Factory Act. For implementation of the Environment Monitoring Service, approval will need to be obtained from MONRE Department of Environmental Quality Preservation (DEQP).

In addition, among target sites for the project, IEAT managed Map Ta Phut Industrial Complex will need to comply with IEAT's own environmental regulations (wastewater regulations, etc.) applied based on the Industrial Estate Law.

3) Others

With environmental issues such as water pollution caused by industrial wastewater and air pollution caused by car exhaust emission in the background, the concept of "Eco-Industrial Estate" (EIE) was introduced in Thailand in 2000 led by MOI and IEAT to promote the development of an environment-friendly industrial estate.

Nine industrial estates, including Hemaraj Rayong Industrial Estate, Purachinburi 304 Industrial Park, and Ayutthaya Rojana Industrial Estate were selected as the site for a pilot study on the development of an "Eco-Industrial Estate". Currently, MOI is drawing up a master plan which targets all industrial zones

in 77 provinces nationwide. The master plan aims to reduce environmental and health problem at these industrial zones by 2018, focus on an eco-friendly economic growth, and a development of community/society around industrial towns.

Five perspectives and 22 standards have been described by the "Eco-Industrial Estate" however, there are no specific criteria, and the scheme does not involve any public assistance by the Thai government for the target industrial estates. Although Map Ta Phut Industrial Complex is not a target industrial estate for the "Eco-Industrial Estate", Industrial Estate Smart Community Development Project will contribute to the improvement of environmental quality in multiple areas that may fulfill the terms as an "Eco-Industrial Estate". However, since the benefits of obtaining this certification is not fully understood, the certification is considered not necessarily a requirement at this moment.

8.3.2 Draft of the Scoping Plan and the Draft of TOR for the Social Environmental Consideration

The Energy Service, one of the services targeted in the project, has possibility of causing Social Environmental issue. Table in below shows draft of scoping plan including evaluation items, and draft of TOR for the social environmental consideration according to the draft of scoping plan.

As the Energy Service includes on-site power generation and installation of energy conservation facilities, items in the draft of scoping plan were listed according to the check list for category "Other Electric Generation" and "Other Infrastructure Projects" in the "JICA Guidelines for Environmental and Social Considerations (April 2010)".

Table 8-1 Draft of the Scoping Plan for Energy Service

Category		Environmental Item	Evaluation		Basis of Evaluation
			Before Construction During Construction	During Operation	
Pollution Control	1	Air Quality	B-	B-	During Construction: Temporary deterioration in air quality around the site is expected during construction. During Operation: Emission of SOx, NOx, TSP etc., from operation of equipment are expected.
	2	Water Quality	C-	C-	During Construction: There is a possibility of deterioration in water quality by waste water from construction site, operation of heavy machineries, digging and from workers' accommodation. During Operation: Emission of oil, TSPs etc., in wastewater from air conditioning is expected.
	3	Wastes	C-	D	During Construction: Waste from earthwork and construction, PCB and asbestos from dismantling are expected. During Operation: Generation of waste that may impact surrounding environment is not expected.
	4	Soil Contamination	D	D	No work that may cause soil contamination is expected.
	5	Noise and Vibration	B-	B-	During Construction: Although temporary, noise and vibration from traffic caused by construction vehicles are expected. During Operation: A risk of noise from operation of equipment is expected.

Category		Environmental Item	Evaluation		Basis of Evaluation
			Before Construction During Construction	During Operation	
	6	Subsidence	D	D	No work that may cause ground subsidence is expected.
	7	Odor	D	D	No work that may cause odor is expected.
Natural Environment	8	Protected Areas	D	D	The project site is in existing industrial estate, and there are no national parks or protected area within or in the vicinity of the site
	9	Ecosystem	D	D	There are no rare animals and/or plants at the project site and thus the impact on the ecosystem is considered to be negligible.
	10	Hydrology	D	D	No work that may cause impact on hydrology is expected.
	11	Topography and Geology	D	D	The project is installation of equipment to factories within existing industrial estates and thus impact on the topography and geology is considered to be negligible.
Social Environment	12	Resettlement	D	D	The project is installation of equipment to factories within existing industrial estates and thus it will not involve resettlement of residents.
	13	Poor	D	D	There will be no impact on the poor by the project.
	14	Living and Livelihood	D	D	The project is installation of equipment to factories within existing industrial estates and thus impact on the living and livelihood of local residents are considered to be negligible.
	15	Heritage	D	D	There are no cultural heritage etc, at or in the vicinity of the project site.
	16	Landscape	D	D	The project is installation of equipment to factories within existing industrial estates and thus impact of the landscape is considered negligible.
	17	Ethnic Minorities and Indigenous Peoples	D	D	There are no ethnic minorities no indigenous people at or in the vicinity of the project site.
	18	Working Conditions	B-	B-	During Construction: There is a need to consider the working condition for construction workers. During Operation: There is a need to consider the working condition for employees of the lease company involved in operation and maintenance of equipment.
その他	19	Accidents	B-	B-	During Construction: There is a need for consideration on accidents during construction. During Operation: There is a need to consider prevention of accidents for employees of the lease company involved in operation and maintenance of equipment, and prevent impacts on client factories.
	20	Transboundary Issue and Climate Change	C-	B-	During Construction: A risk of a small amount of Hydrochlorofluorocarbon (HCFC) leaking from an old air conditioning system at the time of replacement is expected. During Operation: An emission of a certain amount of CO2 from installation of a 6MW natural gas cogeneration facility is expected.

A+/- : Significant positive/ negative impact is expected.

B+/- : Positive/ negative impact is expected to some extent.

C+/- : Extent of positive/ negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D : No impact is expected.

Table 8-2 Draft of TOR for Energy Service

Environmental Item	Study Item	Study Method
Consideration of an Alternation Plan	Construction Method	Construction method to minimize environmental impact
Air Quality	① Environmental Standards (Thai Environmental / Emission standards, WHO Standards etc.,) ② Current Condition of Air Quality ③ Residential Areas, Schools and Hospitals in the Vicinity ④ Impacts during Construction	① Survey of existing data (report of regulating authority etc.,) ② Survey of existing data and actual measurements if necessary ③ Site study and interviews ④ Study on the item of works, methodology, duration, location, covered area, type of construction equipment, location and duration of operation, number of construction equipment, operated routes etc.,
Water Quality	① Hydrology in the vicinity (rivers, groundwater) ② Water use in the vicinity	① Survey of existing data ② Site study and interviews
Wastes	① Method of disposal for construction waste	① Interviews to related agencies, case studies
Noise and Vibration	① Environmental Standards (Thai Environmental / Emission standards, WHO Standards etc.,) ② Distance between the source to residential areas, schools and hospitals ③ Impacts during Construction	① Survey of existing data (report of regulating authority etc.,) ② Site study and interviews ③ Study on the item of works, methodology, duration, location, covered area, type of construction equipment, location and duration of operation, number of construction equipment, operated routes etc.,
Working Conditions	① Safety measures	① Case studies (contents of the contract with contractors of similar projects etc.,)
Accidents	① Risk measures for traffic accidents during constructions ② Measures during operation	① Case studies (measures taken in similar projects etc.,) ② Conform to the above study on working conditions.
Climate Change	① Unit calorific value and emission factor of CNG ② Measures to prevent leakage during dismantling of air conditioning system	① Survey of existing data (gas supplier) ② Site study and interviews
Stakeholder Consultation	① Implement when project location (client) is confirmed.	① Visits and interviews Start: December 2015 ~ February 2016 Target: Management body of industrial estates, employees of local authorities

8.3.3 Result of the Survey on Social Environmental Consideration (including Forecast)

Survey on the Social Environmental Consideration for the Energy Service, as written in Chapter 8.3.3, based on the scoping plan will be conducted during coming survey. Result of the survey is as shown in Table 8.3.

Table 8-3 Draft of the Scoping Plan and Result of the Survey for Energy Service

Air Quality	· Target industrial estates focused on manufacturing industry (Amata Nakorn, Pinthong, and Rayong) are all located in the suburbs, with trucks transporting construction materials and buses transporting employees running through the industrial estates. · According to an interview conducted with a tenant (SANYO KASEI) of an industrial estate focused on manufacturing industry, air quality in the vicinity is poor due to exhausts from pickup trucks and private cars, with concern for further deterioration due to the flow of PM 2.5 from China. · In an interview with local authority of an industrial estate focused on heavy chemical industry (Map Ta Phut Industrial Complex), it was expressed that air pollution from industrial sector is a severe problem, and thus particularly strict monitoring system has been put in place. Furthermore, in an interview carried out with the above personnel in December 2015, it was expressed that although air pollution is particularly severe in industrial sector however, the Energy Service proposed in the project should not have particular impact to the air quality. · From the study including above interviews, a significant deterioration of the air quality due to implementation of the project is considered not likely.
Water Quality	· In an interview with a tenant of industrial estate focused on manufacturing industry (MIURA, August 2015), and an interview with local company (TDC, August 2015), it was expressed that, water quality is unstable due to corrosion within water supply pipes, and factories are required to treat water by installation of filters etc., with particularly poor quality being found at Amata Nakorn Industrial Estate. · In an interview with a local authority of an industrial estate focused on heavy chemical industry (Map Ta Phut City, December 2015), it was expressed that an adverse impact to water quality by construction work for the Energy Service and operation of a generation facility should be negligible. · From above, a significant deterioration of the water quality due to implementation of the project is not considered likely.
Wastes	· In an interview with a personnel at Map Ta Phut City, it was found that, construction waste generated from industrial estate focused on heavy industry is disposed in Rayong Province, and hazardous waste such as PCBs are transported to Prachinburi Province where it is recycled for use as a cement. It is considered that the situation is similar for industrial estates focused on manufacturing industry. · An appropriate waste management based on local environmental regulation are being considered for implementation of the project and thus significant increase in the volume of waste generated by the project is considered unlikely.
Noise and Vibration	· In an interview with a personnel at local authority of an industrial estate focused on heavy industry (Map Ta Phut City, December 2015), it was expressed that noise and vibration due to implementation of the Energy Service is unlikely. In implementing the project, construction and operation will conform to the noise and vibration standard in Thailand. Furthermore, as the number of factories subject to the project in the industrial complex would be few (1~2 locations), significant noise and vibration are unlikely.
Working Conditions	· Safety measures conforming to Thailand's environmental standards in above sectors of air and water quality, wastes, noise and vibration will be taken in implementing the Energy Service, as well as measures considering working conditions of construction workers and employees carrying out the operation and maintenance of facilities. As such, significant deterioration of working condition due to implementation of the project is thought unlikely.
Accidents	· As mentioned above, necessary safety measures as well as consideration for working conditions will be taken, and thus significant increase in accidents due to implementation of the project is considered unlikely.
Climate Change	· Out of industrial estates focused on manufacturing and heavy chemical industry, a consultation was held with the local authority of the latter (Map Ta Phut City, December 2015). Environmental concerns regarding implementation of the project was not expressed by the representatives of the local authority, and the response were positive. · For industrial estates focused on manufacturing, in view of the potential benefit to be

	received by tenants, opposition from the management body of the industrial estate is not expected. ・ As of above, it is considered that agreement from stakeholders towards implementation of the project can be obtained.

8.3.4 Environmental Impact Assessment

Environmental Impact Assessment will be conducted according to the result of above 8.3.4 to evaluate environmental impact by the project.

Table 8-4 Environmental Impact Assessment for the Energy Service

Category	No.	Environmental Item	Evaluation at Scoping		Evaluation based on the Study		Basis of Evaluation
			Before Construction During Construction	During Operation	Before Construction During Construction	During Operation	
Pollution Control	1	Air Quality	B-	B-	C-	C-	As the air quality at the target industrial estates are already poor, and the impact of the project implementation on deterioration of the air quality is thought to be less than initially anticipated, evaluation has been reviewed for both during construction and during operation to C-. Appropriate measures will be taken to mitigate risks of socio-environmental impacts by implementation of the project. The scale of the socio-environmental impacts will be evaluated again with consideration to generation capacity etc., proposed to the clients.
	2	Water Quality	C-	C-	C-	C-	Water quality in target industrial estates are already poor, and as the impact of the project implementation on deterioration of the water quality is thought to be small, evaluation has been kept at C-. However, appropriate measures will be taken to mitigate risks of socio-environmental impacts. Moreover, the scale of the socio-environmental impacts will be evaluated again with consideration to generation capacity etc., proposed to the clients.
	3	Wastes	C-	D	C-	D	Evaluation was kept as generation of hazardous wastes such as PCB etc., are expected during construction, and as appropriate treatment / disposal conforming to the regulation of the local authority are required.
	4	Soil Contamination	D	D	D	D	

Category	No.	Environmental Item	Evaluation at Scoping		Evaluation based on the Study		Basis of Evaluation
			Before Construction During Construction	During Operation	Before Construction During Construction	During Operation	
	5	Noise and Vibration	B-	B-	D	D	As noise and vibration are negligible according to the interview result with representatives of local authorities, impacts are evaluated to be negligible.
	6	Subsidence	D	D	D	D	
	7	Odor	D	D	D	D	
Natural Environment	8	Protected Areas	D	D	D	D	
	9	Ecosystem	D	D	D	D	
	10	Hydrology	D	D	D	D	
	11	Topography and Geology	D	D	D	D	
Social Environment	12	Resettlement	D	D	D	D	
	13	Poor	D	D	D	D	
	14	Living and Livelihood	D	D	D	D	
	15	Heritage	D	D	D	D	
	16	Landscape	D	D	D	D	
	17	Ethnic Minorities and Indigenous Peoples	D	D	D	D	
	18	Working Conditions	B-	B-	B-	B-	Result of the evaluation was kept as there is a need to take necessary measures to ensure working conditions and safety.
Other	19	Accidents	B-	B-	B-	B-	Result of the evaluation was kept as there is a need to take appropriate prevention measures and ensure safety.
	20	Transboundary Issue and Climate Change	C-	B-	C-	B-	There is a need to prevent leakage of alternative Freon in an old air conditioning system by removing refrigerant at the time of replacement. Furthermore, certain amount of CO2 emission is expected from cogeneration using CNG after replacement. As such the result of the evaluation was sustained.

A+/- : Significant positive/ negative impact is expected.
B+/- : Positive/ negative impact is expected to some extent.
C+/- : Extent of positive/ negative impact is unknown.(A further examination is needed, and the impact could be clarified as the study progresses)
D : No impact is expected.

8.3.5 Alleviation Plan and Expense for Implementation of the Alleviation Plan

The alleviation plan and required countermeasures for item evaluated A, B and C, based on the result of EIA, will be identified in Table 8-5. Environmental Impact risk and alleviation plan for those risk

were identified as shown in below table; as of February, 2016. Further survey will be conducted to update the table. In addition, expense for implementation of the alleviation plan will be estimated aiming feasible alleviation plan according to technology and finicality of Thailand.

Table 8-5 Alleviation Plan and Required Countermeasure for Energy Service

No.	Impacts	Proposed EMP	Implementing Organization	Responsible Organization	Cost (unit)
During Construction					
1	Contamination of water by waste water from the construction site	Dehydration of wastewater	SPC	Management body of the industrial estate, DIW	Pending Calculation
2	Generation of waste from earthwork, dismantling and construction	Appropriate disposal based on the regulation of each industrial estates	SPC	Management body of the industrial estate, local authority, DIW	Pending Calculation
3	Generation of PCB and Asbestos from dismantling.	Appropriate disposal based on the regulation of each industrial estates	SPC	Management body of the industrial estate, local authority, DIW	Pending Calculation
4	Noise and vibration from construction vehicles	Appropriate maintenance of construction vehicle and stopping engines during unused hours	Contractor	Management body of the industrial estate, DIW	Pending Calculation
5	Emission of GHG by leakage of HCFC from old air conditioning systems.	Recovery and removal of refrigerant	SPC	MONRE	Pending Calculation
During operation					
1	Emission of SOx, NOx, TSP etc., during operation of generation facility.	Installation of densitometer and catalytic filter	SPC	Management body of the industrial estate, local authority, DIW	Pending Calculation
2	Contamination of water by oil and TSP etc., included in the waste water from air conditioning	Collection of oil by introduction of an oil pit, sedimentation in drainage tank	SPC	Management body of the industrial estate, local authority, DIW	Pending Calculation
3	Nose from operation of equipment	Use of sound proofing	SPC	Management body of the industrial estate, DIW	Pending Calculation
				Cost	

8.3.6 Monitoring Plan

Monitoring Plan for construction period and operation period of the Energy Service is as shown in Table 8-6. Such Monitoring Plan includes monitoring item, location, frequency, responsible administration, and result report; as assumed at this stage.

Additionally, feasibility of the monitoring plan was studied according to several factors such as technical level and status of equipment in Thailand. Monitoring Plan will be revised according to stakeholders' comments which will be identified during further survey.

Furthermore, monitoring activity will be conducted in case capacity of the on-site power generation overs 10MW. Such monitoring activity will be conducted same frequency as set in the Environmental Monitoring Rules based on EIA.

Table 8-6 Monitoring Plan for the Energy Service

Environmental Item	Monitoring Item	Location	Frequency	Responsible Organization
【I. During Construction】				
a. Air Quality	NO_2, SO_2, TSP, PM_{10}	In the vicinity of the construction site	Once / Month	Contractor SPC
b. Water Quality	pH, Total dissolved solids, zinc, copper, lead, nickel, manganese, BOD, COD	All monitored wells	Once / Month	Contractor SPC
c. Wastes	Volume generated (Including PCB and Asbestos)	In the vicinity of the construction site	Once / Month	Contractor SPC
d. Working Condition	No. of accidents	At the construction site	Once / Month	Contractor SPC
e. Accidents	No. of accidents	At the construction site	Once / Month	Contractor SPC
f. Climate Change	HCFC	At the construction site	Once / Month	SPC
【II. During Operation】				
a. Air Quality	NO_2, SO_2, TSP, PM_{10}	In the vicinity of the factory	Once / Month	SPC
b. Water Quality	TSD	Within the factory	Once / Month	SPC
c. Working Conditions	No. of accidents	Within the factory	Once / Month (for six months after beginning operation)	SPC
d. Climate Change	Volume of CNG consumed	Installed cogeneration facility	Once / Month (for six months after beginning operation)	SPC

Draft of the monitoring form, at this moment, which will be used by implementing agency is as shown in (1) of Chapter 8.3.10.

8.3.7 Consultation with Stakeholder

Current status of negotiation with local stakeholders is as shown in below. Further discussion will be held to discuss with local stakeholders such as administrator of the targeted industrial estate, local police, local fire station, and other officers of governmental body. Result of such negotiation and comments from stakeholders will be summarized to the project plan.

(1) Results of Consultation with the Counterpart and Stakeholders, and Interview Survey with Specialists and Organizations related to Social Environmental Status

1) Opinions Concerning the Target Area

- Rojana is manufacturing-centered and Map Ta Phut Industrial Estate is petrochemical-centered. Please specify if demand differs depending on the industry, which industry is your main target, what is the market size, and if business is feasible on that basis.
- Map Ta Phut has serious environmental issue caused by VOC2; and its pollutant emission exceeds Thai environmental standard. Such pollutant emission is mainly from the transportation sector.

2) Other Opinions

- The proposed project will reduce the cost burden for (Japanese) companies advancing to Thailand in the future, and is considered a useful option. The priorities of energy-saving, is approximately fifth counting from the top.
- Energy-saving efforts of Japanese companies' factories are conducted on the initiative of the Japanese headquarter. It would be troublesome if the energy-saving efforts by the SPC do not comply with the headquarters' policy.
- EIA, and environmental monitoring are implemented. Samples of wastewater are submitted to the IEAT twice a week, and undergoes a checkup by SGS, a third party agency every month.
- Energy-saving measures such as turning the lights off during a work break, and replacement to energy-saving light bulb have been conducted. Each departments' assessment manager of the electric equipment sector are appointed in charge of energy-saving, attending energy-saving related workshops and seminars, and preparing reports. Energy-saving efforts began in 2010~2011, and is in full-scale execution since 2013~2014.
- The main facility in the waste treatment facility is the scrapper. The equipment itself has deteriorated however, no issues have been felt as the facility is repaired based on the maintenance plan.
- As the Thai government is promoting introduction of clean energy, we would like to introduce solar power system manufactured in Japan. We would like to receive information on these kinds of clean energy.
- We are interested in electricity conservation, and would like to contact you later.
- We have plans to execute countermeasures for air and water pollution in accordance with our environmental plan. For the operation within the industrial estate, we have set a stricter environmental standard than the government standards. For EIA, we have conducted the Initial Environmental Examination (IEE) based on our production capacity, and have submitted the report to ONEP.
- We have introduced solar panels (745kW) on top of our factory's roof. The electricity generated is currently sold to PEA, and considering to use this for charge of EV buses in the future. Our company aims to reduce 10% of CO_2 emission level recorded in 2007 by 2020.
- Map Ta Phut city monitors air pollutants at 100 locations outside the industrial estate. JTRANATEE is outsourced to also monitor pollutants (such as CO, O3, SO2, NOX, dust in air, benzene, etc.) for 2 weeks at each location every year using monitoring vehicles. Measurements are disclosed at PCD, and stored in a database. Currently, many of the substances are within the standards, however, the measurements of CO, benzene and 1,3-butadiene greatly exceeded the standard in 2014. The cause is still under investigation, and it is still unknown whether it was caused by a factory or transportation.

- The majority of the factories in the Map Ta Phut Industrial Zone have their own wastewater treatment system. 6~7 companies outsources to an external treatment company.
- Since there are no treatment facility for toxic waste, used fluorescent lights are being stored. The collection of industrial waste is not conducted by the Map Ta Phut city, but treated by individual factories. However, Map Ta Phut city do obligate each factories to report on the appropriate treatment of industrial waste. Prior to the construction of waste combustor, it will need to be reported to the city.
- Saha Group is familiar with the Japanese smart community business, and has visited the "Kashiwa-no-ha Smart city" in Kashiwa-city, Chiba province.
- Thailand plans to introduce 3,000MW of solar power nationwide. The aim is to lower the dependence on hydro power in Laos and gas from Myanmar.
- How about selling power generated from waste-to-energy, utilizing the large amount of waste produced from the Map Ta Phut Industrial Estate. If these kind of project cannot be conducted by the industrial estate alone, the proposed project is good.
- At industrial estates managed by IEAT, regulation on wastewater must be satisfied at construction phase of the factory. Industrial estate also conducts patrol and monitoring on air/wastewater, and there are cases where occupants are given a warning. These measures are conducted throughout the nation, however there are no such regulation and measures alike conducted at private industrial estates. For this reason, it will be good if the approval is granted by the government and to conduct environmental monitoring measures.
- As a private industrial estate, we value the fact that implementation of the environmental monitoring will guarantee operation of the industrial estate to comply with the environmental standards in Thailand.
- Water quality of TPARK, Well Grow Industrial Estate and Amata Nakorn is not good. Japanese companies located in those 3 industrial estate faces hard situation due to the water quality. Water in that area is high water hardness, contains many impurities, plenty chloride ion, and contains less silica. Thus, waste water treatment facility needs 3 times as much as that in Japan. On the other hand, water quality in Amata City and Eastern Seaboard is as good as Japan.
- In Thailand, water quality at water treatment facility is fine. However, water quality at industrial estate is not good. Water quality spoils during water supply due to bad condition of water pipe including corrosion.

8.3.8 Land Acquisition and Relocation

Land acquisition and relocation do not occur in the project.

8.3.9 Others

(1) Draft of the Monitoring Form

See Table 8-7 and 8-8.

Table 8-7 Draft of Monitoring Form for the Energy Service (Construction Period)

The latest results of the below monitoring items shall be submitted to the lenders as part of Quarterly Progress Report throughout the construction phase.

Construction Phase

1. Response/ Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments from the public	
Number and contents of responses from Government agencies	

2. Pollution

- Air Quality (Ambient Air Quality)

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
NO_2	mg/m^3							
SO_2	mg/m^3							
TSP	mg/m^3							
PM_{10}	mg/m^3							

- Water Quality

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
pH	-							
Oil	mg/l							
TDS	mg/l							
Zn	mg/l							
Cu	mg/l							
Pb	mg/l							
Ni	mg/l							
Pb	mg/l							
Mn	mg/l							
BOD	mg/l							
COD	mg/l							

- Waste

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
PCD	t/month							
Asbestos	t/month							
Total waste	t/month							

- Climate Change

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
HCFC	t/month							

3. Social Environment

- Work Environment and Accident

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
Work Environment		
Accident		

Table 8-8 Draft of Monitoring Form for the Energy Service (Operation Period)

The latest results of the below monitoring items shall be submitted to the lenders as part of Quarterly Progress Report throughout the construction phase.

Construction Phase

1. Response/ Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments from the public	
Number and contents of responses from Government agencies	

2. Pollution

- Air Quality (Ambient Air Quality)

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
NO_2	mg/m^3							
SO_2	mg/m^3							
TSP	mg/m^3							
PM_{10}	mg/m^3							

- Water Quality

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
pH	-							
Oil	mg/l							
TDS	mg/l							
Zn	mg/l							
Cu	mg/l							
Pb	mg/l							
Ni	mg/l							
Pb	mg/l							
Mn	mg/l							
BOD	mg/l							
COD	mg/l							

- Waste

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
PCD	t/month							
Asbestos	t/month							
Total waste	t/month							

- Climate Change

Item	Unit	Measured Value (Min.)	Measured Value (Max.)	National Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency

HCFC	t/month							

3. Social Environment

- Work Environment and Accident

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
Work Environment		
Accident		

(2) Check list regarding to the Social Environmental Consideration (Draft)

Item and detailed plan for the Social Environmental issue which may be affected by the Energy Service of the project are as shown in Table 8-9.

Items are listed according to the check list for category "Other Electric Generation" and "Other Infrastructure Project" in the "JICA Guidelines for Environmental and Social Considerations (April 2010)".

Table 8-9 Check list regarding to the Social Environmental Consideration for the Energy Service (Draft)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a)N (b)N (c)N (d)Y	(a)(b)(c) EIA is not required for implementation of the project. (d) Implementation of the project require operation permits from the DIW based on the Factory Act which includes environmental requirements.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a)Y (b)Y	(a) NESDB, IEAT and potential stakeholders of each site have been briefed on the overview of the project, and have agreed to cooperation in terms of confirming needs and providing information. However, as it is still at the early stage of project formation, further explanation in line with progress of the project implementation to gain understanding of local stakeholders is required. (b) Comments from IEAT, management body and tenants of industrial estates have been reflected to the project design. Further consultation will be conducted in line with the progress towards project implementation, and outcome will be reflected on the project design.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)N	(a) The project consists of technologies owned by each member of the project and thus no alternative plan has been considered.
2 Pollution Control	(1) Air Quality	((a) In the case that electric power is generated by combustion, such as biomass energy projects, do air pollutants, such as	(a)Y (b)Y (c)N	(a)(b) Generation technology meeting emission standards will be installed, and appropriate measures will be taken for air

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by power plant operations comply with the country's emission standards and ambient air quality standards? Are any mitigating measures taken? (b) Do air pollutants emitted from other facilities comply with the country's emission standards? Will measures for air pollution be taken? (c) Is fuel with low emission factor (CO2, NOx, SOx etc.,) used for power/heat source of accommodation facilities etc.,		quality. (c) Appropriate power / heat source will be selected for workers' accommodation facility during construction.
	(2) Water Quality	(a) Do effluents (including thermal effluent) from various facilities, such as power generation facilities comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards? (b) Do leachates from the waste disposal sites comply with the country's effluent standards and ambient water quality standards? Are adequate measures taken to prevent contamination of soil, groundwater, and seawater by leachates?	(a)Y (b)-	(a) Generation technology meeting the emission standards will be introduced. (b) Not applicable as there will be no waste disposal site at the project.
	(3) Wastes	(a) Are wastes generated by the plant operations properly treated and disposed of in accordance with the country's regulations (especially biomass energy projects)?	(a)Y	(a) Wastes will be treated and disposed appropriately in accordance with the country's regulations.
	(4) Noise and Vibration	(a) Do noise and vibrations comply with the country's standards? (b) In case of Wind Power Station, does low frequency noise comply with the environmental standard?	(a)Y (b)-	(a) The plan will comply with the country's standard. (b) Not applicable as there will be no wind power station.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a)N	(a) As there will be no extraction of ground water, it is considered that there will be no concern for ground subsidence.
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a)N	(a) As the high-efficiency gas combined cycle system for generation will use natural gas, it is considered that the facility will not be a source of odor.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a)N	(a) The project site is not located in a protected area designated by the country's law or international treaties and conventions.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on	(a)N (b)N (c)N (d)- (e)-	(a)(b) As the project site is located in an industrial estate, it does not encompass primeval forests, tropical rain forests, or ecologically valuable habitats. (c) The project site does not encompass protected habitats of endangered species and thus significant impact are not of concerns. (d)(e) Not applicable as there will be no wind power station.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		the ecosystem? (d) Is there a possibility that localized micro-meteorological changes due to wind power generation will affect valuable vegetation in the surrounding areas (Is there valuable vegetation in the vicinity of the wind power generation facilities)? If impacts on vegetation are anticipated, are adequate measures considered? (e) Are the wind power generation facilities (wind turbines) sited by considering the habitats and migration routes of sensitive or potentially affected bird species?		
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to installation of the structures, such as weirs will adversely affect the water flows, waves and tides?	(a)-	(a) Not applicable as the project will be implemented within an existing industrial estate and does not involve expansion of the industrial estate to a coastal region etc.,
	(4) Topography and Geology	(a) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas?	(a)-	(a) There will be no impact on the hydrology as the project will be implemented within an existing industrial estate and will not involve construction in the surrounding area.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plan developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a)N (b)- (c)- (d)- (e)- (f)- (g)- (h)- (i)- (j)-	(a) The project will be implemented within an existing industrial estate and will not involve expansion of the industrial estate, and thus there will be no resettlement of residents. (b)~(j) Not applicable as there will be no resettlement of residents.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if	(a)N (b)-	(a) As the project will be implemented within an existing industrial estate and as environmental measures for installed equipment will be taken to mitigate

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		necessary? (b) Is there a possibility that the amount of water (e.g., surface water, groundwater) used and discharge of effluents by the project will adversely affect the existing water uses and water area uses?		impacts to residents in the surrounding area, any impacts on the living of the residents are considered negligible. (b) Not applicable as no water will be taken, and no heated/wastewater will be discharged.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)-	(a) Not applicable as there are no heritage at the site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken? (b) Is there a possibility of an adverse affect to the landscape by construction of a large scale accommodation facility or a high-rise building?	(a)N,Y (b)-	(a) There are no particular landscape of importance at the site. Furthermore, any activities at the Map Ta Phut will take into consideration of its nature as a resort destination, and necessary measures will be implemented. (b) Not applicable as these buildings will not be constructed in the project.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a)- (b)-	(a)(b) Not applicable as there are no ethnic minorities and/or indigenous peoples at the project site.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a)Y (b)Y (c)Y (d)Y	(a) Necessary measures will be considered and taken. (b)(c)(d) Necessary measures will be taken based on the experience of industrial estates and smart community related efforts.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a)Y (b)N (c)N	(a) Mitigation measures for pollution during construction will be taken. Mitigation measures against environmental pollution that may be caused by construction will be considered thoroughly before implementing construction. (b)(c) Although no significant impact on natural and social environment is expected as the project will take place within an industrial estate, mitigation measures will be taken as necessary.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the	(a)Y (b)-	(a)～(d) IEAT requires regular reporting of water and air quality, noise and wastes

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(c)Y (d)Y	in an effort to reduce environmental impacts of development and operation of industrial estates including the project site. Monitoring will be carried out appropriately using the monitoring form in attached in this report.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities). (b) Where necessary, items described in the Ports and Harbors checklists should also be checked (e.g., projects including construction of ports and harbors). (c) For projects, such as installation of telecommunication cables, power line towers, and submarine cables, where necessary, pertinent items described in the Power Transmission and Distribution Lines checklists should also be checked.	(a)- (b)- (c)-	(a) Not applicable as project activities will be carried out within target factories located within an industrial estate. (b) Not applicable as there will be no construction of a port facility. (c) Not applicable as there will be no installation of telecommunication cables, power line towers, and submarine cables.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)Y	(a) Appropriate measures will be taken as there is a possibility of leakage of HCFC, a greenhouse gas during replacement of air conditioning.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Source: Prepared by the Study Team

(3) Future Measures towards Project Implementation

Industrial Estate Smart Community Development Project aims to provide tenant companies of existing industrial estates with the Energy Services, the Energy-Conservation and O&M Services, the Transportation Services, etc., and management entities of existing industrial estates with the Environmental Monitoring Services, etc.

Judging from the nature of the project, negative environmental and social impact by implementation of the project activities are relatively low. Furthermore, in the process of designing the details of the

project activities, it is anticipated possible to increase the positive impacts on the environment and social aspects.

In this process, EHIA based on the various laws and regulations previously described and briefing/consultation with important stakeholders, such as residents will be required. In addition, there is a need to swiftly proceed with consultations with relevant agencies prior to obtaining necessary permits and licenses and other procedures listed below:

Necessary procedures for implementation of the Energy Service by the SPC (consultations with EGAT, MoE, IEAT, etc.);

Study on availability of incentive measures for introduction of the energy saving equipment (consultation with MoE);

Confirmation of the compliance with the safety standards associated with operation and maintenance as stated in the Factory Act; (consultation with DIW)

Procedures for implementation of the Transpiration Service using EV buses (acquisition of operation permit etc.);

Others

9 Cash Flow Analysis and Business Scheme

9.1 Proposed Business Schemes and Comparison of Options

As examined in 7-3, the project will be implemented with any one of the schemes that include the Alliance Agreement, the Agency Agreement, and the SPC, depending on factors such as a period from which the project launches business operations, the components and scale, and the number of potential clients. This section describes the business schemes, the Agency Agreement that the project has been specifically deliberating with the locally incorporated companies in Thailand to pursue the planned business, and the SPC intended to start from the 4th project year on.

9.1.1 Business by Agency Agreement

Concerning business by the Agency Agreement, role of each company, business operation and process of providing service are categorized before and after receive orders.

9.1.2 Business by SPC

Concerning establishment of the SPC, there are 2 patterns; the SPC with assets (pattern 1) and without assets (pattern 2).

Pattern 1: SPC without assets (In case the SPC manage large scaled generator.)

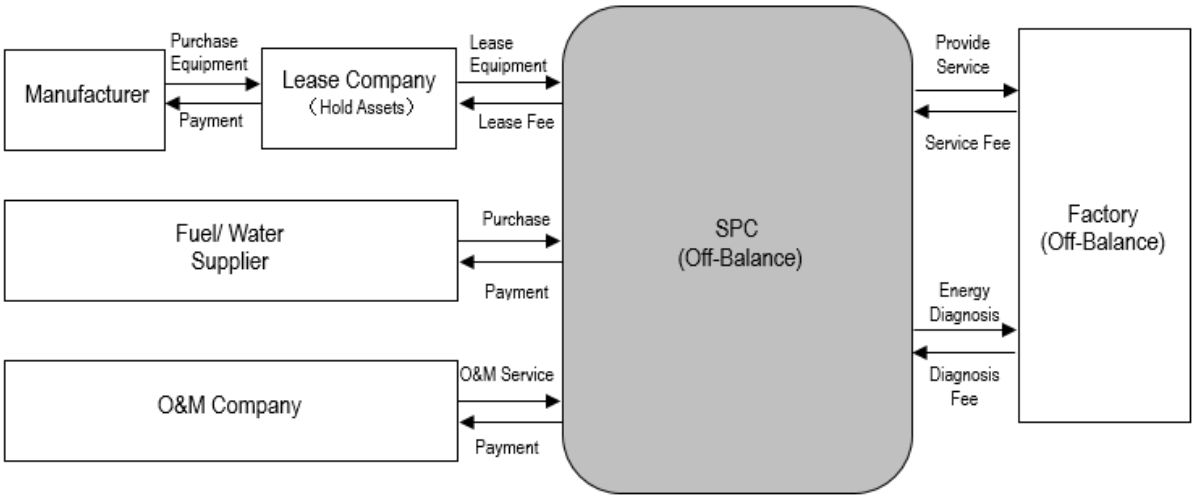


Figure 9-1 SPC without assets

Pattern 2: SPC with assets (In case the SPC manage small scaled facilities.)

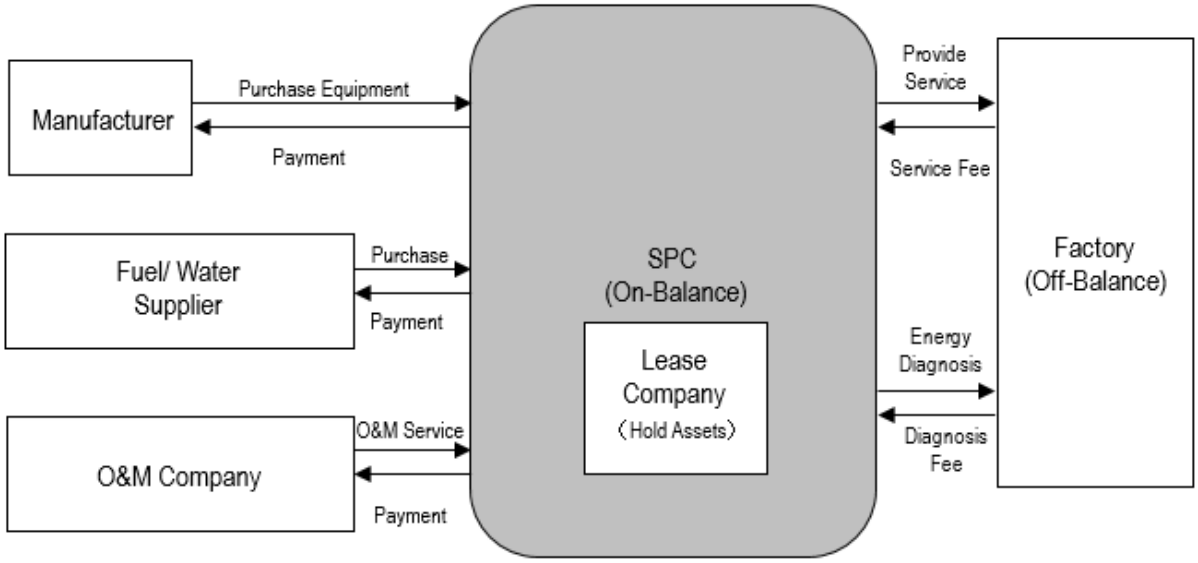


Figure 9-2 SPC with assets

Table 9-1 Comparative Table of the Business Schemes

Pattern	1 Off-balance accounting of SPC	2 On-balance accounting of SPC
Merits of clients related to financial accounting	○Off-balancing resulting in no capitalization	
Merits of SPC related to financial accounting	○Off-balancing resulting in no capitalization	×On-balance-sheet transaction resulting in capitalization
	○In case benefits are obtained, the initial five years may apply "1" above for the purpose of no capitalization, followed by an acquisition thereafter. This allows then tax saving through depreciation.	

9.2 Roles, Investment Ratio, and Organizational Structure of Public and Private Sectors

If the project is implemented with the Alliance Agreement or the Agency Agreement, the business scale will be small. Also, the project intends to use a lease finance, and thus only SPC is deliberated here in this section, which will be established from the 4th year on. When the project applies a layer scheme described in 9-3, the investment ratio and roles of the SPC are as configured in the table below.

Table 9-2 Shares of Capital and Roles

Member organizations	Percentage of share in SPC	Percentage of share in SPC with a layer scheme	Roles
① Japanese company	Ordinary shares 49%	Shares in Company A 74% ※Details: Subordinated shares 49% →49%+51%×49%=74%	Primarily responsible for operating the businesses Owns 74% of share capital and have voting rights
② IEAT	0% (or X% of ordinary shares)	—	IEAT's policies and licensing are likely to affect SPC on how the industrial estates are operated.
③ Company A (Thailand)	Preferred shares (Non-voting shares) 51%	—	If the project conflicts with regulations for foreign companies, and they mandate a Thai company to hold the majority of the shares, the percentage of its shares indicated in the first column shall be 51%.
④ Local company (Thailand)	—	Shareholding company of Company A (Thailand) 51%×51%=26%	The percentage of the Thai-company's shares indicated in the second column shall be 51%.

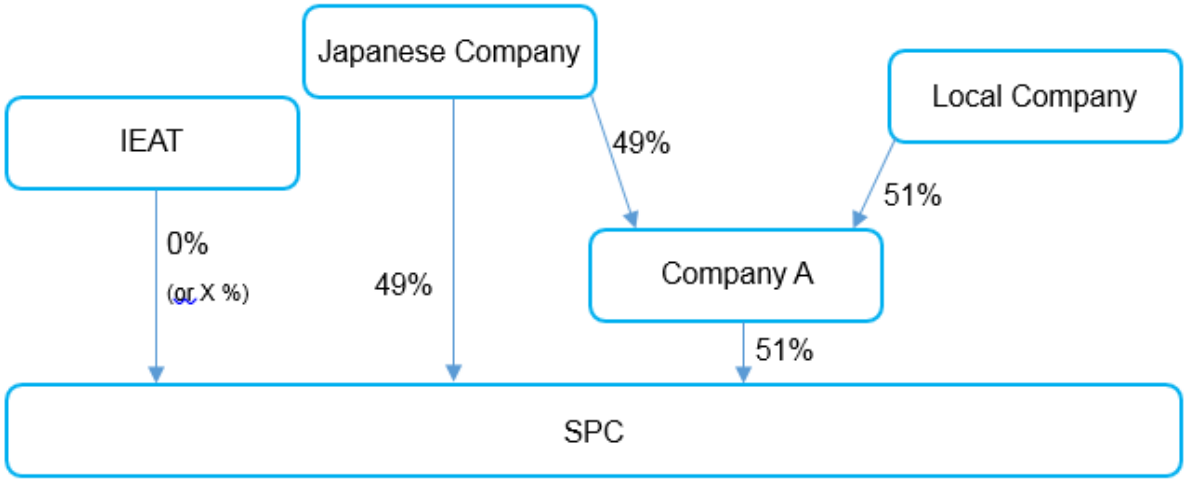


Figure 9-3 Business Scheme (In case with Layer Scheme)

Source: Developed by the Survey Team

9.3 Optimal Measures for Financing at Initial Investment Phase (Investment and Loan)

9.3.1 Prerequisite and Financing Structure

There are 3 prerequisites when considering funding measures for the project: ①100% of the capital shall be invested by a single or multiple Japanese companies (large electronic manufacturer, etc.), ② loan shall be procured by corporate finance based on the project size, and ③ funding shall be procured by common investments and/or a loan.

The project is expected to gradually develop the Smart Service Business; and finally the SPC will be established to run the business. For the first a few years, establishment of the operation company to operate the Smart Service is not planned. However, operation company, including subsidiary, and the

SPC will be established according to business expansion; and furthermore, financing will be required for that purpose. Scale of financing for an initial investment is assumed to be a few hundred million JPY.

Financing will take different forms depends on operation scheme. Thus, in this section, preferable financing structure for each operation scheme (Alliance, Platform and SPC) is studied which was mentioned in Chapter 7.

Table 9-3 Definition of Financing

Financing	Overview
Lease Finance	Equipment will be selected by the operator. Leasing company purchase such equipment and lease to the operator.
Corporate Finance	The operator which conduct the project debts finance.
Project Finance	Establish SPC to conduct the project. SPC itself will be the operator and invite investment.

Business by the Alliance Agreement, at preparation stage, business will be implemented by utilizing personnel of the Local Consortium Members as this stage is very early stage of the business implementation. Thus, large demand for finance is not expected; and it is assumed that there is no requirements for loan from financial bodies.

Secondly, business by the Platform at 1st stage, business will be expanded step-by-step. Agent Company will be selected from the Local Consortium Members to implement business. Then, establishment of subsidiary or selection of existing subsidiary is expected to conduct business. In this regard, investment or capital increase from Agent Company or participating companies as well as loan from financial bodies will be expected.

Thirdly, business by the SPC at 2nd stage, the SPC will be established as business at this stage seems to have constant revenue. However, scale of the SPC will be gradually developed; and the SPC will have medium number of equipment at the beginning and will be expanded business scale according to gradual increase of investment or loan. It is assumed that annually approximately 0.9 billion THB (approximately 3 billion JPY) of demand for finance will be occurred in first 10 years after establishment of the SPC. In this case, some scale of demand for finance will be occurred, the SPC will be the operator and invite investment from the Local Consortium Members and borrow loan from Japanese banks or Thai local banks.

Concerning equipment required for the business, it is expected that equipment will be purchased by lease finance. (Lease and purchase will be mixed depends on business development.) At the 2nd stage, all equipment is expected to be managed by purchase.

Based on above, applicable financing at each business scheme are as shown in below table.

Table 9-4 Business Scheme and Financing

Scheme	Equipment	Financing Body	Financing Method
Preparation Stage: Business by Alliance Agreement (Utilize existing facility and personnel)	Number of equipment is small.	-	Lease Finance
1st Stage: Business by Platform (Establish subsidy for business implementation)	Number of equipment is medium. (Lease and purchase will be mixed.)	Agent Company (Contact Person)	Lease Finance
			Corporate Finance
2nd Stage: Business by SPC (Establishment of SPC)	Number of equipment is large. (Purchase equipment)	SPC	Project Finance

Accordingly, there are 2 types of the financing scheme, one is investment and another is loan.

Concerning study on structure of investment and loan, financial stability will be increase when investment ratio increase; and lenders will have advantage even sponsors decrease in leverage from the business. Ratio of investment and loan has trade-off relationship; thus, ratio should be decided according to opinions from sponsors and lenders.

The case which will have finance by both investment and loan (at 2nd stage of the project) is the project finance. Ratio of investment and loan is generally set 4:6 to 3:7 in countries with low country risk such as Thailand; even there are differences according to business characteristics.

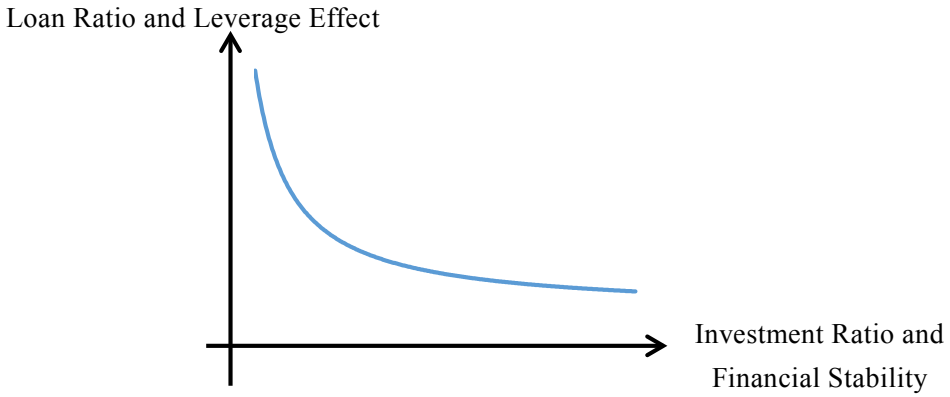


Figure 9-4 Relationship between Loan Ratio/Leverage Effect and Investment Ratio / Financial Stability

9.3.2 Interview Results on Loan Conditions by Thai and Japanese Financial Institutions

Interview on loan conditions for the project were conducted with Thai branch of Japanese banks. Banks interviewed and its general descriptions are as follows[13].

Concerning interview survey, 2 points as shown in below, were selected as precondition based on study situation at this stage.

13 As a prerequisite of a loan for projects that are granted benefits by BOI, the loan amount needs to be within 3 times the capital (In other words, the capital adequacy ratio needs to be greater than 25%.) Furthermore, when receiving a loan, the recipient will need to have a bank account in Thailand.

1) Implement financing by one or more Japanese companies such as large electric company
2) Implement financing by corporate finance according to business scale

(1) Japanese Banks
- Japanese Bank A Bangkok branch
- Japanese Bank B Bangkok branch

(2) Local Banks
- Thai Bank A
- Thai Bank B
- Thai Bank C

As a result of interviews, although terms and concept differs by a banking institution, the trend be categorized into two groups: Japanese banks and local banks.

Concerning an investment structure, one of important elements in determining loan, Japanese banks tends to base the decision on the comprehensive creditability (organization's size, past trading performance, financial standings, name recognition, etc.) of the majority shareholder's parent company, whereas Thai banks have the tendency to lay weight on financial standings. Furthermore, local banks requires a stand-by Letter of Credit of the parent company from a Japanese partner bank, and may ask for covenants his cannot be (collateral mortgage, prior confirmation on dividends, etc.) if this cannot be obtained.

Interest rates vary depending on the credibility of the parent company however, Japanese banks offer advantageous terms compared to Thai banks. In addition, Thai l banks has the tendency to place more importance on the financial standing of the parent company, regardless of whether the investors are Japanese or Thai companies.

Loan period for a corporate finance is generally set at within five years for both Japanese and Thai banks, and there are no significant differences for required documents and repayment terms. The audit period seems to be faster at Japanese banks however, period required to determine investment structure and guarantee by a parent company prior to the audit is assumed to take several months for both Japanese and Thai banks.

As described in 9.3.1 , these interviews have been conducted on the condition that the project will be executed by 100% investment by a single or by several Japanese companies (major electronic manufacturer, etc.). However, after consultations with the Thai government, if the project conflicts with regulations regarding foreign business, majority of the share need to be held by Thai companies and following two countermeasures may be considered.

1) Utilization of the Layer Scheme

As described in the figure below, by establishing Company A under Company B – a company with 49% Japanese capital and 51% Thai capital, influence of the Japanese company can be expanded from

49% to 74% (49% + 51%×49%) while retaining the majority share by the Thai company (Layer Scheme). This is a countermeasure widely and commonly used in Thailand.

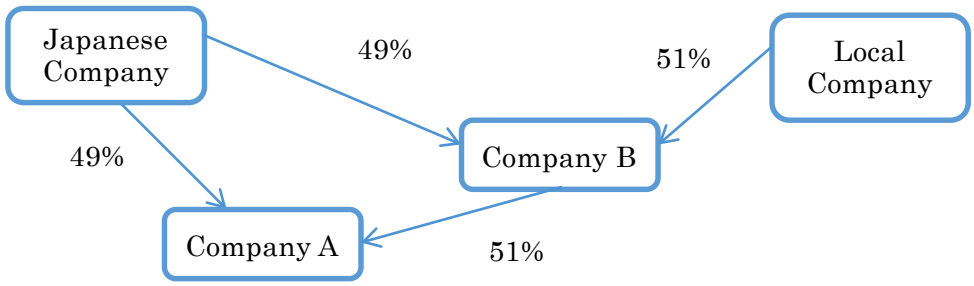


Figure 9-5 Utilization of the Layer Scheme

2) Utilization of a Local Subsidiary by a Japanese Bank

This is a countermeasure where a local subsidiary of a Japanese (considered domestically-funded) invest 51% of the capital to maintain the majority by a Thai company (so-called silent partner), while retaining the voting rights of the Japanese company.

*Local subsidiary of the Japanese bank retains the voting rights of the Japanese Bank despite being considered as domestically funded corporation by the having the Thai shareholder hold preferred shares, whilst the Japanese bank hold the deferred share.

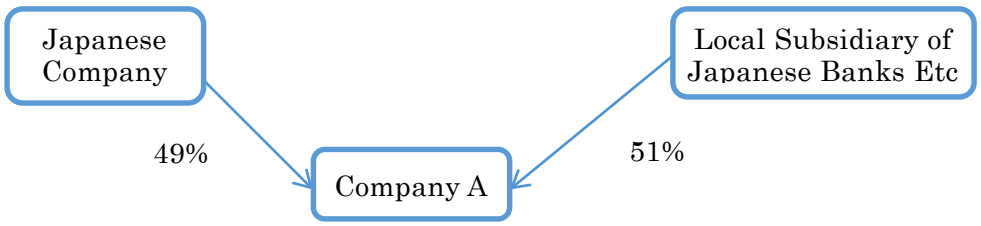


Figure 9-6 Utilization of a Local Subsidiary by a Japanese Bank

9.3.3 Optimal Financing Measure

As mentioned above, a financing measure varies depending on the intended business scale and form. Where the planned business has solid actual demand and is able to maintain a reasonable operating scale, project financing will be required for funding. Investment and loan shall be provided at 4:6 or 3:7 approximately. Financial contribution may be obtained by foreign investments and loans from such entities as companies involved in the project planning (consortium members), related Thai companies (including Japanese-affiliated subsidiaries), and JICA. Furthermore, the project suggests to obtain loans from Japanese banks operating in Thailand as well as local financial institutions. The table below indicates a model.

It should be noted that the table provides an annual capital requirement for the project that is 0.9 billion THB (3 billion JPY) after 10 years from the establishment of the SPC, resulting in an estimated operation fund of 4.5 billion THB (15 billion JPY) for the 5 years thereafter (Loan repayment is expected to start, albeit varied among financial institutions, from the 6th project year on).

Table 9-5 Financing Measure (Plan)

Investor	Percentage of Investment	Percentage of Loan
Some of the Japanese Consortium members and the Local Consortium members	4.5 billion JPY (30%) (1.5 billion JPY each)	
JICA	3 billion JPY (20%)	
Japanese Bank A		3.75 billion JPY (25%)
Japanese Bank B		3.75 billion JPY (25%)
Thai Local Bank A		1.5 billion JPY (10%)

※The project cost is estimated 0.9 billion THB (3 billion JPY) annually, amounting 4.5 billion THB (15 billion JPY) for 5 years.

9.4 Project Cash Flow Analysis (Equity IRR and Debt service Coverage Ratio) and Sensitivity Analysis

For the project cash flow analysis and sensitivity analysis of the SPC in charge of the project's operation, the project cash flow analysis (Equity IRR and Debt service Coverage Ratio) and sensitivity analysis has been calculated based on the prepared financial model of the SPC and under the following premises.

9.4.1 Project Cash Flow Analysis

In this section, the service in the project is categorized in 4 services, as shown below; and cash flow model is planned for each service.

- The Energy Service (On-Site Power Generation (Cogeneration))
- The Energy Service (On-Site Power Generation (Gas Engine Generation))
- The Energy Service (Cold Water Supply (Air Conditioning))
- The Energy Service (Equipment Lease (Air Conditioning, Factory Facilities))

Cash flow analysis has been made for the following scenarios of Case 1 to 3. Case 1 assumes that all the businesses obtain 100 % of long term contracts covering 12 or 15 years. Case 2 assumes a benchmark case in which 9-year mid-term contracts account for 20% to 50%. Case 3 assumes that contracts less than 6 years account for 50% to 100% of the contracts. The table below indicates percentage of business contracts covering various years, provided respectively for the scenarios Case 1 through 3.

Table 9-6 Percentage of Business Contracts

		Case 1	Case 2	Case 3
The Energy Service (On-Site Power Generation (Cogeneration))				
	3 years contract	0.0%	0.0%	20.0%
	6 years contract	0.0%	10.0%	30.0%
	9 years contract	0.0%	20.0%	50.0%
	12 years contract	30.0%	40.0%	0.0%
	15 years contract	70.0%	30.0%	0.0%
The Energy Service (On-Site Power Generation (Gas Engine Generation))				

	Case 1	Case 2	Case 3
3 years contract	0.0%	0.0%	10.0%
6 years contract	0.0%	0.0%	70.0%
9 years contract	0.0%	0.0%	20.0%
12 years contract	0.0%	30.0%	0.0%
15 years contract	100.0%	70.0%	0.0%
The Energy Service (Cold Water Supply (Air Conditioning))			
3 years contract	0.0%	0.0%	10.0%
6 years contract	0.0%	0.0%	70.0%
9 years contract	0.0%	0.0%	20.0%
12 years contract	0.0%	30.0%	0.0%
15 years contract	100.0%	70.0%	100.0%
The Energy Service (Equipment Lease (Air Conditioning, Factory Facilities))			
3 years contract	0.0%	20.0%	20.0%
6 years contract	0.0%	30.0%	30.0%
9 years contract	0.0%	20.0%	50.0%
12 years contract	30.0%	20.0%	0.0%
15 years contract	70.0%	10.0%	0.0%

In light of the above premises, the results of the project cash flow analysis for the SPC (calculation of Equity IRR and DSCR) are as follows. See Appendix (2) for details of the project period covering 26 years. It should be noted that EIRR and DSCR are significantly high for the reason that the project is a lease business of whose assets are not owned by the SPC.

Table 9-7 Cash Flow Analysis

	Case 1	Case 2	Case 3
Capital (Million THB)	36	111	2,895
Gross Income (Million THB)	40,661	29,960	18,946
Income after Tax (Million THB)	11,741	6,727	1,014
Equity IRR (%)	79.9	77.1	75.7
DSCR*	410.9	236.3	37.4

* Average for a period of 26 years

When all the cases are examined for the total project periods, the project anticipates a good investment effect. However, whereas Case 1, which is an upside scenario, will have profits generated in the entire project period, a downside scenario of Case 3 will need as much capital as 80 times Case 1, as it will result in a deficit from the 16th year on, requiring additional funds. Accordingly, this will entail a relevant measure, including limitation on dividend.

9.4.2 Sensitivity Analysis

As mentioned above, cash flow analysis has been made for each case for a period of 26 years. The sensitivity analysis identifies three major variable factors as below.

- Factors related to demand fluctuation
- Factors related to fluctuation of sales prices of steam and power

・ Factors related to cost fluctuation

These variable factors are assessed using the business plan of Case 2 regarding the extent to which they may affect the business. It should be noted that the amount of the project cash flow is estimated to provide an indicator to assess profitability of the business.

(1) Factors Related to Demand Fluctuation

Demands for the services provided by the project will be subject to the trends of which Japanese manufacturing companies expand their business and operate production in Thailand. As indicated in Chapter 5, the direct investment in the Thai manufacturing sector is larger in precision machinery and equipment as well as transport machinery and equipment, which has been approximately doubled in the last 5 years. Specifically, Japanese companies account for 60% of the direct investment in Thailand in 2013. It should be noted, however, that in recent years those Japanese companies expanding their businesses in Thailand are primarily SMEs. Therefore, they are keen to an initial investment, payout period, and other costs. Accordingly, potential demands estimated under the current situations may fluctuate unexpectedly, resulting from factors such as economic trends in Thailand, and a price competition imposed by emerging rival services. The below section examines the extent to which demand fluctuation of each business may affect the project cash flow whereby the current figures of demand forecast are multiplied by the fluctuation rate.

Table 9-8 Sensitivity Analysis on Demand Fluctuation

(Million THB)

Percentage of Demand Fluctuation	75%	80%	85%	90%	95%	100%
The Energy Service (On-Site Power Generation (Cogeneration))	4,594	5,024	5,452	5,879	6,306	6,734
The Energy Service (On-Site Power Generation (Gas Engine Generation))	6,701	6,708	6,714	6,721	6,727	6,734
The Energy Service (Cold Water Supply (Air Conditioning))	6,727	6,728	6,730	6,731	6,733	6,734
The Energy Service (Equipment Lease (Air Conditioning, Factory Facilities))	7,101	7,028	6,954	6,881	6,807	6,734

As indicated above, the sensitivity of demand fluctuation is largest in the Energy Service (On-Site Power Generation (Cogeneration)), resulting in a range of 21.4 billion THB reduction when the demand is decreased by 25%. On the other hand, the effect on the Energy Service (Cold Water Supply (Air Conditioning)) is insignificant. It should be noted that the Energy Service (Equipment Lease (Air Conditioning, Factory Facilities)) is likely to have an improved cash flow as the demands decrease, because Case 2, which will be mostly underpinned by short- and mid-term contracts, anticipates a deficit.

(2) Factors Related to Fluctuation of Sales Prices of Steam and Power

Sales prices of steam and power in Thailand are subject to such factors as future energy demand and the government's energy policies. As indicated in Chapter 5, EGAT forecasts that power demand would more than double in Thailand. Accordingly, the government is promoting alternative energy development including renewable energy and energy saving. While these situations are advantageous for prices of power and steam, many other variable factors exist, such as the stagnant crude oil price in recent years. An effect of the price fluctuation in recent years is examined.

Table 9-9 Sensitivity Analysis on Sales Prices of Steam and Power

(Million THB)

Percentage of Sales Price Fluctuation	75%	80%	85%	90%	95%	100%
Sales Price of Steam	4,480	4,933	5,386	5,835	6,285	6,734
Sales Price of Power	4,850	5,229	5,606	5,982	6,358	6,734

As indicated above, the business will be affected by a price fluctuation of steam sales in a range of 22.54 THB reduction, which is equivalent to the outcome of the demand fluctuation in the Energy Service (On-Site Power Generation (Cogeneration)).

(3) Fluctuation Risk of Fuel Prices

An effect of fuel price fluctuation in the Energy Service (On-Site Power Generation (Cogeneration)) is examined.

Table 9-10 Sensitivity Analysis on Fuel Price for Co-generation

(Million THB)

Percentage of Fuel Price Fluctuation	100%	105%	110%	115%	120%	125%
Fuel Price	6,734	6,462	6,190	5,919	5,647	5,375

As indicated above, a fuel price rise affects the business in a range of 13.59 billion THB reduction, resulting in 1/5 of the total project cash flow.

9.5 List of Related Contracts and Main Clauses

Related contracts and main clauses for each models are as follows.

9.5.1 Business by Alliance Agreement

(1) Service and sales contract (between each consortium member and a client)

- ✓ Including but not limited to; a lease contract with a lease company, an engineering contract with an engineering company, a sales contract and an O&M service contract with manufacturers.
- ✓ Terms of agreement may vary depending on the content and the structure of the service and the equipment sold however, in general, is likely to include the followings:
  - Service contract: content of the service, price, terms of payment, guarantee, conditions for

compensation, contract period, and other general clauses etc.,

- Sales contract: description of the equipment, price, terms of payment, inspection, quality assurance, conditions for compensation, contract period, and other general clauses etc.,
- Lease contract: description of the equipment subject to lease, lease period, fee, terms of payment, covenant clause, risk of loss clause, and other general clauses etc.,
- EPC contract: description of the service provided, price, terms of payment, installation and inspection, assurance, conditions for compensation, contract period, risk of loss clause, and other general clauses etc.,

(2) Service and sales contract (between members of the consortium)

- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(3) Energy supply contract (between a consortium member and a client)

- ✓ Terms of contract between a member of the consortium and a client may be set freely. In general, it is thought to include followings:
  - Conditions of supply, fee (pay-as-you-go in general), time of payment, risk of loss at the time of outage, contract period, and other general clauses etc.,
- ✓ A fixed contract used by PEA must be used when surplus power is sold to PEA.

(4) Consortium contract (between the Local Consortium Members)

- ✓ Agreement is thought to include an overview of the project, roles and responsibilities of each members, division of income etc.,

9.5.2 Business by Agency Agreement

For the utility service (O&M and sales of equipment), the role of the agency could be limited to brokerage of clients, with contracts signed directly between each member of the Local Consortium Members and a client (similar to the alliance agreement) however, the following assumes that the agency sign the contract with a client, and thus bearing certain responsibilities.

As for the Energy Service, it is assumed that the contractor for the O&M Service sign the contract with a client, whereas the agency enter into an agreement with the engineering company for business cooperation.

(1) Service and sales contract (between each member of the Local Consortium Members and the agency)

- ✓ Including but not limited to; a lease contract with a lease company, an engineering contract with an engineering company, a sales contract and an O&M service contract with manufacturers.
- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(2) Service and sales contract (between members of the consortium)

- ✓ Including but not limited to; an engineering contract between an engineering company and a design company, and a contract between an engineering company and a construction company.
- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(3) Service and sales contract (between an agency and a client)

- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(4) Energy supply contract (between a consortium member and a client)

- ✓ Terms of contract between a member of the consortium and a client may be set freely. In general, it is thought to include followings:
  - ・ Conditions of supply, fee (pay-as-you-go in general), time of payment, risk of loss at the time of outage, contract period, and other general clauses etc.,
- ✓ A fixed contract used by PEA must be used when surplus power is sold to PEA.

(5) Consortium contract (between the Local Consortium Members)

- ✓ Agreement is thought to include an overview of the project, roles and responsibilities of each members, division of income etc.,

9.5.3 SPC Model

(1) Service and sales contract (between the SPC and a client)

- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(2) Service and sales contract (between each consortium member and the SPC)

- ✓ Contracts between members of the consortium shall not differ greatly from as described in 9.6.1-(1).

(3) Joint venture contract (between the Local Consortium Members)

- ✓ JICA may be a party to a contract in case JICA invest in the SPC.
- ✓ Terms of contract may be set based on agreement between parties. In general, it is thought to include followings:
  - ・ Organization and capital structure (Paid-in capital, procedure of capital increase), board of directors (structure, procedure of convention, voting right to elect directors, a resolution of the board of directors), general meeting of stakeholders (procedure of convention, resolution method, a resolution of the general meeting of stakeholders), accounts, duty not to compete, stock transfer, deadlock, termination of agreement, and general conditions.

(4) Contract between the SPC and investors and loan providers such as JICA, IEAT, etc.

- ✓ A contract between investors and loan providers may be required as well as an investment and lending contract between the SPC and each investor or loan provider.
- ✓ Terms of contract between the SPC and investors and loan providers may be set individually based on discussion with each investor or loan provider.

9.6 Relevant Regulation (Foreign Investment and International Loan, PPP and Infrastructures, Exchange and Transfer of Foreign Currency, Land Acquisition and Land Use, Corporate Tax and Tariff, etc.)

9.6.1 Foreign Investment and Foreign Loan

It is unclear whether benefits of BOI will be applied to the project however, since the project includes "Other services" in List 3 of the Foreign Business Act, restriction of the Foreign Business Act will be applied if benefits of BOI is not granted. In this case;

- Foreign Business License (FBL) will need to be obtained for foreign majority of the capital;
- If the project includes power generation business, the president of the SPC must be a Thai national;
- Financing by loan will depend on the SPC structure; and
- If IEAT invests in the SPC, IEAT may possibly dispatch board of directors.

9.6.2 PPP and Infrastructures

It has been confirmed that there are no possibility that the new PPP act will not be applied to the project.

9.6.3 Exchange and Transfer of Foreign Currency

Capital transactions are free in principle however, some capital transactions with large amount require prior notification and prior approval by BOT. In addition, some capital transactions have upper-limits to the transaction amount. There are no specific regulations concerning two-generation loan.

Settlement currencies are not specified for trade transactions.

10% withholding acquisition tax is collected at the payment on profit generated by the SPC transferred to Japan.

9.6.4 Acquisition of Land and Land Use

Land law prohibits the ownership of land in Thailand by foreigners and foreign companies. However, benefits of IEAT and BOI exempts this regulation, therefore allowing acquisition of land if benefit is granted.

If the benefit cannot be granted by BOI, the project may be able to receive the benefits of IEAT by placing a business office in the industrial estate.

If the SPC is categorized as a Thai company, there will be no regulations concerning the purchase of land.

9.6.5 Corporate Tax and Customs

As of September 2015, the corporate tax is 20% and retained losses may be carried over for five years.

On November 1st, 2007, the EPA has been issued between Japan and Thailand. The EPA Preferential tax rates will be applied if the certificate of origin can be obtained for the preferential items. The MFN tax rates (WTO standard tax rate) will be applied for non-preferential items and items without the certificate of origin. If the B2 benefits are granted by BOI, import duties on raw materials will be exempt.

10 Risk Analysis and Mitigation Measure

10.1 Risk Analysis and Mitigation Measure

10.1.1 Risk Associated with Project Implementation

(1) Risk related to Investment and Business Licensing System

At this point, whether the project can receive the benefits of BOI is uncertain. Even if the benefits of BOI is granted, depending on the rank of the basic and additional benefits, there are concerns of significant impact on the business balance.

(2) Sponsor Risk

The industrial estate is operated either by IEAT or a private company however, risk of bankruptcy by the operating company of the industrial estate can be assumed. Even if the operating company goes bankrupt, since the right of the land is with the factory or the factory lender, business can be continued.

However, there is a possibility of inconvenience for utilities such as electricity, water supply and sewage system.

Similarly, in the case of rental factories, there is a possible risk of bankruptcy by the operating company of the rental factory. If the operating company of the rental factory goes bankrupt, there is possibility of causing a problem in continuation of service provision.

(3) Risk of Bankruptcy and Change in Business Plan by Clients

Services provided by the SPC involve setting up a utility at the client's facility, and providing maintenance. Therefore, if the client goes bankrupt and operation is terminated, there is a risk that recovery of the utility to become difficult.

Furthermore, there is a risk of clients to change their business plan.no longer requiring the utility provided by the SPC within the contract period.

(4) Financing Risk

In implementing the project and the nature of the project, we are currently requesting investments from JICA, IEAT, etc. On the other hand, the SPC plans to implement the business through corporate finance procured based on the credibility of the parent company.

Therefore, there is a concern for risk of reduced credibility of the parent company.

(5) Market Risk

As of September 2015, economic downturn in Thailand is continued due to domestic political factors and stagnation in foreign demand. In addition, due to the change in BOI's incentive system in 2015, new investments from foreign countries, including Japan are few.

At this point, the impact of ASEAN economic integration is unknown, and there is a possibility of a future risk for Thailand due to its' relationship with the neighboring countries.

(6) Social Risk

In May 2014, there was an outbreak of a coup in Thailand, and the country is still under military government as of September 2015. Outlook of transition to civilian rule is still uncertain and the country is politically unstable. Certain level of political risk is therefore conceivable.

(7) Technical Risk

Utilities provided by the project are planned to be installed and maintenance by Thai engineers. Even if the Japanese stakeholders were to supervise, there are technical risks assumed such as securing competent engineers and improvement of technical skill through training.

(8) Risk Concerning Related Infrastructures

The project will provide secure and safe operating environment for clients by taking responsibility of all possible risks concerning utilities. However, due to the nature of the service provided, there are uncertain risks concerning the demarcation of responsibility with infrastructures owned by factory owners and other providers of electricity/steam.

(9) Accident and Hazard Risk

At the industrial estate, traffic is increasing drastically due to increased use of private cars by employees, and thus the occurrence of traffic accidents is also on the rise. Furthermore, due to the traffic congestion in the morning and afternoon commuting hours, loss of time in transit has increased, and the risk of being caught in a traffic accident is also growing. Moreover, due to traffic congestions caused by traffic accidents, there is a risk of delay in service delivery time to the clients.

Generally, measures against traffic accidents are implemented by each factory however, industrial estate operating companies also promote measures such as promotion of awareness, installation of humps in high-accident spot, and local improvement constructions.

Risks on natural disaster risk are indicated below.

10.1.2 Natural Disasters

Natural disaster risks are organized here based on publically available references in Thailand.

(1) Flood Risk

Ayutthaya province has flood risks. The province is a low land with the Chao Phraya River where a flood caused by a typhoon in 2011 caused a serious damage. There is a risk of inundation in case of more than 100 mm of rainfall in districts where a rainwater drainage is not properly provided. In industrial estates, flood risks are lower than in urban and rural areas, as they have been addressing the risks by developing a drainage system and embankment of road surfaces.

Flood risks are low in Prachinburi, Rayong, and Chonburi provinces located in a relatively high land.

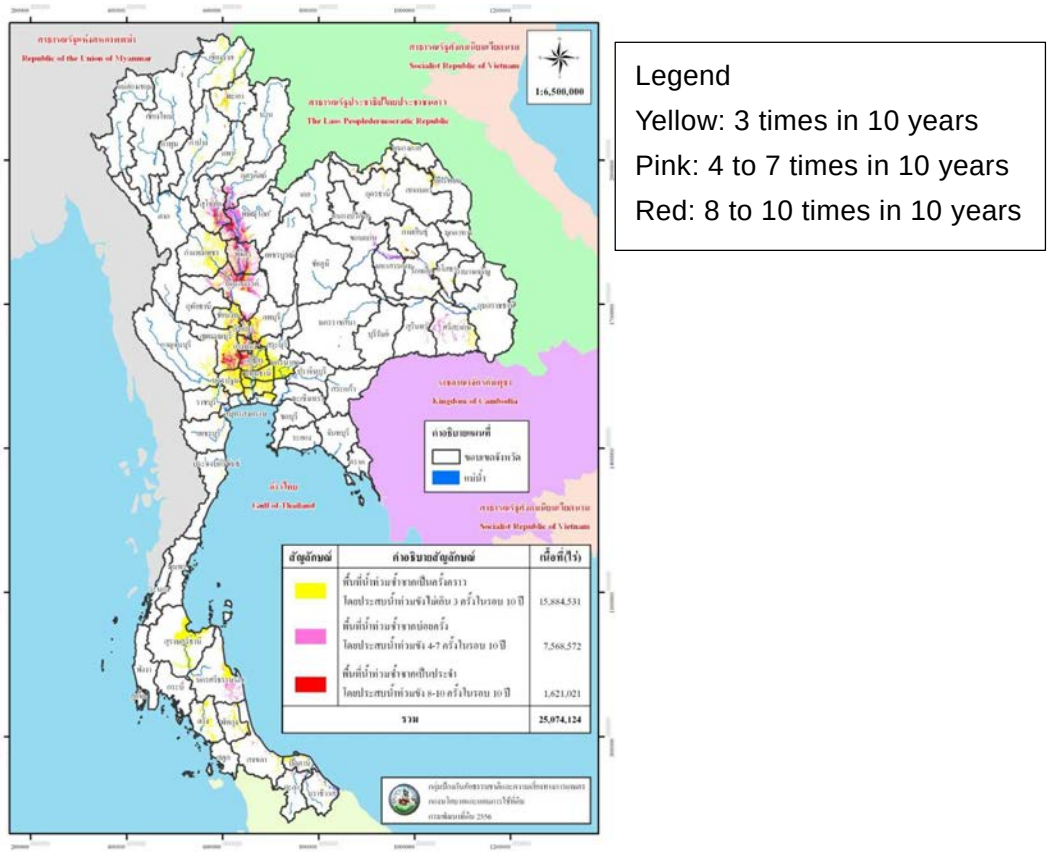


Figure 10-1 Flood Risk Map

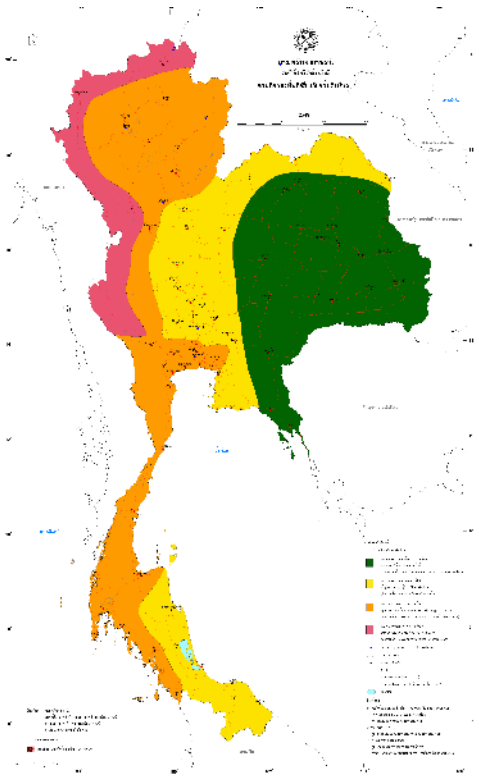
Source: Web Site of Department of Disaster Prevention and Mitigation of Thailand

(2) Storm Surge Risks

Thailand has minimal risks of storm surge, which was recorded in 1962, 1989, and 1997 to note the recent events. The target provinces have low risks of storm surge.

(3) Seismic Risks

Most parts of the target provinces are located in areas in yellow indicated in the figure below. Although they have a probability of an earthquake with a seismic intensity of 2 to 4, a seismic risk is low. According to Seismological Bureau of Thailand, however, a tremor of an earthquake with its epicenter in Myanmar was observed in Prachinburi and Ayutthaya provinces in 1930.



Legend
Pink: Area with a risk of earthquake 7 to 8 in Mercalli scale (equivalent to a Japanese seismic intensity upper and lower 5)
The risk level is moderate.
Orange: Area with a risk of earthquake 5 to 7 in Mercalli scale (equivalent to a Japanese seismic intensity 4 to 5)
The risk level is low or moderate.
Yellow: Area with a risk of earthquake 3 to 5 in Mercalli scale (equivalent to a Japanese seismic intensity 2 to 4)
The risk level is high.
Green: Area with a risk of earthquake less than 3 in Mercalli scale (equivalent to a Japanese seismic intensity less than 2)
No requirement of an earthquake-resistant design for buildings

Figure 10-2 Seismic Risk Map (2005)
Source: Web Site of Department of Disaster Prevention and Mitigation of Thailand

(4) Epicenter Risks

According to Seismological Bureau of Thailand, no earthquake has been observed so far with an epicenter in Prachinburi, Rayong, and Chonburi provinces. An earthquake with an epicenter in Ayutthaya province has not occurred since 1600's when it was recorded.

(5) Tsunami (Tidal Wave) Risks

The target four provinces have a low risk of tsunami, as there are no potential epicenters in proximity. In these provinces, no damage was reported in the 2004 Great Sumatra Earthquake.

(6) Volcanic Hazards

There are no volcanos in the target four provinces and neighboring areas, and thus they have no volcanic hazards.

(7) Forest Fire Risks

Forest coverage is 16 to 25% of the land in Prachinburi province, 25 to 35% in Rayong province, and 8 to 12% in Ayutthaya province, and 3 to 8% in Chonburi province, respectively. Forest fire risks are not high, compared with northern and southern parts of Thailand where forest coverage is higher.

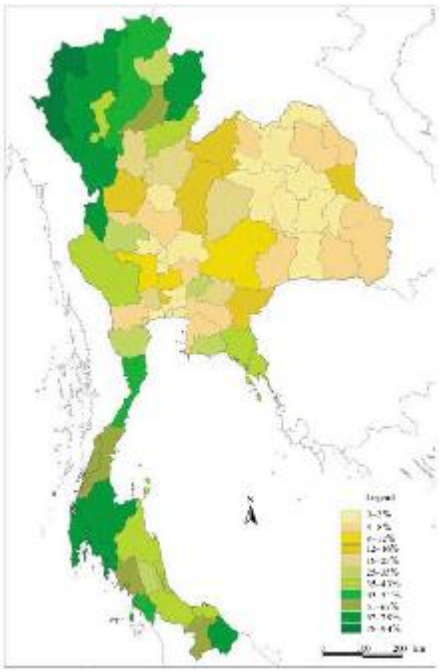


Figure 10-3 Percentage of Forest

Source: Parnell and others (2003) Plant collecting spread and densities: Their potential impact on biogeographical studies in Thailand

(8) Rainfall Risks

Rainfall risks are high in Prachinburi and Chonburi provinces. Rayong and Ayutthaya provinces have moderate risks.

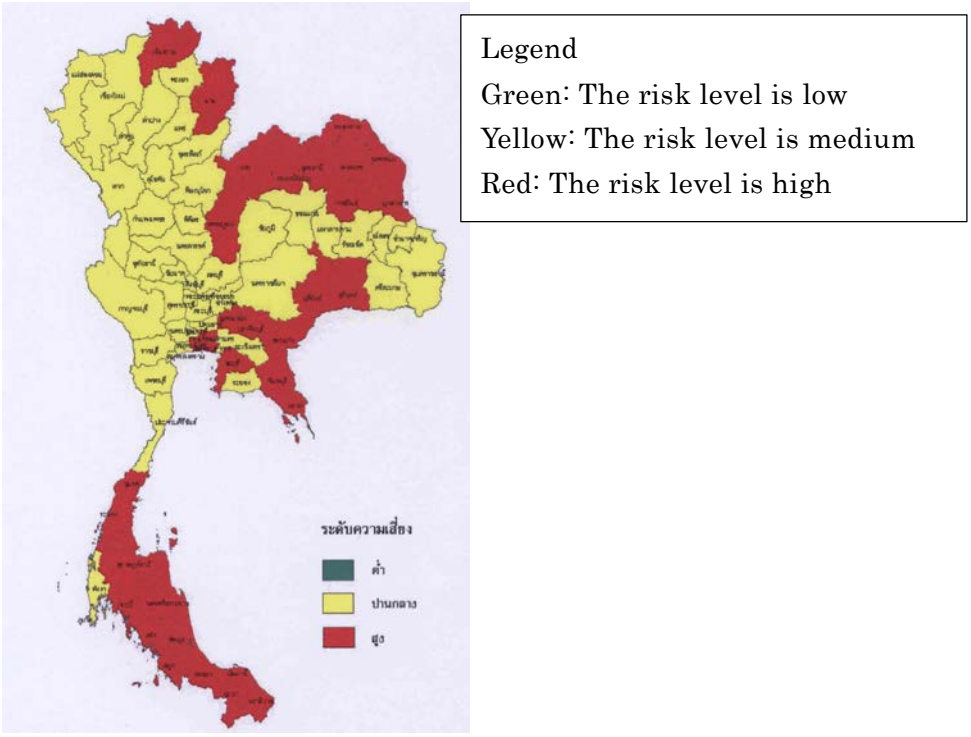
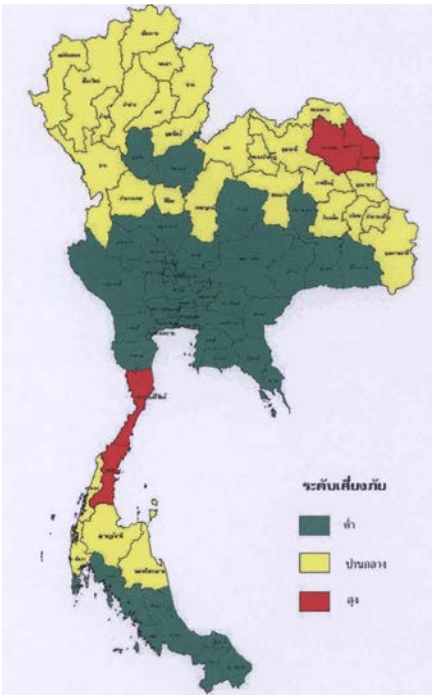


Figure 10-4 Rainfall Risk Map

Source: Website of Department of Disaster Prevention and Mitigation (DDPM)

(9) Typhoon Risks

Typhoon risks in the target four provinces are low. These areas are unlikely to have direct damage resulting from a typhoon.



Legend
Green: The risk level is low
Yellow: The risk level is medium
Red: The risk level is high

Figure 10-5 Typhoon Risk Map
Source: Website of Department of Disaster Prevention and Mitigation (DDPM)

(10) Strong wind Risks

The target four provinces are not located in areas with a strong wind probability, and therefore have a low risk.

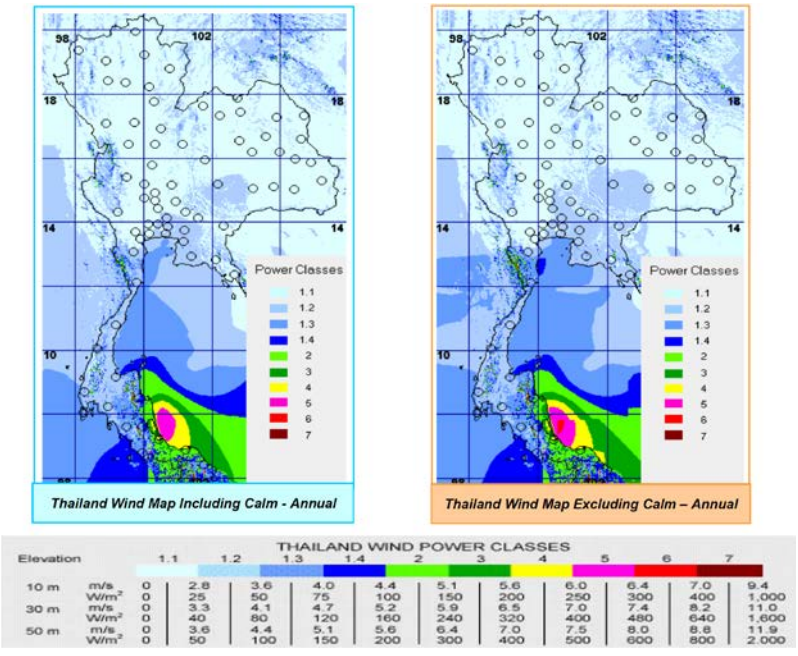
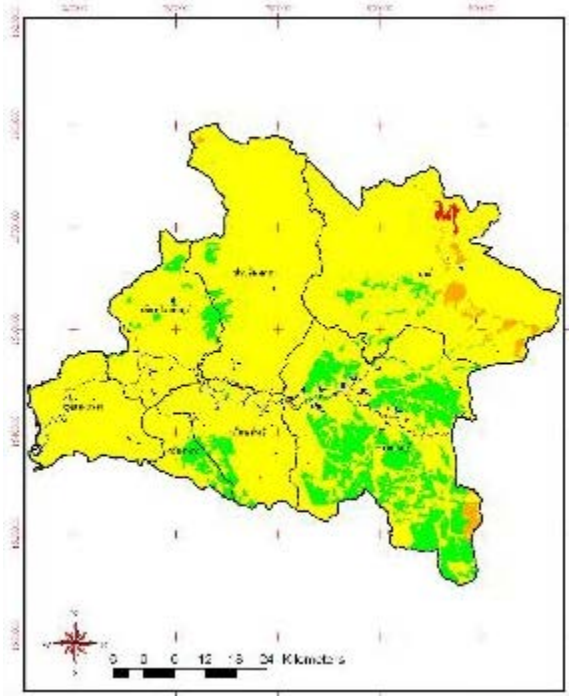


Figure 10-6 Wind Velocity Map
Source: Website of Department of Alternative Energy Development and Efficiency

(11) Drought Risks

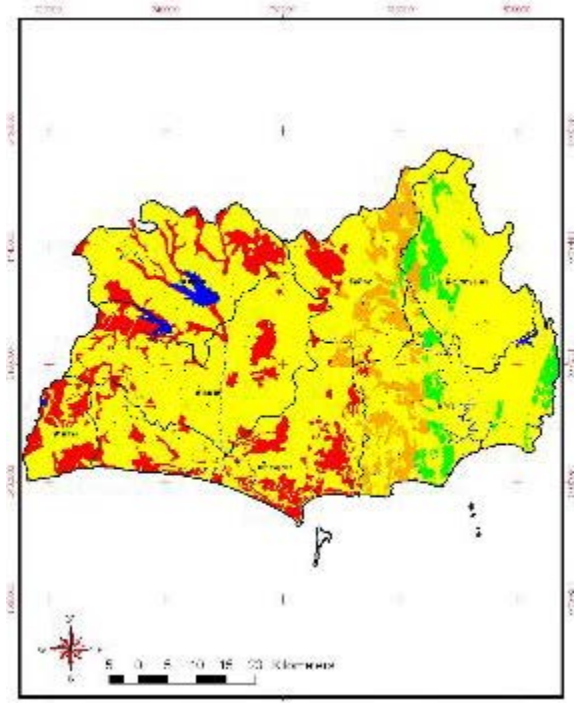
Parts of Rayong and Chonburi provinces are prone to drought. However, water is supplied for industrial use, and some industrial estates have their own reservoirs.

Prachinburi and Ayutthaya provinces, on the other hand, have virtually no risk of drought.



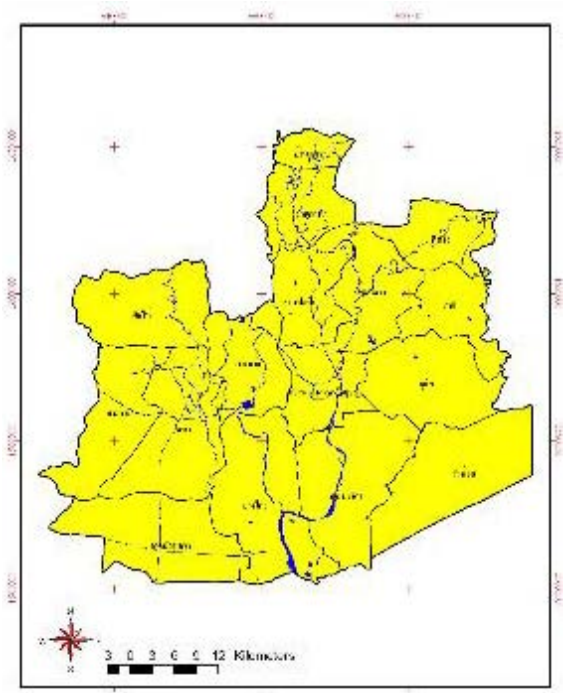
Legend
Red: The risk level is high
Orange: The risk level is medium
Green: The risk level is low
Yellow: The risk level is extremely low
Blue: Water Resources

Figure 10-7 Drought Risk Map (Prachinburi Province)
Source: Website of Department of Disaster Prevention and Mitigation (DDPM)



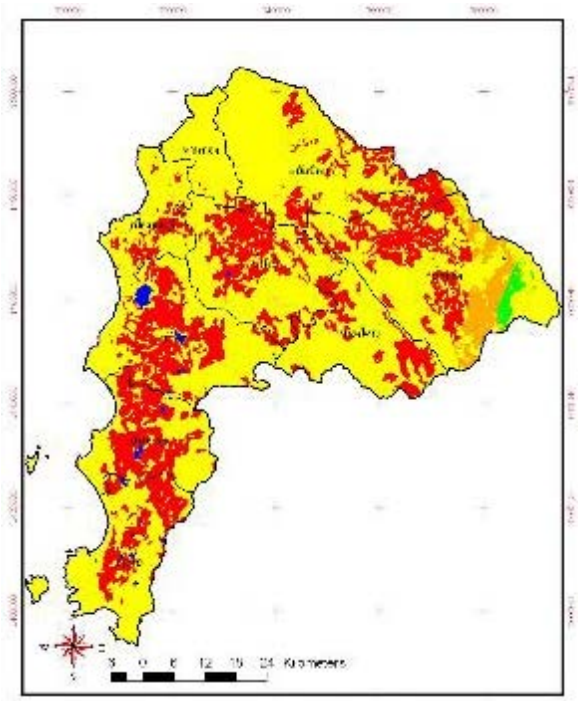
Legend
Red: The risk level is high
Orange: The risk level is medium
Green: The risk level is low
Yellow: The risk level is extremely low

Figure 10-8 Drought Risk Map (Rayong Province)
Source: Website of Department of Disaster Prevention and Mitigation (DDPM)



Legend
Red: The risk level is high
Orange: The risk level is medium
Green: The risk level is low
Yellow: The risk level is extremely low

Figure 10-9 Drought Risk Map (Ayutthaya Province)
Source: Website of Department of Disaster Prevention and Mitigation (DDPM)



Legend
Red: The risk level is high
Orange: The risk level is medium
Green: The risk level is low
Yellow: The risk level is extremely low

Figure 10-10 Drought Risk Map (Chonburi Province)
Source: Website of Department of Disaster Prevention and Mitigation (DDPM)

10.1.3 Risk Mitigation

Measures to mitigate risks evaluated in the previous chapter were considered. Risk countermeasures have been organized into 4 categories: “avoidance”, “reduction”, “retention”, and “transfer”.

Table 10-1 Project Risk and Risk Mitigation Measures

No	Risk	Countermeasure	Mitigation Measures
1	Risk Concerning Investment and Business Licensing	Reduction	· Availability of incentives and various application procedures will be clarified and support for smooth acquisition of licensing will be requested through consultation with BOI and MOE via IEAT.
2	Sponsor Risk	Avoidance Reduction	· Although the operation status of IEAT, private industrial estates, and rental factory operating companies considered for partnership seems to be in good order, the eligibility for partnership shall be determined based on analysis of supporting documents concerning the business conditions and past performance of operating industrial estate.
3	Risk of Bankruptcy and Change in Business Plan by Clients	Reduction Avoidance	· Contracts shall specify the handling in case clients go bankrupt and business is terminated. · To avoid the risk of early-termination due to a change in business plan, early-termination charges (100% of the remaining time) shall be set.
4	Financial Risk	Reduction Avoidance	· By requesting JICA to invest in preferred shares, credibility of the project will be increased, enabling financing at lower interest. · By obtaining credibility through IEAT's minor investment, and through corporate finance, reduce financing risk.
5	Market (Macroeconomic) Risk	Reduction	· Strive to collect information concerning industrial trend related to the ASEAN regional economic integration, particularly on automobile and electricity-related sector. · Strive to collect information concerning the political/economic conditions.
6	Social Risk	Reduction	· Despite reputation of a stable and safe environment, there was a terrorist attack in the downtown Bangkok on August 2015 which caused many casualties. Furthermore, the political status is extremely unstable, and thus political risk needs to be considered.
7	Technical Risk	Reduction	· Prevent the actualization of risk by conducting appropriate supervision and monitoring of construction workers.
8	Environmental Risk	Reduction	· Strive to collect information including on countermeasures against flood and drought risk, and make sure the sign of actualization or expansion of these risks can be detected early. · Comply with decrees and regulations related to environment.
9	Risk Concerning Related Infrastructures	Reduction	· Specify the demarcation of responsibility with clients and electricity/steam providers. Handlings at the occurrence of an event shall also be specified beforehand.
10	Accident and Hazard Risk	Transfer	· Subscribe to various insurance (construction, fire, car, accident, liability, labor, etc.), and transfer the damages at the occurrence of accidents and hazards. · The positioning of the maintenance personnel for traffic congestion measure shall consider the appropriate time and distance while securing the balance with cost. · As traffic accident measures, actively work on securing a safe means of transportation for employees.

10.2 Impact of the Project

The project expects primary and overall effects as follows.

(1) Primary Effects

- Utility equipment provided for the target factories will allow stable use of the functions.
- Energy efficiency in the target factories will be improved.

(2) Overall Effects

- An energy efficiency will be increased, energy costs will be saved, and stable operations of equipment will make production and management also stable.
- An increased energy efficiency will reduce CO2 emission.
- Business will be managed more efficiently by using functional services with low and standardized costs.
- Industrial advancement in Thailand will be achieved.

The project intends to have multiple consequences that include these primary effects as above, and the resulting overall effects. As mentioned in 7-5, however, it is not practical to monitor the overall effects of each project. Indicators to assess the project effects are scales of service provision and the resulting increase in an energy efficiency which will also verify the primary effects. Where the overall effects need to be assessed in detail, the project will numerate the intended effects using 2 performance indicators set forth in 7-5.

10.3 Measurement of Quantitative Impacts

The section below provides the operation and performance indicators set forth in 7-5, the number of potential beneficiaries, and EIRR of each service. Quantitative impacts to other than number of staffs in clients, users of the services, will be depends on scale of facilities, ratio of the services in facilities, and details of the services; and thus, such quantitative impacts will be largely different in each factory. Accordingly, it is difficult to simply measure the quantitative impacts of comprehensive business scale which is planned in the project. Therefore, quantitative impacts are studied targeting 4 companies which showed interests in use of the project's services and which the schematic design was studied for, namely, Japanese Company A, Japanese Company B, Japanese Company C, and Japanese Company D.

10.3.1 Measurement of Operation and Performance Indicators

(1) Operation Indicators

1) Number of tenant companies in the target industrial estates

The companies strongly interested in the project's services tenant in the following industrial estates: Japanese Company A in Rojana Rayong Industrial Park, Japanese Company D in Pinthong Industrial Estate, Japanese Company B and Japanese Company C in Amata Nakorn Industrial Estate, respectively. The number of tenant companies in each industrial estate is provided below (entirely based on results of the interviews during the on-site visit).

- Rojana Rayong Industrial Park: 23 companies (as of October 2013)
- Pinthong Industrial Estate: Approximately 240 companies (as of August 2015)

• Amata Nakorn Industrial Estate: Approximately 600 companies (as of January 2016)

2) Number of potential service users

Japanese Company A, Japanese Company B, and Japanese Company D are considering to use services in a factory that they operate respectively. Japanese Company C noted that it might use services in an additional factory in Amata Nakorn Industrial Estate.

Demand forecast provided in 5-2 indicates that about 278 factories are likely to use the project's services over the coming 10 years. Assuming that the project could obtain contracts with about 30% of these factories, approximately 83 factories over 10 years, or 8 per year will be using the services.

3) Sales

As estimated in 6-4-1 and 6-4-2, annual service fees for the Energy Service (the Air Conditioning Service and the Factory Equipment Service) are provided in Table 6-12 and 6-13. Japanese Company A, Japanese Company D, and Japanese Company C intend to use the Air Conditioning Service, and Japanese Company B, the Factory Equipment Service, respectively.

Table 6-12 Cost Estimation (Air Conditioner)

Option	Service fee
3 years	93,000THB/ year - 202,000THB/ year
6 years (basic plan)	51,000 THB/ year - 110,000THB/ year
9 years	First 3 years 42,000 THB/ year - 130,000THB/ year Next 3 years 36,000 THB/ year - 113,000THB/ year Last 3 years 38,000 THB/ year - 98,000THB/ year

Table 6-13 Cost Estimation (Factory Equipment Service)

Option	Service fee
3 years	311,000THB/ year - 965,000THB/ year
6 years (basic plan)	167,000 THB/ year - 525,000THB/ year
9 years	First 3 years 139,000 THB/ year - 430,000THB/ year Next 3 years 121,000 THB/ year - 374,000THB/ year Last 3 years 104,000 THB/ year - 324,000THB/ year

In addition to the Energy Service, the project has suggested the 4 companies to use the Energy Conservation and O&M Service (remote monitoring systems for power monitoring and an air conditioning system). They have indicated an interest in these services, and therefore, an annual sales of the above-mentioned Energy Service is added by sales of 49,000 to 77,000 THB to be gained by the Energy Conservation and O&M Service.

Granted that the 4 companies decided to contract a standard 6 year Energy Service, the total annual sales will be 516,000 to 1,163,000 THB, amounting to 3,096,000 to 6,978,000 THB for the 6 years.

(2) Performance Indicators

1) Scales of service provision

This study has suggested the 4 companies the following scale of service provision.

- Japanese Company A: 1,529,000 BTU/H (2 districts: 1,085,000 BTU/H, 444,000B TU/H)
- Japanese Company B: 630 kW (intensive allocation of small-sized compressors) (55kW × 6 units) and use of inverters (100 kW × 3 units))
- Japanese Company C: 1,916,865 BTU/H (3 districts: 440,500 BTU/H, 636,365 BTU/H, 840,000 BTU/H)
- Japanese Company D：2,760,000 BTU/H (120,000 BTU/H・unit × 23 units)

Accordingly, if the project provides the intended services to the 4 companies, it will be assured that air conditioning will be commissioned by the 3 companies, generating a total of 6,205,865 BTU/H, and that factory facility equipment of 630 kW (which are compressors) will be used by the remaining company. Furthermore, the Cloud FEMS and maintenance service will allow stable operations of air conditioning and factory facilities, while at the same time keeping failures and troubles to the minimum.

2) Increase in an energy efficiency achieved by service provision

The services suggested for the 4 companies and the resulting energy efficiency are indicated in Table 10-2.

Table 10-2 Service Components for the Interested Companies

	Facility Conditions	Energy Service business	Energy Conservation and O&M Service	Increase in an Energy Efficiency (Approximation)
Japanese Company A	Faced deterioration of plant air conditioners	Air Conditioning Service ・Intensive allocation of plant air conditioners ・Installation of air-conditioning inverters	Cloud FEMS	Approx. 15% (229,350 BTU/H)
Japanese Company B	Currently using constant speed compressors	Factory Equipment Service ・Inverter compressors ・Intensive allocation of compressors	Cloud FEMS O&M	Approx. 6% (37.8 kW)
Japanese Company C	Replacement of the plant air conditioners is under process	Air Conditioning Service ・Intensive allocation of plant air conditioners ・Installation of air-conditioning inverters	Cloud FEMS O&M	Approx. 15% (287,530 BTU/H)
Japanese Company D	Faced deterioration of plant air conditioners	Air Conditioning Service ・Installation of air-conditioning inverters	Cloud FEMS	Approx. 15% (414,000 BTU/H)

Accordingly, the Air Conditioning Service and the Factory Equipment Service will provide pillar functions intended by the project and increase an energy efficiency, leading to reduced energy costs and CO_2 emission. It should be noted, however, that while the energy efficiency in the above-mentioned 3 companies interested in the Air Conditioning Service will increase by about 15%, it is only an

approximation, and does not guarantee that the said service will uniformly achieve a 15% increase in the energy efficiency. In other words, the nature and quantity of the resulting effects will vary, depending on the equipment conditions in a factory, the intended service components, or the installed equipment types. A quantitative measurement of the effects therefore needs a factory-based assessment to estimate an increase in the energy efficiency based on the findings thereof. The outcome will be then made available for the factories when the project suggests relevant services for them.

10.3.2 Number of Beneficiaries

Primary beneficiaries of the project are assessed in terms of "the number of employees in the target factories," who will directly receive benefits of the services delivered. The project's services, when used, will increase production and management efficiencies in the factories, keeping up and expanding the production scales thereof. Consequently, employment will be sustained and increased.

As of this study (January 2015 through May 2016), the number of employees in the above-mentioned companies is as follows.

- Japanese Company A: 385
- Japanese Company B: 600
- Japanese Company C: 1,500
- Japanese Company D: 275

Accordingly, the service provision for the 4 companies will help increase production and management efficiencies, while also sustaining employment of 2,760 persons in total. As mentioned in 5-2-2, the average number of employees in factory in Thailand is generally 93 to 963. Factories that are likely to use the project's services are estimated 8 per year, resulting in potential beneficiaries of 744 to 7,704 employees annually across the country who will be able to take advantage of the project.

Notably, an increased energy efficiency achieved by the project's service provision for the target factories will save fossil fuels, and reduce greenhouse gases generated by the use of such fuels, which will benefit Thai people, and ultimately human being on the entire globe. Furthermore, lower energy costs resulting from an increased energy efficiency will help save production costs, possibly leading to benefits delivered to consumers by way of lowered product prices.

10.3.3 IRR

The project cash flow analysis indicates as high EIRR as 75.7 to 79.9% in all the intended cases. While the project is planned as a lease business whose assets will not be owned by the SPC, and therefore is likely to have a higher EIRR than in general, it is concluded that the project anticipates a good investment effect. However, whereas Case 1, which is an upside scenario, expects to generate profits throughout the entire project period, a downside scenario of Case 3 needs as much capital as 80 times Case 1, as it will result in a deficit from 16th years on, requiring additional funds. Accordingly, this will entail a relevant measure, including limitation on dividend.

10.4 Qualitative Impacts

At this point, effects expected in the project are described as below, specifically in a qualitative term.

(1) Industrial Advancement

As preliminarily researched in an initial document survey, the factories visited by the Survey Team have experienced such unstable power supply as a momentary interruption, causing production suspension and equipment failures. Furthermore, operations of deteriorated facilities entail excessively high utility and maintenance costs. Such unstable utility supply and excessive costs are one of the reasons that the factories are unwilling to strategically replace their production facilities. Therefore, it is essential to address the above-mentioned problems to replace and upgrade the production facilities.

Intended to install a high quality UPS and air conditioners, the project will provide the Energy Service and the Energy Conservation and O&M Service to stabilize utility supply and manage energy control in a holistic manner, using the Cloud FEMS with ICT. When broadly implemented, the project will promote upgrading of production facilities that underpin industrial advancement.

The project's service provision is primarily targeting Japanese SMEs. However, it will contribute to larger-scale industrial advancement, achieved through a reliable utility supply and higher efficiency, when covering broadly local companies in Thailand operating with less efficient utilities and frequent failures than the said Japanese counterparts.

(2) Enhancement of a Business Expansion in Thailand by Japanese SMEs

Since the Plaza Agreement in 1985, many large Japanese companies have expanded their business abroad. A number of those companies have built factories in Thailand. The business expansion of the large companies is already slowing down, and in recent years many Japanese SMEs are broadening their operations in Thailand.

For many of SMEs, factory construction and facility installation entail substantial costs. According to the results of the interviews in this study, SMEs are more likely to obtain a 3 year contract to operate in a rental factory at the outset, followed by renewing the contract or constructing a factory at their own expense when their production and management are successfully sustained. Planning to develop their business with such a step-wise approach, Japanese SMEs will be able to save the substantial initial costs at the outset of their operations in Thailand, as suggested by the project. With a payment of monthly charge, furthermore, they can use high-quality utility equipment together with a maintenance service, which offers a great advantage for them.

11 Feasibility Evaluation

11.1 Summary of the Study

(1) Outline of the Study

The study has examined the feasibility of outsourcing services targeting the Thai industrial estates to install, operate and maintain their utility facilities. To this end, it has assessed the existing utility supply systems and related infrastructure, the legal systems applicable to the intended businesses, a market research and demand forecast, detailed designs of the services, viable business schemes, requirements of environmental and social considerations, and potential impacts of the project, while also carrying out the cash flow analysis and risk analysis.

The project initially planned to provide such outsourcing services as the Energy Service, the Energy Conservation and O&M Service, and the Smart Services (transportation, human resource development, environmental monitoring, and local contributions). In the course of its analysis, however, the study has revealed that the Smart Services are less feasible than the Energy Service and the Energy Conservation and O&M Service, and therefore decided to elaborate on the latter 2 services to undertake facilities planning, schematic designs and cost estimation. Specifically, the Energy Service includes the Air Conditioning Service that replaces and maintains air conditioners, and the Factory Equipment Service primarily to allocate compressors in an intensive arrangement. The Energy Conservation and O&M Service is featured by remote monitoring with the Cloud FEMS and scheduled maintenance on site.

(2) Business Schemes, Financing Measures, and the Implementation Schedule

The study has examined a business scheme that would establish a SPC in the long run to deliver the Energy Service and the Energy Conservation and O&M Service. As a precondition of establishing the SPC, the project must have potential demands and viable business scale. Under the current circumstances. However, only a small start-up business mainly centering on the Air Conditioning Service and the Factory Equipment Service mainly targeting on Japanese-affiliated small-medium scale factories can be practically implemented, as mentioned in 7.3, due to reduction of large scale projects such as on-site power generation which was led by slowdown in Thailand's economy. Therefore, the study has explored if the Alliance Agreement and the Agency Agreement are feasible to cover the period until the SPC is established. Under the Alliance Agreement, the consortium members of this study will consult together and tap business opportunities wherever possible, taking advantage of their strengths. The Agency Agreement, on the other hand, selects an Agency Company from the said consortium members, which will act as a liaison to lead promotional efforts and a collective cooperation to form a business.

A financing measure depends on the intended business scale and form. Project financing will be required for funding where the planned business has solid actual demand, and is able to maintain a reasonable operating scale. Investment and loan shall be provided approximately at a ratio of 4 to 6 or 3 to 7. Financing terms measure is studied to be obtained by foreign investments and loans from such entities as companies involved in the project planning (the Local Consortium Members), related Thai companies (including Japanese-affiliated subsidiaries), and JICA. Furthermore, loans are studies to be

obtained by Japanese banks operating in Thailand as well as local financial institutions. To meet a financial requirement of about 15 billion JPY for the five years, for instance, a funding model comprises investments of 6 billion JPY, including 4.5 billion JPY from some companies centering the consortium members in Japan and the Local Consortium Members, 1.5 billion JPY from JICA's overseas loan and investment finance program, and the remaining loans from Japanese banks and local Thai banks.

The project implementation is scheduled to start with the Alliance or Agency Agreement for the initial 3 years, followed by the establishment of the SPC possibly in the 4th year. To prepare for the SPC, the project must find client companies, develop a business plan, and pursue preliminary consultations with related government agencies including BOI before entering in the 3rd year. The SPC will be then established in the 4th year, obtaining permits and licenses.

(3) Impact of the Project and Feasibility Evaluation

Currently under elaboration, the project intends to provide the 4 companies with the Energy Services that include the Air Conditioning Service (intensive allocation of air conditioners and installation of air conditioning inverters) and the Factory Equipment Service (inverter compressors and intensive allocation of the compressors). The Energy Conservation and O&M Service includes the Cloud FEMS and O&M. When delivered, the Air Conditioning Service will assure an air conditioning capacity of 6,205,865 BTU/H, while the Factory Equipment Service will enable the target factories to stably operate compressors at a power range of 630 kW. An energy efficiency is estimated to increase approximately by 15% resulting from use of the Air Conditioning Service, and similarly by 6% from use of the Factory Equipment Service (compressors).

In addition to the above performance indicators, the O&M Service will minimize troubles and failures of the equipment to be operated by the 4 companies. The project will achieve improvement. Employment of 2,760 workers will be sustained, while also a profit will be generated annually in a range of 516,000 and 1,163,000 THB.

Furthermore, besides the above-mentioned services suggested by the project, the On-Site Power Generation Service and the UPS-based Factory Power Supply Stabilization Service are also available. EIRR of these businesses is estimated as high as 75.7 to 79.9%.

The quantitative impact of the project, albeit difficult to evaluate, includes such primary effects as an increased energy efficiency and stable utility supply, and secondary effects such as increased production and management efficiencies, sustainable employment, and reduced CO2 emissions.

In light of the above, the project expects wide-ranging effects, delivering benefits to factory workers and people in Thailand. The feasibility of the project has been verified by economic indicators, and therefore the study concludes that it should be implemented as intended.

11.2 Prospective Challenges

Challenges in the project implementation are highlighted below.

(1) Risk Sharing among the Member Companies in an Agency Agreement

The project implementation is scheduled to start with the Alliance or Agency Agreement to deliver the services for the initial 3 years. The SPC will be subsequently established in the 4th year when a reasonable number of clients are obtained. The member companies will entail different business risks in either scheme of the Alliance or Agency Agreement to be implemented during the initial 3 years prior to the SPC's start-up. A company acting as an agency will be exposed to more risks associated with business operations, contracts, and responses to the clients. Such risks, when centered on a particular entity, will cause insecurity in the business to be sustained under the Agency Agreement. This may pose a further problem in the SPC's start-up. It is thus essential to diversify the agency's risks among the member companies so as to maintain continual business operations.

(2) Research to Explore Local Client Companies in Thailand

The study carried out interviews with about 100 factories in total, including Japanese-affiliated companies and local Thai enterprises. Brief plant diagnoses were conducted for those interested factories, followed by suggestions of relevant services. The promotional efforts have chiefly targeted these Japanese companies for the reason that the majority of the interested entities are Japanese-affiliated factories. Given this background, the project is likely to target Japanese companies when implemented upon completion of this study. Major reasons of such background are supposed that Japanese-affiliated companies have comparatively higher intension to energy saving than Thai enterprises; and high quality services by Japanese-affiliated companies are attractive to Japanese-affiliated companies in Thailand. Therefore, main marketing target will be Japanese-affiliated companies for the implementation of the business after the project.

On the other hand, NESDB, which is the counterpart of this study, anticipates the project's service provision to local Thai companies as well as a positive impact on the economy obtained through the resulting industrial advancement. The Reason why Thai enterprises have comparatively small intension to the project is supposed that Thai enterprises have comparatively lower intension to the energy saving than Japanese-affiliated companies, and Thai companies are likely to put priority on relationship with existing manufacturers and engineering companies. In other words, such Thai enterprises will have possibility to increase intension to the project by increase of demand for the energy conservation technology and high efficient equipment followed by improving energy saving awareness, and increase of reliability of the project followed by project achievements. Therefore, Thai enterprises will be preferable marketing targets for future as well as Japanese-affiliated companies.

12 Challenges and Project Concept of the Smart Service

12.1 Challenges

12.1.1 Smart Services

(1) Transportation Service

It was found that demand and requirement for the Transportation Service with EV bus is constant due to environmental concern. However, challenges were also found as shown in below:

- Assumed demand is very small. (Demand for commuter bus and tour bus is small. Bus has small transportation share due to strong intention to private car.)
- There is no governmental policy for environmental issue and related subsidy systems. Thus, it seems difficult to have incentives for installation of EV bus.
- The Transportation Service with EV bus requires large investment; and there is no subsidy systems in Thailand. Thus, the Transportation Service with EV bus seems unfeasible.
- At this moment, there is no rules and regulations for driving EV bus. Thus, EV bus cannot be used in Thailand.

(2) Human Resource Development (Employee, Manager)

It was found that demand and requirement for the Human Resource Development is constant. Such demand and requirement were to improve quality of worker and to alleviate job-hopping. However, challenges were also found as shown in below:

- Major companies has their own training system.
- If training contents provided as Japanese private business, volume of demand may be not sufficient.

(3) Environmental Monitoring (air and factory drainage)

Major challenges to implement the Environmental Monitoring Service are currently identified as follows:

- Environmental rules and regulations for private industrial estate to obligate compliance with implementation of environmental measuring and emission is immature. Thus, there is no incentive program for operator of the industrial estates.
- Cooperative target, private industrial estate, has not yet decided.
- DIW's authorization is essential to start the Environmental Monitoring Service in Thailand.

For the latter case, it was found as of October, 2016 that some existing private industrial estate have their voluntary Environmental Monitoring Service for all located factories. On the other hand, it seems that industrial estates are reluctant to install additional Environmental Monitoring Service which is planned in the project.

(4) Local Contributions

- To implement the CSR Advisory Service, increase in number of companies which conduct CSR activities. For increase of number of companies doing CSR activities, system establishment to develop environment for SME's to start CSR activities easily. To develop such environment, public administrations (DIW, IEAT and other related bodies) need to establish and improve subsidy system for CSR activities.
- To improve demand for the CSR Advisory Service, subsidy system for such service is effective as well as DIW's outsourced training for private factories.

12.2 Further Plan

Study on the Smart Service was finalized before submitting ITR. Thus, further survey will be not conducted for the Smart Service. Items in this chapter will be studied further, however, not as a part of this survey.

12.2.1 Smart Services

(1) Transportation Service

Further plan toward installation of the Transportation Service with EV Bus is as follows:

- With the installation of EV Bus for compliance with environmental policy; trend toward demand should be developed.
- Installation of EV Bus not only with seeking for profitability but also with utilizing domestic and international subsidy system for compliance with the environmental policy.
- Develop a roadmap to generalize EV Bus.
- Support to develop rules for EV Bus operation.
- Study on cost reduction for EV Bus installation.

(2) Human Resource Development (Employee, Manager)

Further plan toward installation of the Human Resource Development Service is as follows:

- Seek for collaboration with public administrations which have much experience of government-government based Human Resource Development in past. Study on training contents which are attractive for major companies.
- Further study on training contents of private service to evaluate actual demand in Thailand.

SMEs have difficulties to conduct training by themselves, and have not large budget for HRD. Thus, study on actual needs of SMEs and preferable service price for SMEs should be studied.

(3) Environmental Monitoring (air and factory drainage)

Based on the challenges described in (2) of 12.1.1, research on local private industrial estate which has demand for the Environmental Monitoring Service is required. Target will be developing industrial estate or planned to be developed. Feasibility for business establishment will be studied based on negotiation with operator of the industrial estate which have high environmental concern.

Interview survey with representative of DIW will be conducted to identify process, requirement and

system of authorization which is required to start the service in Thailand.

(4) Local Contributions

Possibility of subsidy and incentives in current CSR promotion program will be studied to challenge issues. Such study will be conducted tough negotiation with DIW and IEAT. Furthermore, possibility of establishment of subsidy system and expansion of such system will be studied.

Appendix (1): Transportation Service (EV Bus)

1 Schematic Design and Cost Estimation

1.1 Schematic Design

This section describe an implementing structure of stakeholders assuming future commercialization. However, as mentioned in previous sections, profit cannot be anticipated.

To supplement the financial demerit, EV busses will be introduced to target industrial estates with assistance from the Japanese and Thai Government against the backdrop of environmental measures, energy-saving measures, and new technology development etc. Under such circumstances, Japanese stakeholders will introduce system under the cooperation of the EV bus manufacturer and station developer.

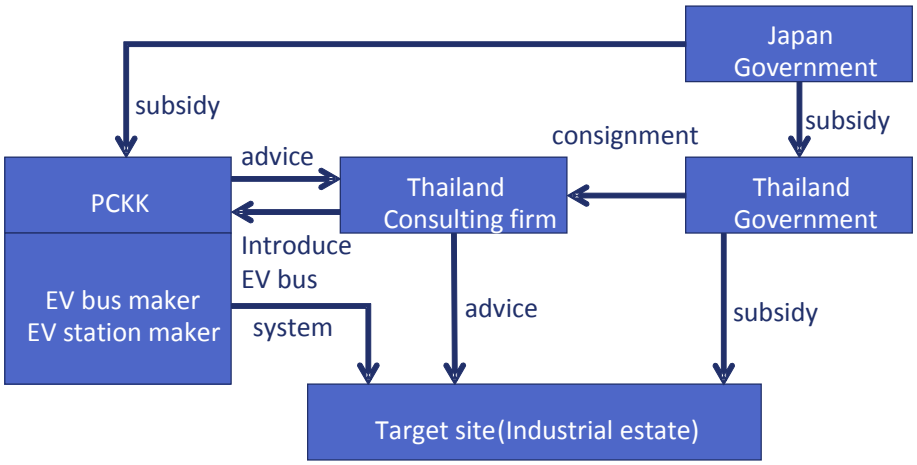


Figure 1-1 Proposed Business Scheme

As assuming the implementing structure above, we proposed a project shown in the next page to IEAT, a Thai stakeholder.

Preliminary Vision of the introduction of EV system in Industrial Estate in Thailand

Concept Paper

December, 2015

Pacific Consultants Co., Ltd.

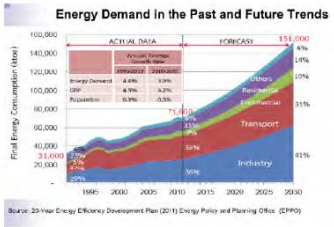
1. Back Ground and GOALS

- Back Ground
  - ✓ Project of Eco-center
  - ✓ Vision of green logistics also emphasis on the importance of environment
  - ✓ Plan to introducing EV bus project for showing The model of Eco-city
  - ✓ Necessity to achieve COP21 target goal with transportation department
    - 35% of emission from transportation in Thailand 2013
    - Thailand intends to reduce its greenhouse gas emissions by 20 percent from the projected business-as-usual(BAU) level by 2030.

Introduce of EV bus system encourage the vision of eco-industrial estate and it also contributes the reduction of CO2 in transportation department, which is demanded by COP21

- Goals
  - ✓ Contribution of reduction of CO2 by introducing EV bus system
  - ✓ Creation of role model for EV bus system in industrial estate

Thailand intends to reduce its greenhouse gas emissions by 20 percent from the projected business-as-usual(BAU) level by 2030.
The level of contribution could increase up to 25 percent, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support through balanced and ambitious global agreement under the United Nations Framework Convention on Climate Change (UNFCCC).



2. Road map of EV bus

1. Introduction of EV bus in Eco-center in Map ta phut I.E. (Pilot Project)
   - ✓ Create an actual result of EV bus for industrial estate (for tour bus)
   - ✓ Promote eco friendly industrial estate concept

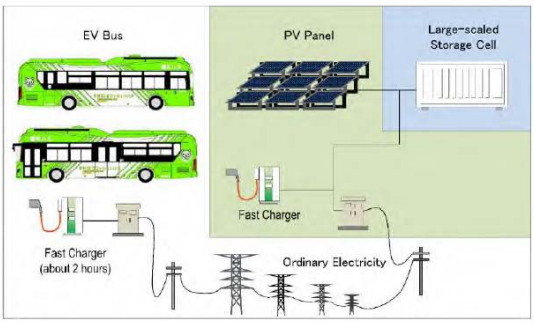
2. Expansion to commuter bus in Map ta phut Industrial Complex (in corroboration with private companies)
   - ✓ More EV bus systems introduced in Map ta phut area (for commuter)
   - ✓ To cultivate the mind for environment
   - ✓ To reduce traffic jam with coordination of transportation project

3. Expansion to other industrial estates in Thailand
   - ✓ To expand the "Map ta phut model" to other industrial estates in whole Thailand
   - ✓ To reduce CO2 emission in transportation domain

3

3. Pilot Project for of the introduction of EV system in I.E.
~Introduction of EV bus system in Eco-center in Map ta phut~

- As the very first step, IEAT is to introduce the EV bus system in Eco-center in Map Ta Phut.
  - ✓ Main station ; Eco-center in Map Ta Phut I.E.
  - ✓ Purpose ; Visitor Tour Bus
  - ✓ Owner and operator ; IEAT (Map Ta Phut office)
  - ✓ Number of EV buses ; Several buses (to be determined)
  - ✓ Number of EV stations ; at Eco-center and some (to be determined)
  - ✓ System Image;



Source; Kitakyushu city

4

Outline of Eco-Center

- The Eco-Center is the first implementation of the concept of sustainable industrial development based on the Eco principle applications in Thailand.

Expected Number of visitors to Eco-center

- Actual result of visit industrial tour in Map ta phut
  - ✓ Without Eco-center, there is certain level of visit industrial tour in Map ta phut, the Eco-center will bring more number of visitors and learners to Map ta phut area.

No.	Month	Number of company	Number of people
1	October 2013	3	115
2	November 2013	9	661
3	December 2013	4	214
4	January 2014	6	265
5	February 2014	12	1,201
6	March 2014	12	935
7	April 2014	2	270
8	May 2014	8	778
9	June 2014	9	503
10	July 2014	5	659
11	August 2014	7	368
12	September 2014	4	276
Total		81	6,245

Note – Only weekday, except for special cases.

Source IEAT

6

Tentative route for EV bus visitor tour in MTP

- Eco Center → Hemaraj Eastern I.E. → Asia I.E. → (AQMS) → Padaeng I.E. → Map Ta Phut Port → Map Ta Phut I.E. → (AQMS) → R.I.L. I.E. → Water Reservoir → Eco Center
  (around 50 km, 3 hours tour)

7

Significance of the introduction of EV bus in Eco-center

- In addition to the creation of the Eco-center, the introduction of EV Bus could be a driving force of eco-industrial town in Map ta phut, where environmental issue occurred in the past.
- The increase of the number of users is expected by the achievement of the Tour Bus and the idea of Eco-center.
- Map ta phut will be a model-case of eco-industrial town in which EV bus is spread in Map ta phut Industrial Complex as a commuter bus.

8

Significance of the introduction of EV bus in Eco-center
~Effect of CO2 emission by EV bus~

- Case if there are 3 EV buses and 3 tours per day, we can reduce 20.2 ton of CO2 emission per year.

				EV bus	Diesel bus
a)	distance	km		50	50
b)	fuel efficiency	l/km		-	3
c)	CO2 emission	g/km		79.2	264
d)	No.of Vehicle	vehicles		3	3
e)	frequency	per day		3	3
f)	CO2 emission	g/day	a)*b)*d)*e)	35,640	118,800
g)	Weekday	day		243	243
h)	CO2 emission	kg/year	f)*g)/1000	8,661	28,868
i)	CO2 Reduction	t/year	h)diesel-h)EV		20.2

9

1.2 Cost Estimation

When EV buses are introduced, the following initial costs are occurred.

- approximately 25 million THB per EV bus
- approximately 0.3 ~ 3.5 million THB per EV station

Although additionally transportation cost for EV buses and other costs will be needed as initial costs, these costs are not specified in this part because they depend on the condition of the buses: the price, the scale, the transportation route, etc.

Regarding running costs (e.g. employment cost of drivers and managers, maintenance cost of bus bodies and EV stations), these costs are not specified in this part because they will be fluctuated with business scheme and implementing structure.

Table 1-1 Evaluation of EV Bus

		EV bus	Diesel bus
Travelling performance	Range	30km～80km	about 300km
	Recharge time	3minutes～	–
	Fuel efficiency	daytime 26yen/km、night17yen/km	20yen/km ※diesel oil: 120yen/L、Fuel efficiency: 6km/L
Cost	Initial cost (vehicle)	80million yen	about 25million yen
	Initial cost (infrastructure)	1～10million yen	100million yen
Environmental performance	CO2 emission (while running)	40% reduction of diesel	132g/km
	Exhaust gas	zero-emission	NOx0.9g/kWh OM0.013g/kWh (in case of heavy vehicles)
	Quietness	quiet than diesel	–
	performance in case of natural disaster	possible of electronic power supply	–
Sales performance in Japan		yes	yes
Total evalutation	Merit	・good environmental performance ・cheap running cost	
	Demerit	・short range ・expensive initial cost	

Appendix (2) Result of the Cash Flow Analysis

Income Statement	2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年
Power Sales	-	-	-	-	-	-	154	312	475	623	776	756	747	738	752	779	807	821	851	882	897	738	575	389	197	-
Steam Sales	-	-	-	-	-	-	184	373	567	745	928	903	893	882	898	930	964	981	1,017	1,053	1,072	882	687	464	236	-
Cogeneration Total Income	0	0	0	0	0	0	337	685	1,042	1,368	1,704	1,659	1,640	1,621	1,650	1,709	1,771	1,802	1,868	1,935	1,970	1,621	1,261	853	433	-
Leasing Fee	0	0	0	0	0	0	-25	-50	-77	-104	-132	-132	-132	-132	-132	-132	-132	-132	-132	-132	-132	-107	-81	-55	-28	-
O&M (Fixed)	0	0	0	0	0	0	-12	-24	-37	-51	-65	-67	-69	-71	-74	-76	-78	-80	-83	-85	-88	-72	-56	-38	-20	-
O&M (Variable)	0	0	0	0	0	0	-4	-7	-11	-16	-20	-21	-22	-22	-23	-24	-24	-25	-26	-27	-27	-23	-17	-12	-6	-
Fuel	0	0	0	0	0	0	-94	-190	-290	-401	-515	-524	-543	-563	-573	-594	-615	-626	-649	-672	-684	-563	-438	-296	-150	-
Total Costs	-	-	-	-	-	-	-134	-272	-415	-571	-733	-744	-766	-788	-801	-825	-849	-863	-889	-916	-931	-765	-593	-402	-204	-
Cogeneration Gross Margin	-	-	-	-	-	-	203	413	627	797	972	915	874	832	848	884	922	939	979	1,019	1,039	856	668	451	229	-
Leasing Charge	-	-	10	10	22	20	32	31	43	42	55	54	54	52	52	52	52	43	43	33	33	23	23	12	12	-
O&M Charge	0	0	6	6	13	13	21	21	29	30	39	40	41	42	44	45	46	38	39	30	31	21	22	11	12	-
Gas Engine Total Income	0	0	17	17	35	34	53	52	73	72	94	94	95	95	96	97	99	81	83	64	65	44	45	23	24	-
Leasing Fee	0	0	-8	-8	-16	-16	-24	-24	-34	-34	-43	-43	-43	-43	-43	-43	-43	-36	-36	-27	-27	-19	-19	-10	-10	-
O&M Fee	-	-	-6	-6	-12	-12	-19	-19	-27	-27	-35	-36	-37	-39	-40	-41	-42	-35	-36	-28	-28	-20	-20	-10	-11	-
Total Costs	-	-	-13	-13	-28	-28	-43	-44	-60	-61	-79	-80	-81	-82	-83	-84	-85	-70	-71	-55	-56	-38	-39	-20	-20	-
Gas Engine Gross Margin	-	-	3	3	7	6	10	8	13	11	16	14	14	13	13	13	13	11	11	9	9	6	6	3	3	-
Capacity Charge	-	2	2	4	4	6	6	8	8	10	11	11	11	12	12	12	10	11	8	8	6	6	3	3	-	-
O&M Charge	0	1	1	2	2	3	3	4	4	6	6	6	6	6	7	7	6	6	5	5	3	3	2	2	-	-
Electricity Charge	0	2	2	5	5	8	8	11	12	15	15	16	16	17	17	18	15	15	12	12	8	8	4	4	-	-
Total Income	0	5	5	10	11	17	17	24	24	31	32	33	34	35	36	37	31	31	24	25	17	18	9	9	-	-
Leasing Fee	0	-1	-1	-3	-3	-5	-5	-7	-7	-8	-8	-8	-8	-8	-8	-8	-7	-7	-5	-5	-4	-4	-2	-2	-	-
O&M (Fixed)	0	-1	-1	-1	-2	-2	-2	-3	-3	-4	-5	-5	-5	-5	-5	-5	-4	-4	-3	-4	-2	-3	-1	-1	-	-
O&M (Variable)	-	-0	-0	-0	-0	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-2	-1	-1	-1	-1	-1	-1	-0	-0	-	-
Electricity	-	-2	-2	-5	-5	-8	-8	-11	-12	-15	-15	-16	-16	-17	-17	-18	-15	-15	-12	-12	-8	-8	-4	-4	-	-
Total Costs	-	-5	-5	-10	-10	-16	-16	-22	-23	-29	-30	-30	-31	-32	-32	-33	-27	-28	-21	-22	-15	-15	-8	-8	-	-
Type 1 Gross Margin	-	0	0	0	1	1	1	1	2	2	2	3	3	3	4	4	3	4	3	3	2	2	1	1	-	-
Capacity Charge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M Charge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricity Charge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leasing Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M (Fixed)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M (Variable)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Type 2 Gross Margin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chill Water	-	0	0	0	1	1	1	1	2	2	2	3	3	3	4	4	3	4	3	3	2	2	1	1	-	-
Leasing Charge	0	2	6	9	13	19	25	32	39	47	54	54	53	52	52	52	50	47	44	40	35	29	22	15	8	-
O&M Charge	0	1	3	6	8	12	16	21	26	32	38	39	40	41	43	44	43	41	39	36	33	28	21	15	8	-
Total Income	-	3	9	15	22	30	41	53	66	79	92	93	93	93	94	96	93	88	83	76	67	56	43	29	15	-
Leasing Fee	-	-2	-4	-7	-10	-14	-19	-25	-30	-36	-43	-43	-43	-43	-43	-43	-41	-38	-36	-33	-29	-24	-18	-12	-6	-
O&M Fee	-	-1	-3	-5	-8	-11	-15	-19	-24	-29	-34	-35	-37	-38	-39	-40	-39	-37	-36	-33	-30	-25	-19	-13	-7	-
Total Costs	-	-3	-7	-12	-18	-25	-33	-44	-54	-65	-77	-78	-79	-80	-81	-83	-80	-76	-72	-66	-58	-49	-37	-26	-13	-
Type 1 Gross Margin	0	1	2	3	4	6	7	9	11	13	15	14	14	13	13	13	13	12	11	10	9	8	6	4	2	-
Leasing Charge	0	4	10	15	22	31	41	53	66	78	91	89	88	86	86	86	83	78	73	66	58	48	37	25	13	-
O&M Charge	0	2	6	9	14	20	27	35	44	53	63	65	67	69	71	73	72	69	66	61	54	46	35	24	13	-
Total Income	-	6	15	25	36	50	68	88	110	131	154	154	155	155	157	159	154	146	138	127	112	94	72	49	25	-
Leasing Fee	-	-3	-7	-11	-17	-23	-31	-41	-51	-61	-71	-71	-71	-71	-71	-71	-68	-64	-60	-54	-48	-40	-30	-20	-10	-
O&M Fee	-	-2	-5	-8	-13	-18	-24	-32	-40	-48	-57	-59	-61	-63	-65	-67	-65	-62	-60	-55	-49	-42	-32	-22	-11	-
Total Costs	-	-5	-12	-20	-29	-41	-56	-73	-91	-109	-128	-130	-132	-134	-136	-138	-133	-127	-119	-110	-97	-81	-62	-43	-22	-
Type 2 Gross Margin	0	1	3	5	7	9	12	16	19	22	25	24	23	21	22	22	21	20	19	17	15	13	10	7	3	-
Leasing Charge	0	6	14	23	34	46	62	80	98	117	136	134	132	129	129	129	124	116	109	99	87	72	55	37	19	-
O&M Charge	0	4	9	14	21	29	40	53	66	80	95	98	100	103	107	110	107	103	98	91	81	69	53	36	19	-
Total Income	-	10	23	37	54	76	102	133	164	197	231	232	232	233	236	239	231	220	207	190	168	141	108	74	38	-
Leasing Fee	-	-4	-11	-17	-25	-35	-47	-61	-76	-91	-107	-107	-107	-107	-107	-107	-102	-96	-90	-82	-72	-59	-45	-31	-16	-
O&M Fee	-	-3	-8	-13	-19	-27	-36	-48	-60	-73	-86	-89	-91	-94	-97	-100	-98	-94	-89	-83	-74	-63	-48	-33	-17	-
Total Costs	-	-8	-18	-30	-44	-62	-84	-109	-136	-164	-193	-195	-198	-201	-204	-206	-200	-190	-179	-164	-146	-122	-94	-64	-33	-
Type 3 Gross Margin	0	2	5	7	10	14	18	23	28	33	38	36	34	32	32	33	32	30	28	26	23	19	14	10	5	-
Leasing Charge	0	12	29	46	67	93	124	160	197	234	272	268	263	259	259	259	248	233	218	198	174	144	110	74	38	-
O&M Charge	0	7	17	28	42	59	80	105	132	160	189	195	201	207	213	220	215	206	197	182	163	138	106	73	38	-
Total Income	-	19	46	74	109	151	204	265	329	394	462	463	464	466	472	478	463	439	414	380	336	282	216	147	75	-
Leasing Fee	-	-9	-21	-34	-50	-70	-94	-123	-152	-182	-213	-213	-213	-213	-213	-213	-204	-192	-179	-163	-143	-119	-91	-61	-31	-
O&M Fee	-	-6	-16	-25	-38	-54	-73	-96	-120	-145	-172	-177	-183	-188	-194	-200	-195	-187	-179	-166	-148	-125	-97	-66	-34	-
Total Costs	0	-15	-37	-59	-88	-124	-167	-218	-272	-327	-385	-391	-396	-401	-407	-413	-400	-380	-358	-329	-291	-244	-187	-128	-65	-
Type 4 Gross Margin	-	4	9	15	21	28	37	47	57	67	76	72	68	64	65	65	63	60	56	51	45	38	29	20	10	-
Energy Conservation Business	0	8	19	30	42	56	74	95	115	135	155	147	139	130	132	133	128	121	114	104	92	77	59	40	20	-
Total Revenue	-	44	115	178	266	358	821	1,299	1,807	2,273	2,770	2,727	2,713	2,697	2,741	2,816	2,841	2,808	2,817	2,797	2,735	2,256	1,755	1,185	609	-
Total Cost	-	-36	-93	-143	-217	-295	-533	-782	-1,050	-1,327	-1,625	-1,649	-1,683	-1,718	-1,744	-1,782	-1,775	-1,733	-1,710	-1,662	-1,594	-1,315	-1,020	-689	-357	-
Total Gross Margin	-	8	22	34	50	63	288	517	757	946	1,145	1,079	1,031	979	997	1,035	1,067	1,075	1,107	1,135	1,141	941	734	496	252	-
Payroll	0	-12	-12	-12	-13	-13	-14	-14	-14	-15	-15	-16	-16	-17	-17	-18	-18	-19	-19	-20	-21	-21	-22	-22	-23	-
SPC Running Cost	-	-5	-5	-5	-6	-6	-6	-6	-6	-7	-7	-7	-7	-7	-8	-8	-8	-8	-9	-9	-9	-9	-10	-10	-10	-
Depreciation	-	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
EBIT	-	-9	4	15	31	43	268	497	736	924	1,122	1,056	1,007	955	971	1,008	1,040	1,047	1,078	1,106	1,111	910	702	463	218	-1
Interest Expense	-	-1	-1	-1	-1	-1	-1	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
Initial Cost	-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income from Selling Assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EBT	-10	-10	4	15	30	43	268	496	735	924	1,122	1,055	1,006	954	971	1,008	1,039	1,047	1,078	1,106	1,111	910	702	463	218	-1
Tax	-	-	-	-	-6	-9	-54	-99	-147	-185	-224	-211	-201	-191	-194	-202	-208	-209	-216	-221	-222	-182	-140	-93	-44	-
Net Earning	-10	-10	4	15	24	34	214	397	588	739	897	844	805	763	777	807	831	838	862	885	889	728	562	370	175	-1

Balance Sheet		2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年	平均
Cash	*M THB*	-	-	-	9	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Account Receivable	*M THB*	-	7	19	30	44	60	137	217	301	379	462	455	452	450	457	469	474	468	470	466	456	376	292	197	102	-	-
Inventory	*M THB*	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	-	-
Warehouse	*M THB*	6	6	6	5	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	1	1	1	1	0	0	-	-
Machine	*M THB*	9	9	8	8	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	2	2	1	1	1	0	-	-
Total Assets	*M THB*	30	37	48	66	72	87	163	242	326	403	486	478	475	472	478	490	494	488	489	485	474	393	309	214	117	-	-
Account Payable	*M THB*	-	6	10	14	19	25	51	79	107	139	172	176	181	187	192	198	201	199	200	199	195	162	128	88	48	-	-
Loan	*M THB*	20	19	19	18	18	17	16	16	15	14	14	13	12	11	11	10	9	8	7	6	5	4	3	2	1	-	-
Paid in Capital	*M THB*	20	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	-	-
Retained Earning	*M THB*	-10	-20	-16	-1	-	9	60	113	168	215	265	254	246	237	240	247	249	245	246	244	238	191	143	88	32	-	-
Net Asset & Liabilities	*M THB*	30	37	48	66	72	87	163	242	326	403	486	478	475	472	478	490	494	488	489	485	474	393	309	214	117	-	-

Cash Flow Statement		2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年	平均
Cash Beginning Balance	*M THB*	-	-	-	-	-	9	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cogeneration	*M THB*	-	-	-	-	-	-	337	685	1,042	1,368	1,704	1,659	1,640	1,621	1,650	1,709	1,771	1,802	1,868	1,935	1,970	1,621	1,261	853	433	-	26,928
Gas Engine	*M THB*	-	-	17	17	35	34	53	52	73	72	94	94	95	95	96	97	99	81	83	64	65	44	45	23	24	-	1,451
Chill Water	*M THB*	-	5	5	10	11	17	17	24	24	31	32	33	34	35	36	37	31	31	24	25	17	18	9	9	-	-	515
Energy Conservation	*M THB*	-	39	94	150	221	308	414	539	668	801	939	942	944	947	959	972	941	893	842	773	684	573	439	299	153	-	14,536
Total Income	*M THB*	-	44	115	178	275	359	821	1,299	1,807	2,273	2,770	2,727	2,713	2,697	2,741	2,816	2,841	2,808	2,817	2,797	2,735	2,256	1,755	1,185	609	-	43,439
Tax	*M THB*	-	-	-	-	-6	-9	-54	-99	-147	-185	-224	-211	-201	-191	-194	-202	-208	-209	-216	-221	-222	-182	-140	-93	-44	-	-3,257
Total Income After Tax	*M THB*	-	44	115	178	269	350	768	1,200	1,660	2,088	2,545	2,516	2,512	2,507	2,547	2,615	2,633	2,599	2,601	2,576	2,513	2,074	1,614	1,092	566	-	40,182
Leasing Fee	*M THB*	-	-20	-52	-80	-121	-163	-246	-331	-426	-517	-617	-617	-617	-617	-617	-617	-598	-565	-538	-497	-454	-372	-286	-191	-101	-	-9,261
O&M Fee	*M THB*	-	-14	-38	-59	-91	-124	-185	-249	-323	-395	-477	-491	-506	-521	-537	-553	-547	-527	-512	-481	-448	-372	-291	-197	-106	-	-8,045
Fuel Cost	*M THB*	-	-	-	-	-	-	-94	-190	-290	-401	-515	-524	-543	-563	-573	-594	-615	-626	-649	-672	-684	-563	-438	-296	-150	-	-8,979
Electricity Cost	*M THB*	-	-2	-2	-5	-5	-8	-8	-11	-12	-15	-15	-16	-16	-17	-17	-18	-15	-15	-12	-12	-8	-8	-4	-4	-	-	-246
Payroll	*M THB*	-	-12	-12	-12	-13	-13	-14	-14	-14	-15	-15	-16	-16	-17	-17	-18	-18	-19	-19	-20	-21	-21	-22	-22	-23	-	-404
SPC Running Cost	*M THB*	-	-5	-5	-5	-6	-6	-6	-6	-6	-7	-7	-7	-7	-7	-8	-8	-8	-8	-9	-9	-9	-9	-10	-10	-10	-	-177
Total Opex	*M THB*	-	-53	-110	-161	-235	-314	-552	-802	-1,071	-1,348	-1,647	-1,671	-1,706	-1,742	-1,769	-1,807	-1,801	-1,760	-1,738	-1,690	-1,623	-1,345	-1,052	-722	-391	-	-27,113
Working Capital	*M THB*	-15	-2	-8	-6	-9	-9	-51	-52	-56	-46	-50	11	8	9	-3	-6	-2	4	-1	2	6	47	49	56	56	68	-
Cash from Selling Expired Assets	*M THB*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Cash Flow	*M THB*	-15	-11	-3	10	25	27	164	346	534	693	849	856	814	773	775	801	830	843	863	888	896	776	611	427	231	68	13,070
CAPEX	*M THB*	-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-15
Initial Cost	*M THB*	-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-10
Loan	*M THB*	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Equity	*M THB*	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Cash After CAPEX & Funding	*M THB*	-	-11	-3	10	25	27	164	346	534	693	849	856	814	773	775	801	830	843	863	888	896	776	611	427	231	68	13,085
Interest Expense	*M THB*	-	-1	-1	-1	-1	-1	-1	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-9
Loan Repayment	*M THB*	-	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-20
Cash After Debt Service	*M THB*	-	-12	-4	9	23	25	163	345	532	692	847	855	813	772	774	800	829	842	861	886	895	775	610	425	230	67	13,056
Dividend	*M THB*	-	-	-	-	-23	-25	-163	-345	-532	-692	-847	-855	-813	-772	-774	-800	-829	-842	-861	-886	-895	-775	-610	-425	-230	-32	-13,027
Reduction / Additional Injection	*M THB*	-	12	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-36	-20
Cash Remained in Account	*M THB*	-	-	-	9	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Index		2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年	平均
EIRR	%		-20	-12	-4	-	23	25	163	345	532	692	847	855	813	772	774	800	829	842	861	886	895	775	610	425	230	67	79.9
PIRR	%		-40	-11	-3	10	16	26	164	346	533	693	849	856	814	773	775	801	830	843	863	888	896	776	611	427	231	68	68.7
Total Project Cash Flow	M THB																											13,034
EIRR 10y	%																											74.2
PIRR 10y	%																											62.2
DSCR	*x*	na		-9	-2	8	21	23	143	301	464	604	739	746	709	673	675	698	723	734	751	773	780	676	532	371	201	59	