



ECONOMY OF TOMORROW



Green Growth and Green Jobs in Thailand: Comparative Analysis, Potentials, Perspectives

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June 2012

- With growing concerns over environmental impacts and environmental standards, or requirements imposed in various key export markets of Thailand, the Thai government has put much effort into promoting the development of clean and green industry without sacrificing economic progress.
- As this development occurs, it is vital to ensure that low-income groups are able to access renewable energy and environmentally friendly products and services. In designing policies to green the economy, the issues of poverty alleviation and reduction of inequality must also be taken into account.
- Given that the green economy agenda has just begun to gain foothold in Thailand, it is difficult to develop coalitions or key alliances to make green issues stand at the center of discourses.
- The growth of green jobs is, meanwhile, not yet rapid and some pressing concerns still need to be addressed.



ACKNOWLEDGEMENT

This research was generously funded by Friedrich Ebert Stiftung (FES). We express our appreciation to the Office of Agricultural Economics, the Department of Alternative Energy Development and Efficiency, the Federation of Thai Industries, and the Siam Cement PLC (SCG). Without their support, it would not have been possible to complete this report. Our gratitude is also extended to all the coordinators for their kind collaboration in providing the data and information for this study. Finally, we would like to thank Ms. Patcharee Vihakarat and Ms. Anchalee Modsiri for their invaluable research support and assistance.



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1. Economic Model and Its Impacts on the Environment

1.1 Sectoral Composition of the Economy and its Evolution

Long before the early 1970s when Thai economy started to experience significant transformation in her economic structure, agriculture was considered the engine of rapid economic growth for Thailand as the sector contributed most to the country's gross domestic products (GDP). Agricultural exports provided substantial foreign exchange earnings. This happened mainly because of the world commodity price boom and the plentiful supply of available land that opened up for agricultural expansion in the past. However, the agricultural sector started to lose its comparative advantage due to the closing land frontier and the decline in world commodity prices. At the same time, the Thai government began to change its focus, moving away from agriculture-led development strategies towards industrial development and modernization of the economy.

This process of structural transformation was likely have to started in the early 1960s when the government formulated the country's first National Economic and Social Development Plan or NESDP (1961-1966). The plan aimed at promoting domestic and foreign investment in import substitution industries, whereby production mainly served domestic markets. In so doing, local manufacturers were granted generous tariff protection, particularly for basic industries like cement and steel, for simple manufactures such as textiles, electrical products and assembling of automobiles, and other consumer goods industries.

The import substitution policy continued to constitute the basic strategy in the second NESDP Plan (1967-1971). The pursuing of this policy worsened trade balance because it induced large amount of imports of intermediate materials and capital goods for domestic production. In order to improve the country's trade deficit, the government made its move towards more export oriented activities. Several measures were undertaken to promote exports, such as the exemptions of import duties on capital goods, intermediate products and raw materials used for export productions, but the priorities were given to high resource utilizing industries such as construction materials, non-ferrous metal production, vegetable oil refining, food canning and so on. Although the government placed much emphasis on export-promotion policy in the third NESDP (1972-1976) and the fourth NESDP (1977-1981), the implementation of the export-promotion policy was not sufficiently effective as the trade deficits remained high.

In subsequent NESDPs, the export promotion remained an important policy implemented by the government; however, there were some different issues focused in each plan. For example, the fifth NESDP (1982-1986) aimed at promoting investment flows to rural areas through the provision of tax incentives and supportive infrastructure, as well as improving the operational efficiency of existing and new industries, which would enhance the country's competitiveness in international markets, whereas the sixth NESDP (1987-1991) continued to focus on the development of industrial competitiveness and exports.

What Thailand had experienced during the past several decades suggested that using industrialization and top-down planning as a major tool and leverage for high economic growth did little to help alleviate poverty conditions of the Thai people. Instead, such strategies led to an increase in inequalities between the rich and the poor in various aspects (Huntaserini and Jitsuchon, 1988; Sussangkarn, 1992; Tinakorn, 1992; Siriprachai, 1997; Poapongsakorn et al., 2011) and created several other problems such as the growing depletion of natural resources, the degradation of the environment, and the like (Khaosa-ard, 1993; Khaosa-ard, 1998). Therefore, from 1992 onwards, particularly during the implementation of the



ninth and tenth NESDPs, the government has put more emphasis on promoting sustained moderate growth and limiting negative environmental spillovers.

Overall, the implementation of the NESDPs so far has driven the adjustment in economic structure and also helped speed up the process of industrialization, causing changes to the sectoral composition of the Thai economy. There are two key observations which can be drawn from Figure 1.

First, the primary sector's share in value-added declined continuously and the structural transformation of the economy towards industrialization became apparent since the early 1970s with the rise of the secondary sector which included manufacturing, electricity and gas, and construction. In other words, it happened for the first time in the economic history of Thailand that the value-added of the secondary sector (mainly manufacturing) began to surpass that of the primary sector (mainly agriculture) and progressively increased over time, while that of the primary sector decreased year after year. This was mainly due to the policies and strategies that the government used to promote export, foreign direct investment, industrialization and modernization of the economy.

Second, although the tertiary sector had dominated the Thai economy with its share in real GDP increasing over time from about 46.4% in 1951 and reaching its peak at 50.9% in 1982; its share on average fell steadily thereafter, and contracted significantly since 1997 to stand at just about 42.9% in 2010. This might be due to the negative impacts of the financial crisis in 1997 that substantially affected the financial and real estate sectors. Also, the high growth of manufacturing and utilities sectors made great contribution to the rising share of value-added in the secondary sector that began to exceed that of the tertiary sector since 2003.

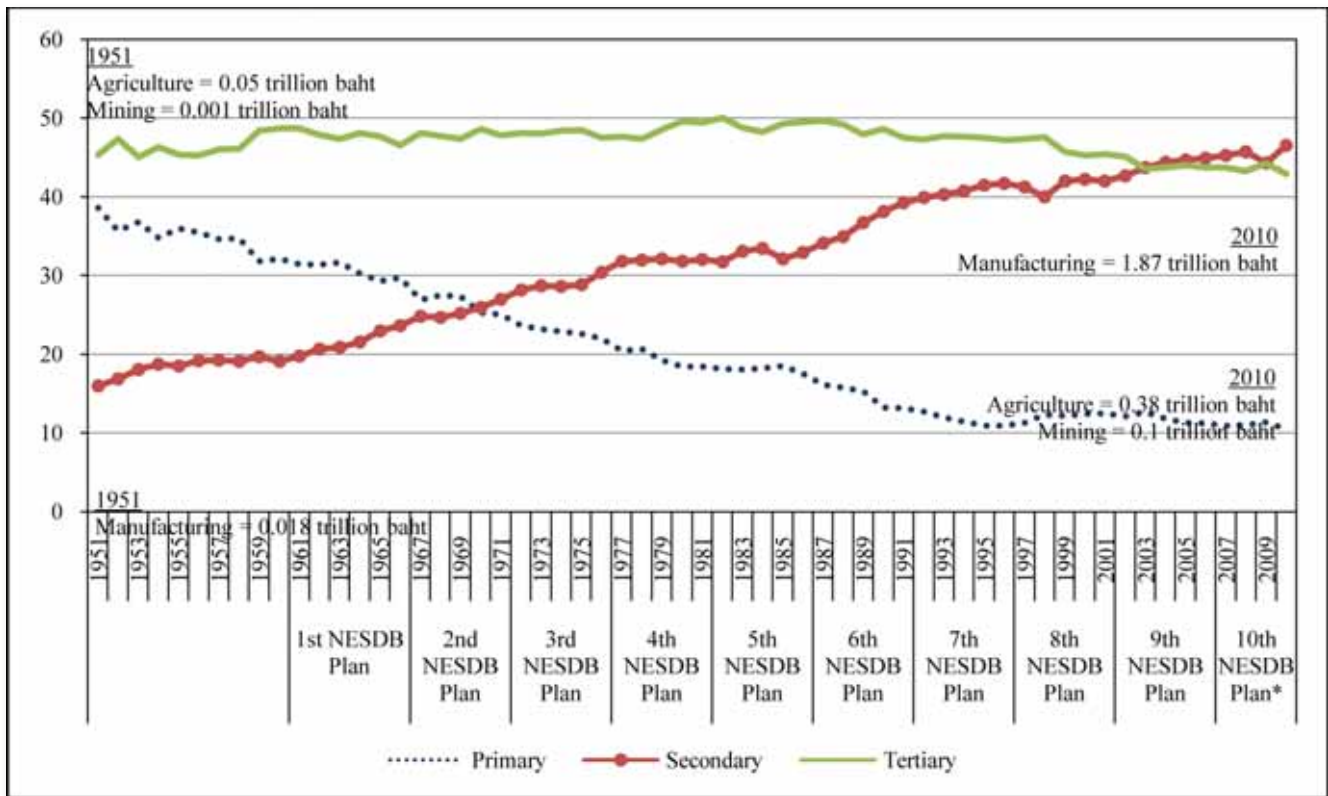


Figure 1: Share of real gross domestic products by major sectors (in percentage)

Note: The primary sector includes agriculture, fishery, mining and quarrying; the secondary sector includes manufacturing, electricity, gas and water supply, and construction; the tertiary sector includes all activities that provide services of all kind such as transportation, financial intermediation, wholesale and retail trade, etc.

Source: Calculated using data from National Economic and Social Development Board (NESDB)

1.2 Resource Intensity

To illustrate challenges for greening the Thai economy, the role of resource-intensive sectors in the economy is initially investigated by comparing with three other industry groups which include labor-intensive industry, scale-intensive industry, science based and specialized supplier products, and then followed by an efficiency analysis of resource use.

Based on the 1985 and 2005 Input-Output Tables, the share of value-added in manufacturing is computed for each of the four industry groups. It is quite clear from Figure 2 that the resource-intensive industries shared largest in total manufacturing value added in the past. However, the role of resource intensive sectors declined substantially as the economy grew to higher development stages. Specifically, the contribution of resource-intensive industries to aggregate manufacturing value-added in 2005 fell sharply from almost 50% in 1985 to about 35% in 2005. This was also experienced similarly by the labor-intensive manufacturing sectors. In contrast, the share of scale-intensive industries, science-based and specialized supplier products in total manufacturing value-added increased apparently. The overall results reflect changes in industrial structure as there was a marked evolution from traditional and less technology-intensive to more technology-intensive industries; that is, from being resource- and labor-intensive to scale-intensive and science-based.

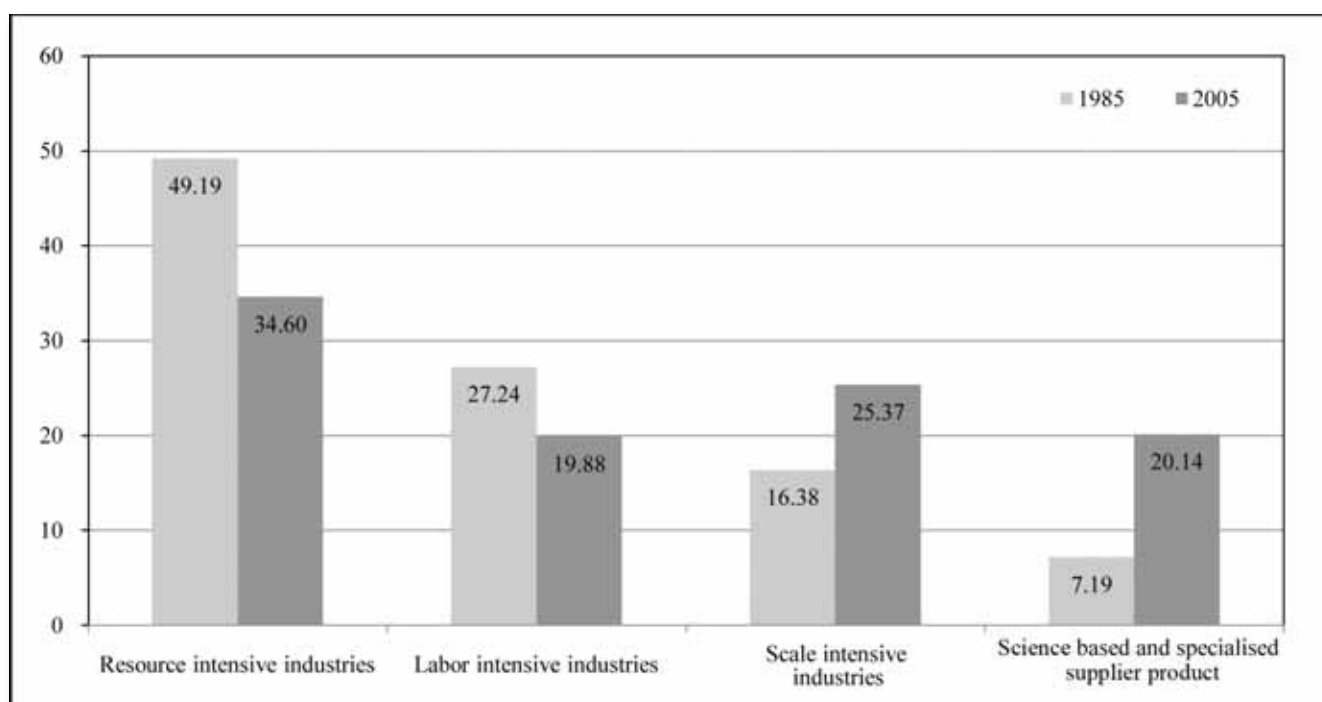


Figure 2: Share of value added in manufacturing sector classified by industry group (in percentage)

Note: The manufacturing industries are classified into resource-intensive, labor-intensive, scale-intensive, specialized supplier and science-based industries according to the orientation based on OECD (1992).

Source: Calculated using data from Input-Output Tables, NESDB

Using the same source of data as described earlier, this section further examines the status of resource efficiency for certain manufacturing sub-sectors which had the largest proportion of total expenses spent on primary inputs for production to total value-added. In other words, this study analyzes the resource intensity of each sector i which is computed by dividing total expenses on primary inputs from agriculture, mining and quarrying of sector i with value added of sector i .^{1,2}

Figure 3 shows the ratio of expenses on material inputs from primary sectors to value-added for top 20 manufacturing sub-sectors that spent substantially on primary inputs from agriculture, mining and quarrying sectors in 2005.³ Note that these sub-sectors altogether spent about 93.9% of total expenses on inputs from primary sectors in 2005, increasing from 91.5% in 1985. Although the structure did not change much when measured with the ratio, the expenses on primary inputs increased substantially, and on average, grew at high rate of 10.81% annually over the 1985-2005 period. Two main observations can be drawn from the figure about resource intensity and resource efficiency.

1 In the Input-Output Table of Thailand that has 180x180 sectors with classification similar to ISIC, agriculture sector includes 29 sub-sectors such as production of main crops (rice, maize sugar cane, etc.), production of ruminant animals (cattle, buffaloes, etc.) and non-ruminant animals (pig, poultry, etc.), production of primary forestry products (logs, charcoal, firewood, etc.), and production of primary fishery products. Mining and quarrying includes crop farming, livestock production, fishery and forestry; mining and quarrying includes 12 sub-sectors such as production of crude oil and coal (coal, lignite, petroleum, etc.), production of metal and non-metal ore.

2 However, the Input-Output table is based on certain critical implicit assumptions that might not valid so in reality. For example, there is only one homogenous commodity output produced in an industry. The producers in an industry use the same proportions of factors of production. In addition, the inter-industry linkages are presented using a transaction table dominated in monetary units. This makes us unable to measure resource intensity which is normally computed using physical units of resources.

3 The sub-sectors can be classified into seven main sectors which include (1) food manufacturing, (2) textile industry, (3) saw mills and wood products, (4) rubber, chemical and petroleum industries, (5) non-metallic products, (6) metal, metal products and machinery, and (7) jewelry and related articles.



For resource intensity, it is found that, in 2005, the petroleum refinery sector was the first in the list of sub-sectors that spent the most on resource inputs (particularly high in using petroleum and natural gas) to produce one unit of value added in the sector, and was followed by the sectors that produced vegetable and animal oils, rice milling activities, produced rubber sheets and block rubber, and produced animal feed respectively.

With regards to resource efficiency, the study compares the level of resource intensity of each sub-sector in 1985 and 2005. If a sector has a lower level of resource intensity in 2005, it means that a smaller amount of primary resources is used to generate the value added of the sector, suggesting that there is an improvement in resource efficiency in the sector. The figure suggests that 13 of the 20 manufacturing sub-sectors were likely to use resources inefficiently, particularly in the four sub-sectors that concentrated on the refinery of petroleum products, the production of vegetable and animal oils, animal feed, paints, varnishes and lacquers, and cement. Among the sub-sectors that showed some improvements in their use of primary resources, the sectors that produced glass and glass products, non-ferrous metal products, rubber sheets and block rubber, and saws mills had a much higher rate of improvements in primary resource intensity. This may be partly due to advancements in science and technology that made the production processes depending less on material inputs.

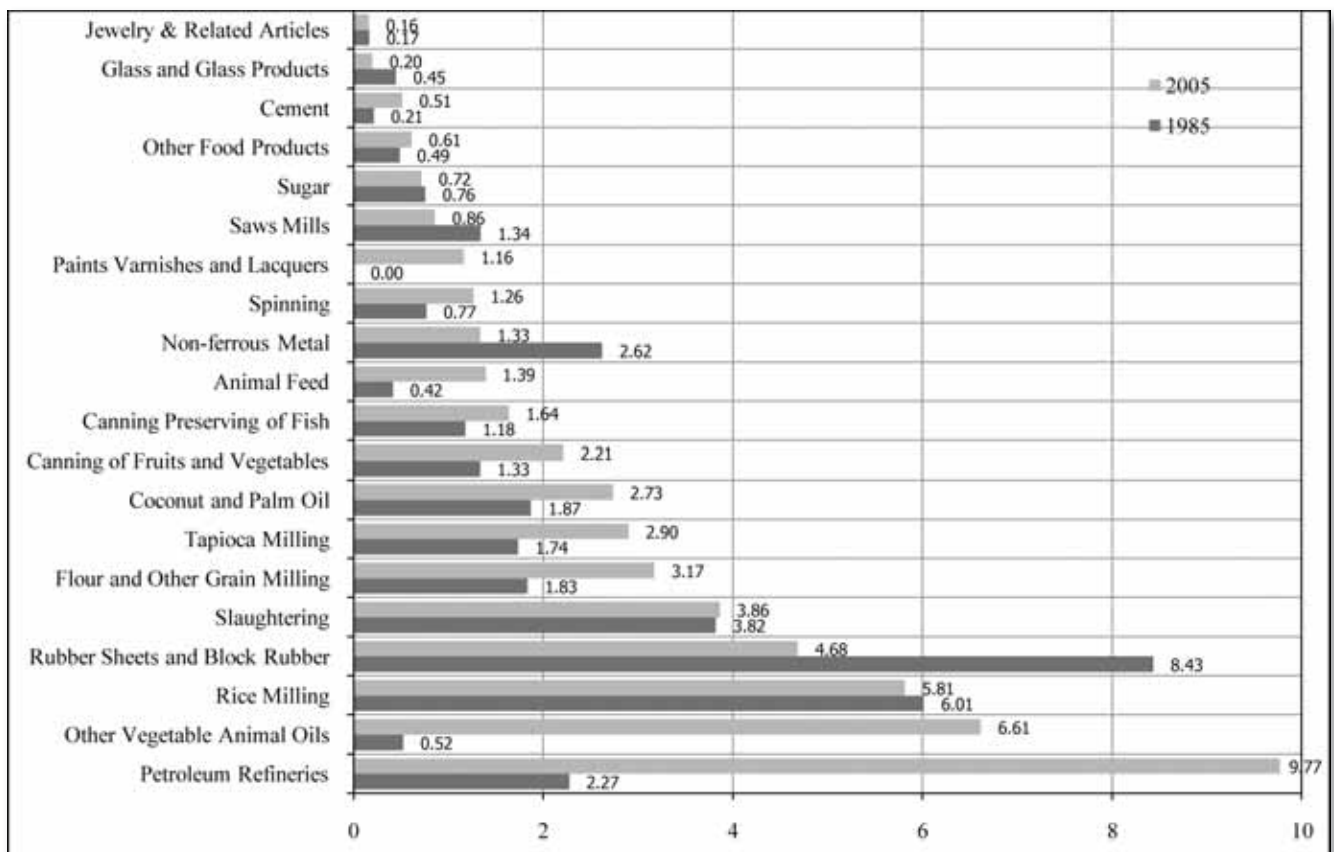


Figure3: The ratio of expenses on primary resources to value added of major manufacturing sectors
 Note: The primary resources refer to material inputs from primary sector which includes agriculture, mining and quarrying sub-sectors.
 Source: Calculated using data from Input-Output Tables, NESDB



1.3 Resource Degradation, Resource Use and Environmental Pollution

For Thailand, existing evidence suggests that there is no sign of decoupling between economic growth and the overall consumption of material resources (Figure 4), meaning that as the economy grows (contracts), there will be an increase (a decrease) in the consumption of materials to support the growth of the economy. This could be clearly observed when the Thai economy was seriously threatened by the financial crisis in 1997, which made the economy to contract by 1.4% and 10.5% in 1997 and 1998 respectively, and caused individuals and businesses to be cautious in making investment and consumption decisions. The amount of domestic material consumption therefore declined, but at a faster rate of 3.5% and 27.9%. However, when the economy recovered from the crisis, the consumption of various material resources started to surge again. To test if there is a linear relationship between these two factors, the correlation coefficient between the growth rate of the economy and of the material consumption is estimated and found to be highly and statistically correlated at 0.875.

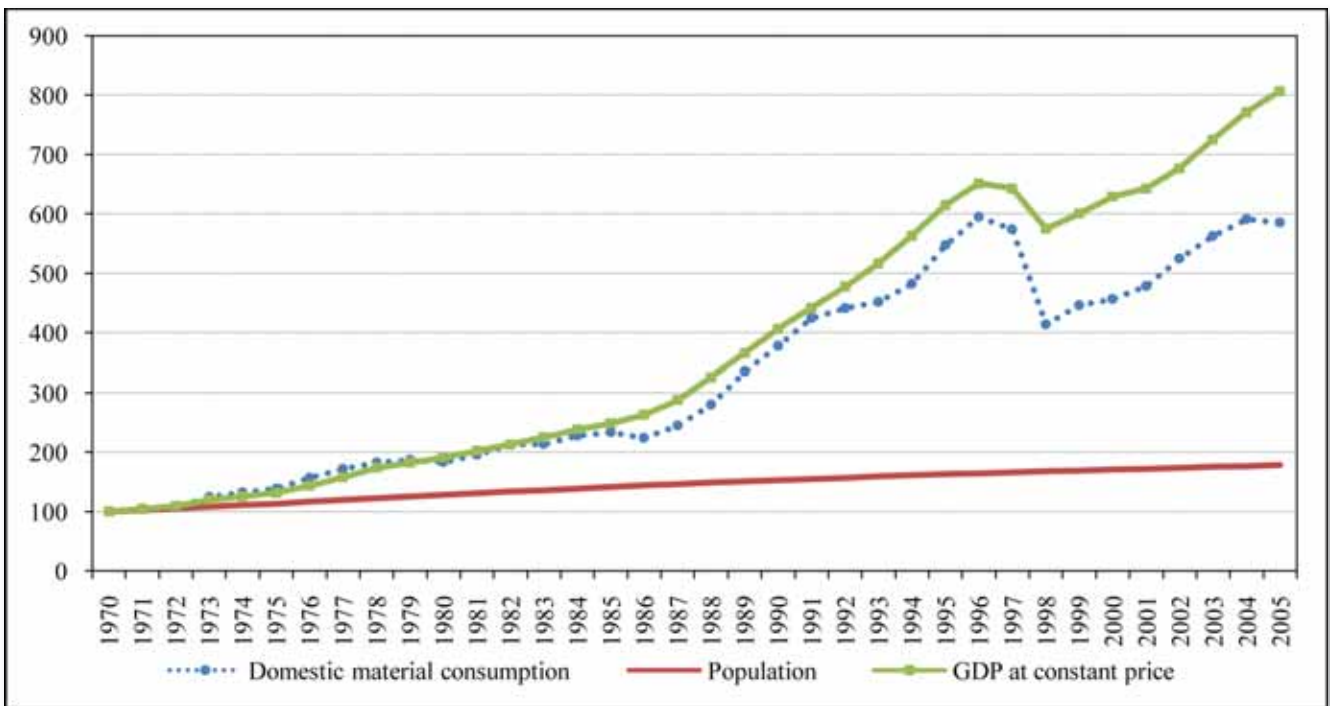


Figure 4: Historical trends in domestic material consumption, population and real GDP
 Note: The value in 1970 is chosen as the base year and set equal to 100.
 Source: Calculated using data from NESDB and CSIRO.

Figures 5 and 6 further show the material intensity and efficiency of various types of materials used in Thailand over different time periods. The time periods are assigned based on the implementation period of the national NESDPs, since these plans were likely to focus on different issues. Overall, the emphasis on the development of physical infrastructure in the first and second NESDBs and the change of industrial policies from import substitution to export promotion during the third, fourth, and fifth NESDPs played an important role in shaping the country's economic structure as it is today. Particularly during the implementation of the sixth NESDP, the industrial policies were quite successful in attracting massive flows of foreign direct investment into the country, and also inducing the relocation of production facilities of firms in textile, automotive and chemical industries from more advanced countries after the post 1985-Plaza Accord. Also, it is apparent that the Thai economy could grow substantially at double-digit rates for



several years during the sixth plan, and continued to expand further during the seventh plan, before getting trapped in the 1997 financial crisis.

As industrialization continued and the economy, on average, grew year after year (except during periods of recession), total domestic material consumption per capita on average grew with the economy. Among the 11 types of materials used for economic activities, construction minerals were the materials mostly used and were likely to vary in line with the economic conditions of the country. For all other materials except grazed biomass and wood, their per capita consumption tended to grow at a slower pace and was not affected by business cycle fluctuations, while that of grazed biomass and wood were getting lower during the past 10 years between 1997 and 2006 (Figure 5).

Although the total material consumption increased over time with GDP, it is quite clear from Figure 6 that the average ratio of material consumption to GDP has become lower in almost all types of materials (except construction minerals, coal, and natural gas) consumed in the country, illustrating that the economy makes greater overall use of resources in generating economic activities than in the past. This may be partly due to some structural adjustments and technological advancements made to improve production processes and also national development to promote sustainable consumption and production patterns.⁴

Although there has been some improvement in overall resource efficiency during the past few decades, it is not sufficient to ensure the reduction in the degradation of natural resources and environment. It is often argued that the continued expansion of consumption and the increasing trend of price of materials and products can severely exert pressure on the environment as they will accelerate the expansion of production in those activities which people may see opportunities to make profits.

Take rubber production as an example: the improvement in the production of rubber sheets and the overall domestic crop consumption per unit of GDP as shown in Figures 3 and 6 respectively. However, this is not sufficient to help ensure environmental sustainability as it becomes clear that there has been on average a continued expansion of land area for planting natural rubber to meet commercial needs (Figure 7). In some cases, this leads to the illegal conversion of forest area to agriculture, which further creates other environmental issues. It is argued that the conversion of forest area into rubber farm area in the southern part of Thailand is one of the important factors that cause flash flood, as well as impacts on the livelihood of the Sakai tribe (Charoenjiratrakul, 2011). Another example: the inappropriate agricultural farming for food supply and food security can cause changes in the quality of fresh water sources and depletion of soil nutrients. The industrial production that lacks proper management of waste and pollution can bring about water pollution and hazardous waste. In what follows, we provide a brief overview of environment conditions of forest area, soil, water and energy resources in Thailand.

4 The emphasis in solving the growing environmental issues was first taken into account in the forth NESDP (1977-1981)

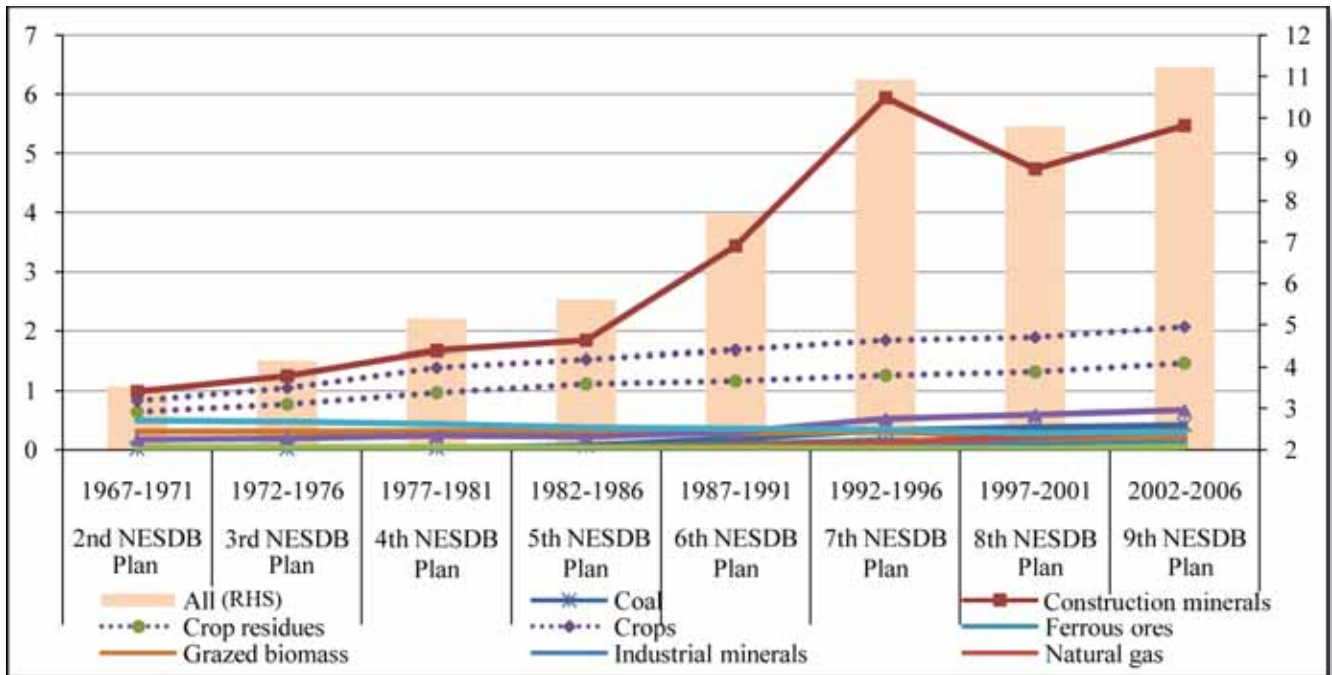


Figure 5: Average domestic material consumption per capita by type of material (Unit: tons per capita)

Source: Calculated using data from CSIRO and National Economic and Social Development Board (NESDB)

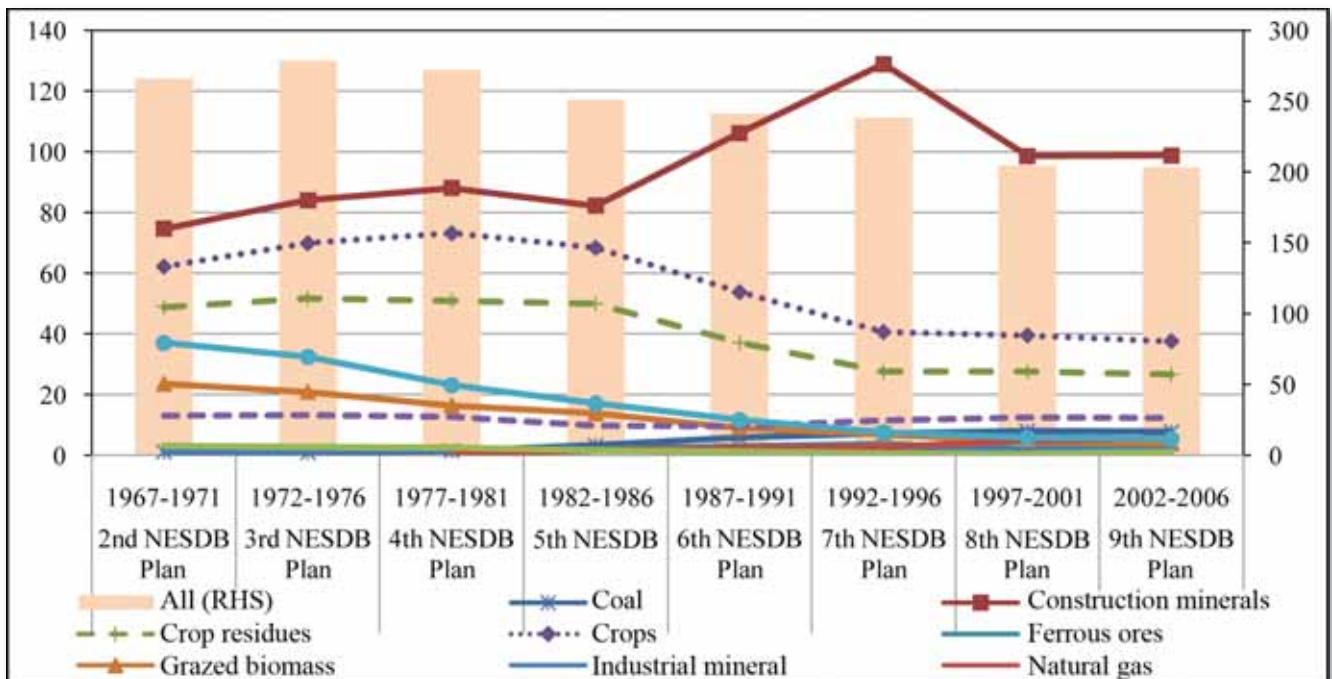


Figure 6: Average ratio of domestic material consumption to GDP by type of material (Unit: tons per million baht of real GDP)

Source: Calculated using data from CSIRO and National Economic and Social Development Board (NESDB)



Figure 7: Planted area and average farm gate price of natural rubber in Thailand
Source: Office of Agricultural Economics

1.3.1 Forest

It is quite striking that the total forest area in Thailand declined substantially during 1960s - 1980s, leaving just about 14.38 million hectares or 28% of total land area in 1988. It continued to decrease further thereafter but showed a sign of improvement with the expansion of forest area by 8.5% in 2008 (Figure 8).⁵ With a growing awareness about the adverse impact of deforestation on the environment, the government formulated the National Forest Policy in 1985 in order to maintain forest cover at least 40% of total land area, and also imposed a nationwide logging ban starting in 1988 in order to protect existing forest reserves from further exploitation. However, because of weak enforceability and monitoring capacity, illegal logging and cutting of trees still persisted while very few arrests were reported by responsible officials. There are several factors that help explain extensive deforestation for agriculture. They include growing population, expansion of agricultural production for domestic consumption and export, and upward trend in prices of agricultural products (Panayotao and Sungswan, 1989; Tonpan et al., 1990; TFSMP, 1993).

⁵ Note that the jump in forest coverage in 2000 should be interpreted with care because there was a change in the estimation technique that might lead to an unusual increase in forest area.

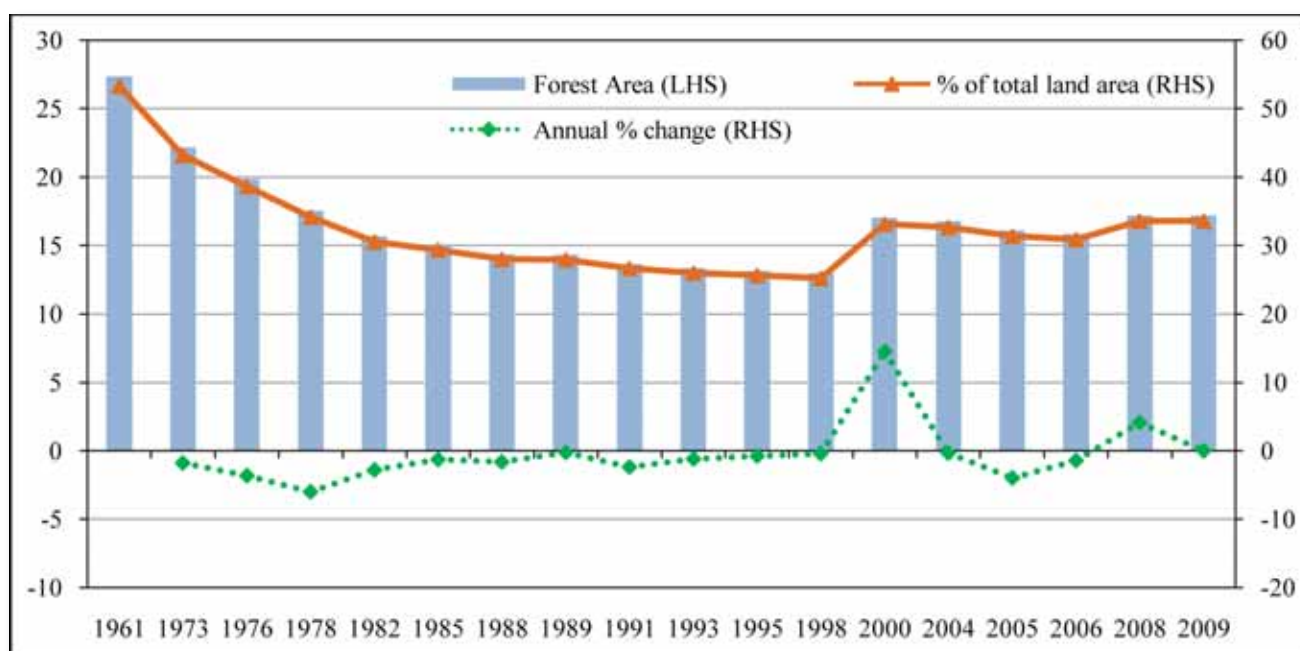


Figure 8: Forest area in Thailand (Unit: million hectares)
 Source: Royal Forest Department (2010), Department of National Parks, Wildlife and Plant Conservation (2009).

Apart from illegal logging, wildfires and threat of human encroachment have been the other two factors that threaten forest protection. Table 1 shows the average number of wildfires that occurred annually in Thailand for the years 1999-2010. During the 9-year period from 1999 to 2010, the average number of fires occurred were 8,564 times and these fires affected average surface area of about 24,026 hectares annually. However, there was a reduction in the average number of fire occurrences and affected land area in 2008 and 2009 compared with those in earlier periods, partly due to of the effectiveness forest management and participation of local communities in forest fire prevention. Concerning the encroachment issue, there has been an increasing trend in the number of forest protected area which has been threatened by illegal encroachment of people, although the amount of forest area that was encroached by human activities declined slightly in 2009, but was still higher than the average for the six-year period (Table 2).

Table 1: Number of wildfires and fire-affected forest area

Protected Area Administration Office (PAAO)	Nine-year period from 1999 to 2008		2009		2010	
	Average number of wildfires	Average area (hectares)	Number of wildfires	Average area (hectares)	Number of wildfires	Average area (hectares)
All Protected Area Administration Offices	8,564	24,026	5,361	9,773	6,784	13,308
% change from the 9-year average number			-37.40	-59.32	-20.78	-44.61

Source: Office of the Forest Protection and Forest Fire Control, Department of National Parks, Wildlife and Plant Conservation.



Table 2: Forest protected area under threat from encroachment

Year	Forest protected area under threat (Hectares)	% Change
2004	2,502.27	
2005	2,997.88	19.81
2006	3,648.28	21.70
2007	3,211.38	-11.98
2008	3,828.48	19.22
2009	3,628.18	-5.23
Average (2004-2009)	3,302.74	7.71

Source: Office of the Forest Protection and Forest Fire Control, Department of National Parks, Wildlife and Plant Conservation

1.3.2 Soil

The transformation of land area from subsistence agriculture to commercial agricultural production, coupled with inappropriate use of soil resources, fertilizers and pesticides, is likely to worsen the soil degradation problems. The soil degradation in Thailand tends to be a threatening problem for Thailand. The problems come in different forms such as soil erosion (34% of total land area in Thailand), reduction in soil nutrients (31%), and soils unsuitable for agriculture (99%), the proportion of which increased substantially from 2002. Among various types of soils problem, acid soils were the biggest problem for Thai agriculture, and constituted about 15.74 million hectares, accounting for 31% of total soils problem, followed by shallow soils and sandy textured soils respectively (Table 3). Geographically, the soil erosion becomes a very serious problem particularly in the northern region of Thailand due to its undulating topography, steep slopes and high rainfall. More importantly, the encroachment of agricultural activities on forest areas and misuse of lands, especially on steeply sloping land without proper conservation measures, speeds up the soil erosion and also soil quality depletion (Tingting, et al., 2008). A good example can be drawn from the farmers' intensive rice farming during the past few years which shows serious the problem can be. Some farmers farm on paddies more than twice a year; however, this will certainly exhaust the land quickly and make farmers rely very much on chemical fertilizer since they do not have time for soil quality regeneration following continuous rice cultivation.

In response to these problems, the government agencies put a lot of effort into helping improve the soil quality. In the implementation of various NESDPs during the past few decades, the government launched a number of land management and soil improvement activities, ranging from building institutional and public awareness of natural resource concerns, collecting and analyzing land resource information, conducting research on soil salinity prevention and rehabilitation, to the transferring of technology and knowledge to farmers in improving soil and land quality. Although not yet successful on a large scale, there was an increase on average in the number of rehabilitated areas (Figure 7).



Table 3: Land area of problem soils by type of soil in 2002 and 2004 (Unit: million hectares)

Types of problem soils	2002	2004*	% change
Soil erosion	17.42	17.42	0.00
Organic soil	15.79	15.79	0.00
Problem soil in agriculture:	33.57	51.15	52.38
Saline soil	3.47	0.72	-79.26
Acid sulfate soil	0.67	0.88	30.95
Acid soil	10.29	15.74	53.03
Bog soil	0.05	0.05	0.00
Sandy textured soil	1.12	2.05	82.86
Shallow soil	6.56	6.94	5.85
Others	21.71	24.77	14.08
Inappropriate use of soil	5.70	5.70	0.00

Note: *This is the latest year for which figures are available in the 2010 report on Thailand Environment Statistics.
 Source: Department of Land Development, Ministry of Agriculture and Cooperatives

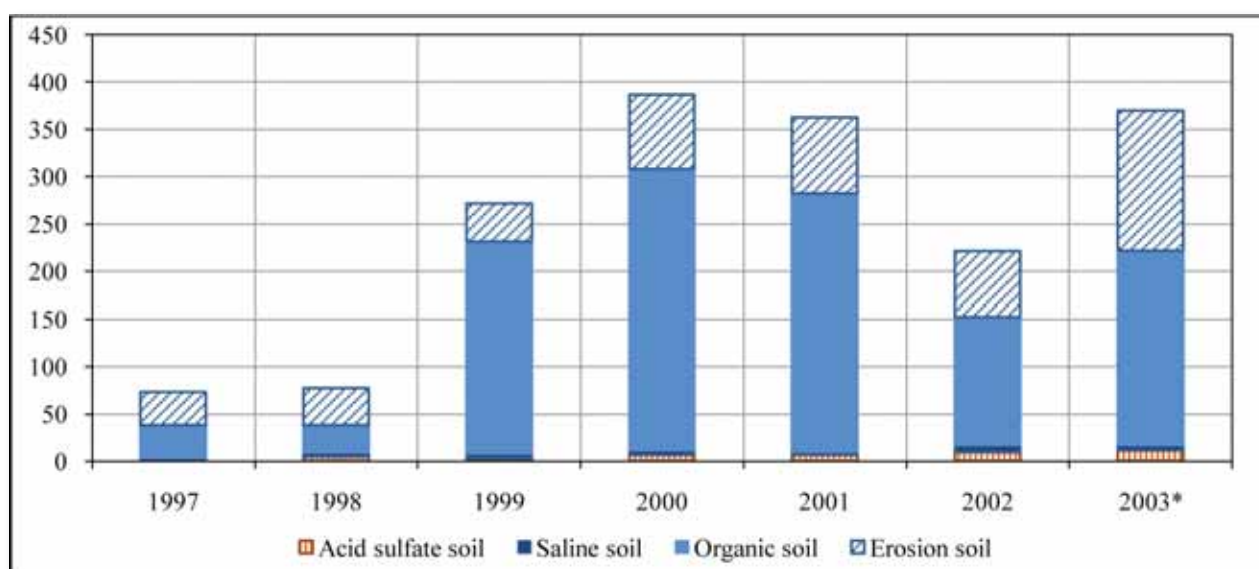


Figure 9: Rehabilitation of land area by type of problem soil (Unit: thousand hectares)
 Note: *This is the latest year for which figures are available in the 2010 report of Thailand Environment Statistics.
 Source: Department of Land Development, Ministry of Agriculture and Cooperatives

1.3.3 Water

The rapid development of the economy has stimulated an expansion of demand for water to support power generation, irrigation for agriculture, domestic and industrial consumption. However, the inefficient use of water by various sectors and the deterioration of water quality due to excessive use of fertilizer and pesticides, sewage and industrial wastes are likely to threaten the availability and adequacy of water resources.

According to the Pollution Control Department, water quality at major rivers and marine quality assessment stations range between five quality category (from very good to highly degraded) respectively. In general, the quality of freshwater sources was in fair and good conditions in 2009, accounting for 31% and 36% respectively. Although a number of major freshwater sources were rated as fair in 2008, some



of them showed sign of improvement and were assessed as being in good condition in 2009 (Figure 8). However, more concern should be placed on water sources that were in degraded condition. One of the most critical causes that make the quality of freshwater sources in the upstream in poorer condition is the discharge of waste water from surrounding communities judged by the high level of Fecal Coliform Bacteria (FCB) that is normally found in human sewage, factories and the runoff of plant nutrients, and organic and inorganic wastes from agricultural farms with little or no treatment.

The marine environment has also deteriorated during the past few years as coastal water in the Inner Gulf (particularly at the estuaries of Chao Phraya River, Tha Chin River, Mae Klong River and Bangpakong River) and certain highly populated areas of the Outer Gulf of Thailand, were found to be in a highly degraded condition, which provokes habitat degradation along the coastal area. Several key indicators for degraded and highly degraded marine water resources are the high level of Total Coliform, Fecal Coliform Bacteria, Enterococci, Total Phosphates, Manganese, and low levels of dissolved oxygen.

To be more specific about the water pollution caused by industrial discharges, Figure 12 shows the contributions of the top six manufacturing sub-sectors to total loads of biological oxygen demand (BOD) and total suspended solids (TSS). The overall results indicate that, as far as the total BOD loads are concerned, three industrial sectors that are the largest producers of BOD include pulp, paper and paperboard sector, industrial chemical production sector, sugar factories and refineries - with the pulp and paperboard sector being the largest producer of BOD which accounts for 32% of total industrial BOD discharges. With respect to TSS, the iron and steel sector discharges the greatest amount of total suspended solids, accounting for 60% of total industrial TSS discharges, while other sectors such as the pulp and paperboard, jewelry, nonferrous metals sectors produce much smaller share of total TSS discharges.

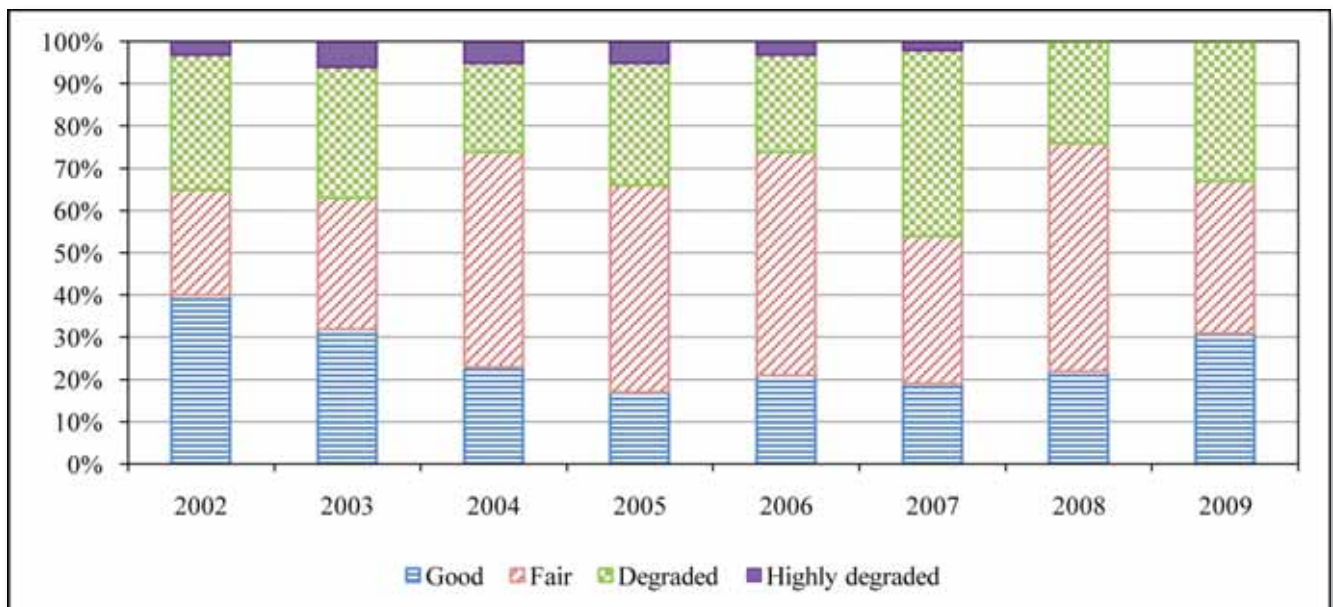


Figure 10: Percentage of the number of major rivers (including lentic water sources) by quality class
Note: Water quality index is used to grade rivers and lentic water sources into four quality classes as shown in the figure. The index is measured based on a pre-identified set of water quality indicators such as level of dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrates, total phosphates, total solids, total suspended solids, fecal coliform bacteria, pH.
Source: Pollution Control Department

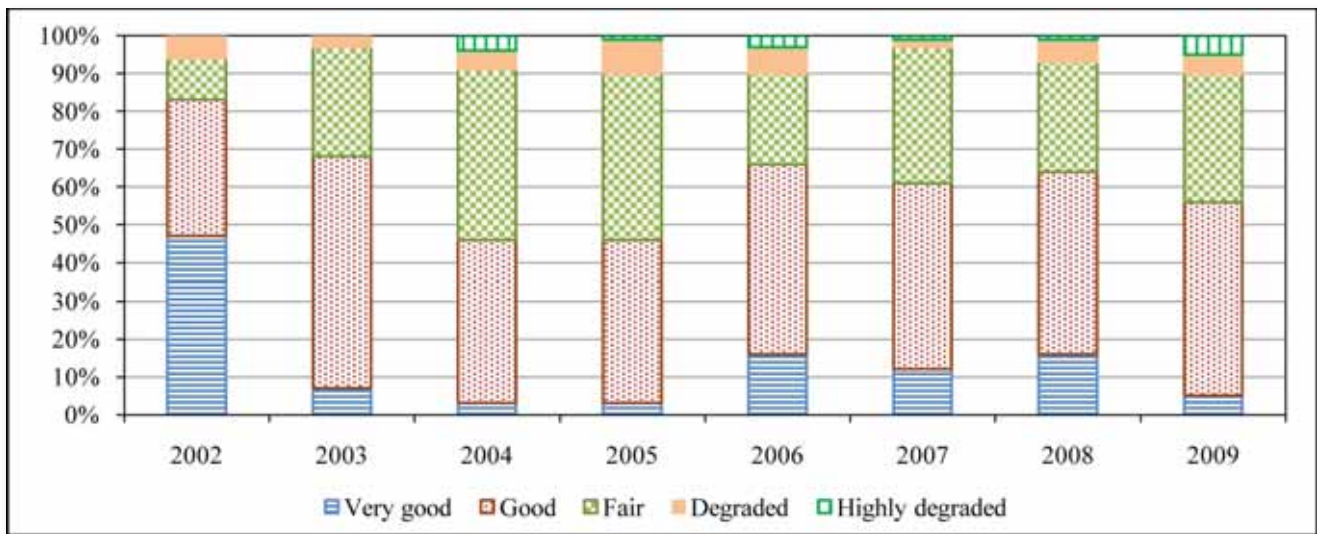


Figure 11: Percentage of the number of marine quality assessment stations in Thailand by quality class
 Note: Marine water quality index is used to grade water sources into five quality classes as shown in the figure. The index is measured based on a pre-identified set of water quality indicators such as level of dissolved oxygen (DO), total coliform bacteria, nitrates, total phosphates, ammonia, temperature, total suspended solids, pH., pesticides, toxic elements, etc.
 Source: Pollution Control Department

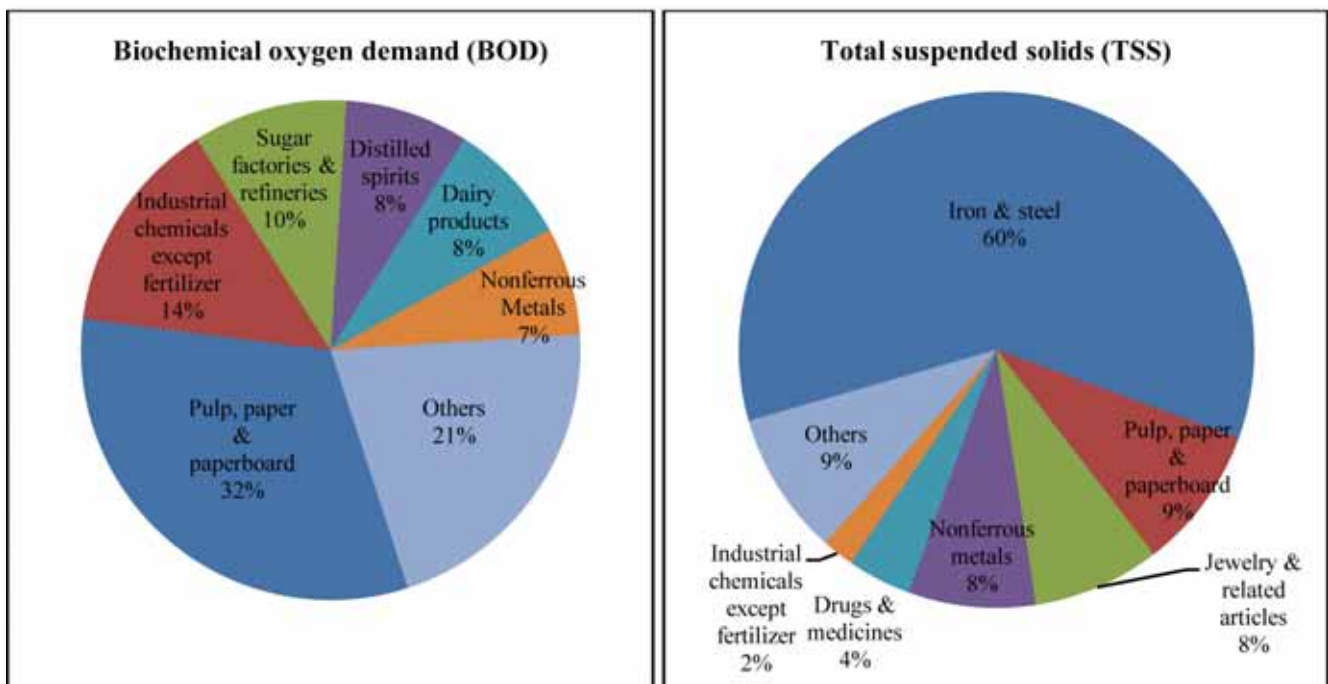


Figure 12: Contribution of industrial sectors to industrial water pollution in Thailand
 Source: Kaosa-ard, Laplante, Rayanakorn, and Waranyuwattana (2008)

1.3.4 Energy

The industrialization and expansion of the economy continue to exert great pressures on energy consumption and carbon dioxide emission. During the past few decades, there has been an increasing trend of final energy consumption and CO₂ emission. The final energy consumption increased substantially from just 14,727 KTOE in 1982 to 71,166 KTOE in 2010, accounting for an average annual growth rate of nearly 6% while the emissions of CO₂ were estimated to rise at an average annual growth rate of 2.8% during 2001-2009.



Although the amount of total final energy consumption and the emissions of CO₂ into the environment increased over time, there was an improvement in both average ratio of final energy consumption to GDP and average ratio of CO₂ emissions to GDP, implying that the economy grew at a faster rate than the increase in energy consumption and CO₂ emissions (Figures 13 and 14). This evidence suggests that the economic structure of Thailand becomes less energy intensive and more carbon productive.

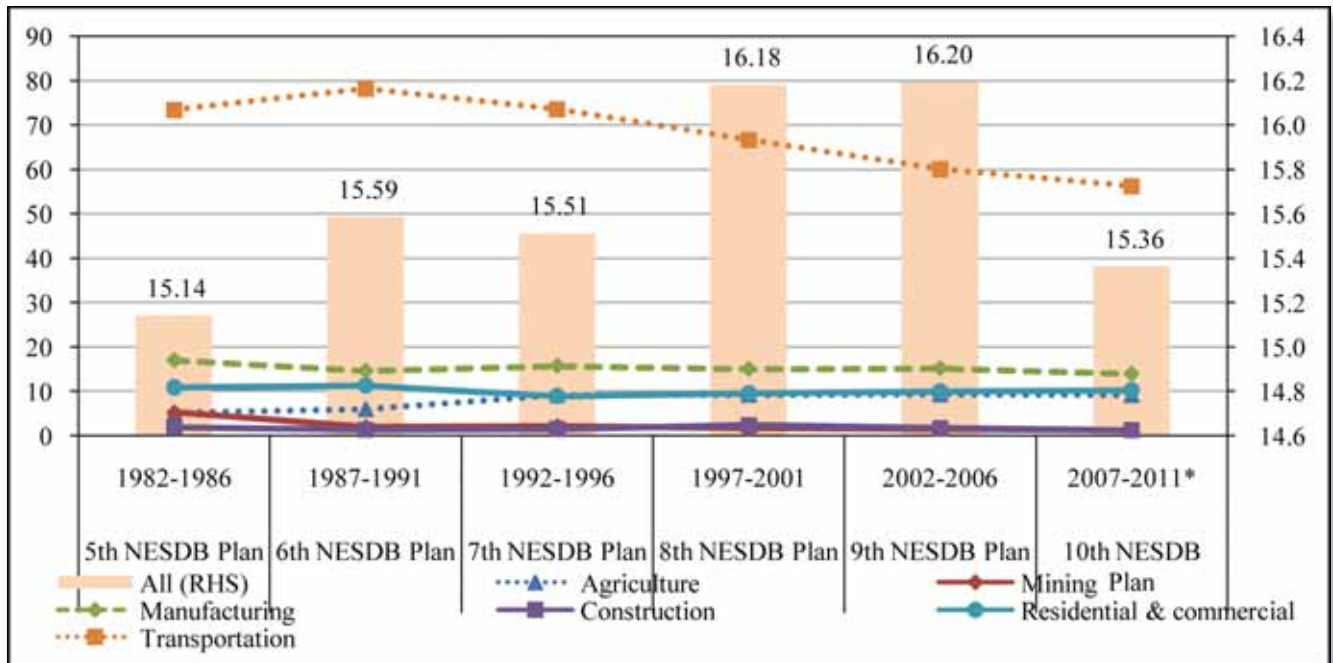


Figure 13: Average ratio of final energy consumption to GDP by sector (Unit: tons of oil equivalent per million baht of real GDP)
 Source: Calculated using data from Department of Alternative Energy Development and Efficiency (DEDE) and National Economic and Social Development Board (NESDB)

Furthermore, when measuring energy intensity by economic sector, Figure 13 illustrates that, out of the six sectors, the transport sector, which was the second largest sector in terms of final energy consumption, had the highest level of energy intensity; however, it showed the greatest improvement in resource use. This happens partly due to the introduction of alternative fuels (such as compressed natural gas, biogas, bio-diesel, and bio-ethanol) for passenger cars and freight transport vehicles. Compared to other sectors, the transport sector showed relatively high intensity of energy consumption; thus, there is ample room for improvement in its energy efficiency.

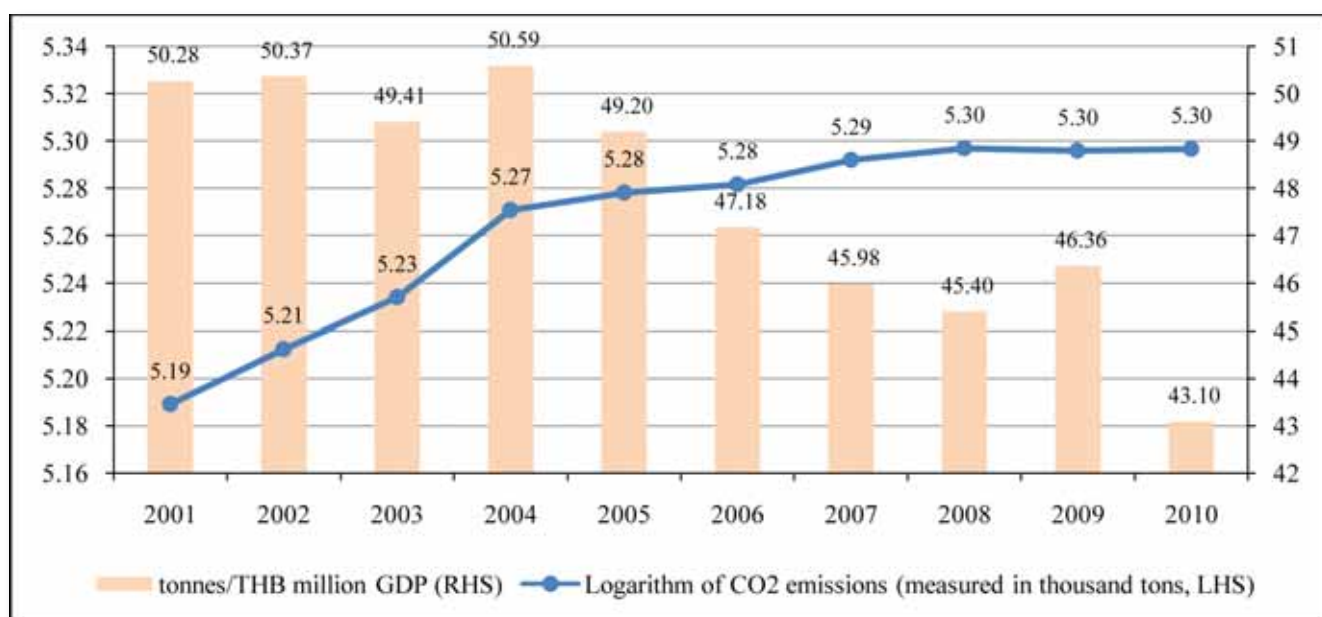


Figure 14: Average estimated CO2 emissions (Unit: tons of oil equivalents per million baht of real GDP)
 Source: Calculated using data from Department of Alternative Energy Development and Efficiency (DEDE) and National Economic and Social Development Board (NESDB)

1.3.5 Waste

The improper treatment and disposal of solid and hazardous waste are other important causes of environmental pollution and degradation. The pressure on the environment due to waste generation continues to grow as the total amount of waste increases year by year. In 2008, the total amount of waste produced by households and industrial users reached 18.16 million tons a year, which can be decomposed into solid waste (82.7%), industrial hazardous waste (13.5%) and domestic hazardous waste (3.8%). Based on the study of Ozaki et al. (2003), the authors purported that the petroleum refineries, the electroplating, textile, paper and pharmaceutical industries are the primary producers of hazardous wastes in Thailand. With respect to nonindustrial hazardous waste, a significant amount of hazardous waste comes from daily activities in community and nonindustrial sources such as automotive repair shops, gas stations, hospitals, farms and households. For community sources, most hazardous waste comes in the form of used oils, lead-acid and dry-cell batteries, cleaning chemicals, pesticides, medical wastes, solvents and fuels, and other unused and worn-out electrical appliances and electronic tools.

According to the Department of Industrial Works, the ability to treat or dispose of waste was low for solid waste, but relatively high for industrial hazardous waste. Specifically, only 40% of the total solid waste generated was reported to be treated properly while almost 97% of total industrial hazardous waste was ensured to have proper treatment or disposal.

Although the amount of waste generated per capita grew substantially in the recent years (Figure 15), there was a high tendency towards better improvement in total waste intensity since the ratio of total waste to GDP declined over the years (Figure 16), probably indicating that the economy has been moving towards less material-intensive production and consumption patterns.

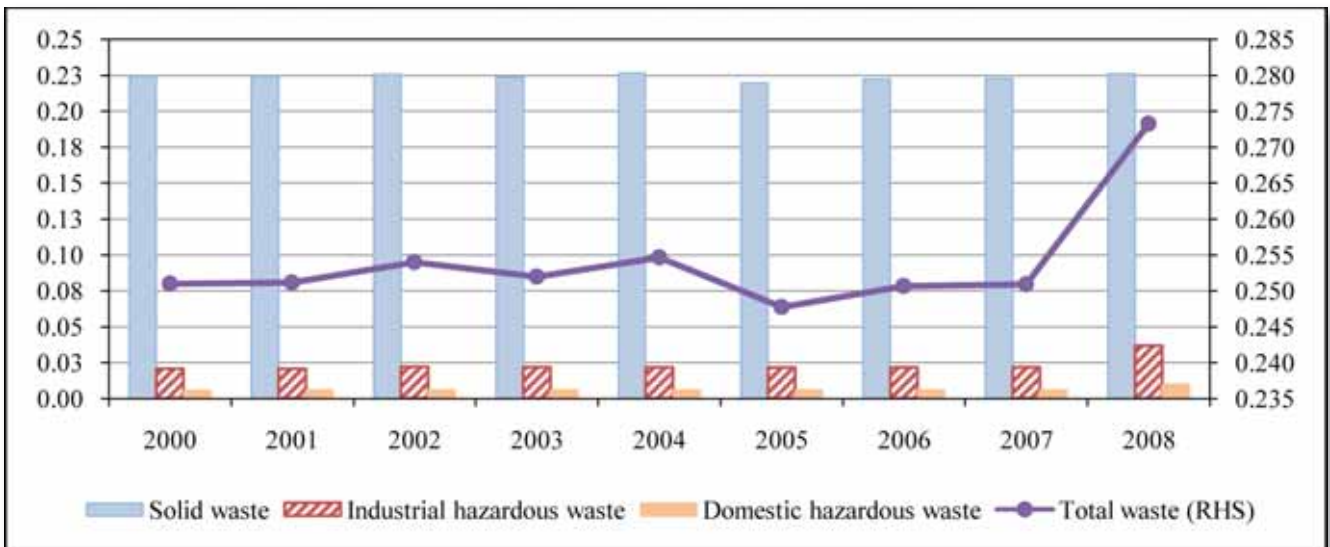


Figure 15: The quantity of waste per capita by type of waste (Unit: tons per capita)
 Source: Calculated using data from Pollution Control Department and National Economic and Social Development Board (NESDB)

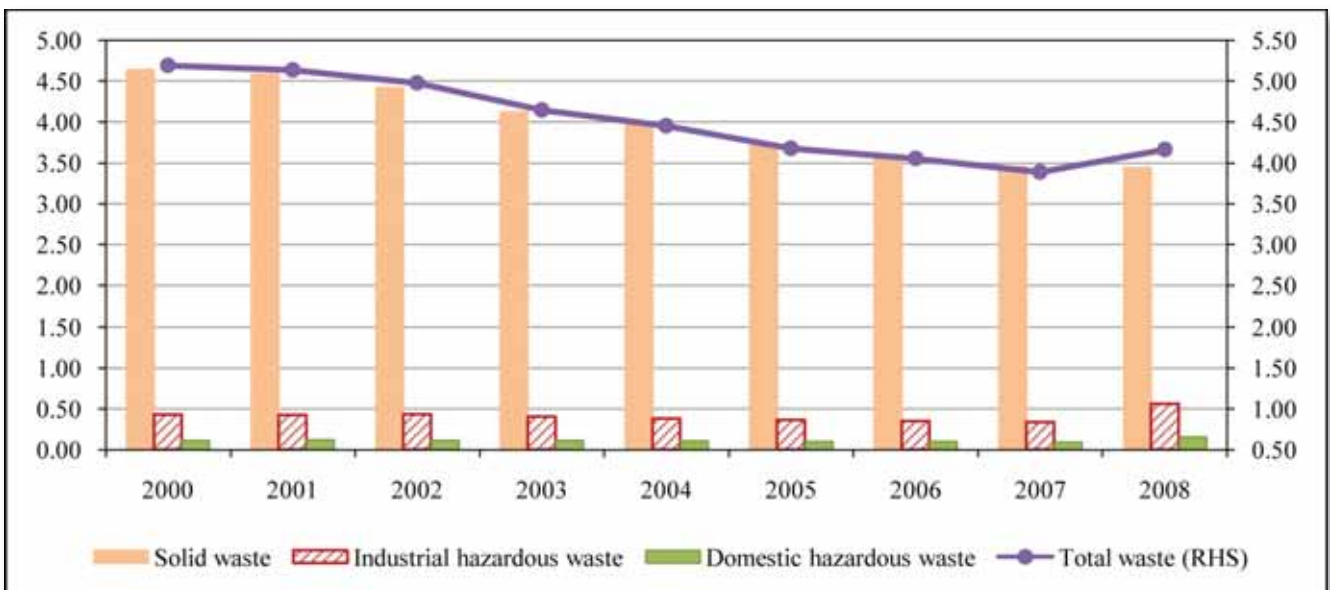


Figure 16: The ratio of the quantity of waste to GDP (Unit: tons per million baht of real GDP)
 Source: Calculated using data from Pollution Control Department and National Economic and Social Development Board (NESDB)

1.4 Advances Dedicated to Improve Environmental Performance

With growing concerns over environmental impacts and environmental standards, or requirements imposed on various key export markets of Thailand, the Thai government has put much effort into promoting the development of clean and green industry without sacrificing economic progress.

Advances in Thailand's science and technology have significantly contributed to the development of a clean and green economy. The country has attempted to promote the development of research capabilities in science and technology and support new innovations in such areas as agriculture, waste water treatment, and alternative energy production. By committing to the long term sustainable development of industries



in the country, the National Science and Technology Development Agency (NSTDA)⁶, in collaboration with several academic institutions and government agencies, have come up with several advances associated with improvement the environmental performance as follows.

a) Agricultural sector:

- The development of Life Cycle Inventory (LCI) database for rice production and rice processing which is essential for the calculation of carbon footprints of rice products.
- The development of greener production processes for natural rubber production to improve rubber quality and productivity and to reduce energy consumption, environmental pollution and odor problems. They are such as the successful development of a compound called TAPS (Thai Advanced Preservative System) to enhance the quality of latex, but that poses no harm to the environment, and a compound called GRASS (Green Recovery Agent for Skim and Sludge) to replace the use of sulfuric acid which normally creates water pollution and odor from the hydrogen sulfide gas problems.
- The development of machine for continuous drying of rubber which positively affects the potential of rubber dehydration, energy consumption, and quality of dry rubber produced.
- The development of integrated materials technology that takes care of the greenhouse effect and reduces the use of chemicals and insecticides. NSTDA supports smart greenhouse design and the development of special plastic covering which altogether can help prevent plant diseases and reduce the use of pesticides by 80%.
- The establishment of the environmental monitoring station by NECTEC that monitors and collects remote meteorological data which can help farmers plan for their crops effectively.

b) Industrial and energy sector:

- The development of clean technologies with zero waste discharge in cassava starch manufacturing.
- The development of a technology called “Closed-type Anaerobic Reactor” to treat wastewater for reuse in irrigation of farmlands while producing biogas in return as a sustainable alternative source of energy.
- The set-up of Thailand’s first plastic biodegradability testing laboratory which has been certified in accordance with ISO 14855 and ASTM D5338 standards.
- The establishment of the first industrial micro-organism manufacturing plant to develop products such as bio-pesticides prototypes in both powder and liquid formulae for the control of pests and plant diseases.

⁶ NSTDA is an autonomous entity established under the Ministry of Science and Technology to promote research and development activities, technology transfer, human resource development and infrastructure development and. The is working through its four national R&D centers, namely the National Center for Genetic Engineering and Biotechnology (BIOTEC), the National Metal and Materials Technology Center (MTEC), the National Electronics and Computer Technology Center (NECTEC) and the National Nanotechnology Center (NANOTEC) to actively promote industrial and research collaborations with companies to boost the growth of industries by focusing five targeted sectors which include agriculture and food, energy and environment, health and medicine, bio-resources and community, manufacturing and service industries.



- The development of a prototype of hybrid thin-film silicon solar cell and flexible solar cell development to improve higher energy yield and reduce the cost of energy.
- The development of community-level steamless palm oil extraction system for producing oil for biodiesel which will help lower the cost of biodiesel's production since a waste water treatment is not needed.
- The research development on a textile waste water treatment system using a photocatalytic reactor and a catalyst recycle unit.
- The introduction of a production technique to produce biodegradable plastic bags that have better humidity resistant properties and increased toughness and are able to completely degrade within three months.
- The launch of a national campaign called Promotion of Carbon Footprint on Products in collaboration with the Thailand Greenhouse Gas Management Organization (TGO) by bringing the concept of carbon footprint labeling with practice. In 2011, the project was launched to promote green production in 30 industries and aimed at having 700 products certified with a carbon footprint label. In so doing, the development plan was designed with five achievement levels of green industry development, which include: green commitment, green activity, green system, green culture, and green network. Currently, there are about 1,050 business enterprises certified by the Ministry of Industry to be in the first to third levels of green industrial development. It is expected that the number of certified enterprises will be increased to 2,500 enterprises in 2012.

Apart from these development programs, there are several other activities undertaken to promote green and sustainable growth such as the creation of eco-town awareness to strengthen cooperative networks among involved stakeholders, the upgrading of industrial performances, the facilitation of green business and eco-town implementation, the capacity building of human resources to promote and develop eco-town.

2. Broad-based Policies

2.1 How do Existing Policies Promote Resource-Intensive Economic Development?

Major challenges to the economic development of Thailand are the depletion of natural resources and the degradation of the environment. Although the relative importance of resource-based sectors diminished during the past few decades as shown in Figure 2, the long-term sustainability of the sectors remains an important issue, as the outputs from the sectors are immediate inputs of several other industries.

Therefore, the government has come up with policies that aim to prolong the lifespan of current reserves of both non-renewable resources such as petroleum and oils, and renewable resources like forests. These include for example: (a) special incentives – both tax and non-tax privileges – granted by the Board of Investment for companies that are willing to set up the manufacturing facilities for the production of eco-friendly materials and products such as bioplastics and for the production of energy saving and alternative energy sources such as biomass, biogas, ethanol, solar, and hydro power; (b) tree bank program initiated by a state-owned Bank for Agriculture and Agricultural Cooperatives (BAAC) in collaboration with the Ministry



of Agriculture and Cooperatives (MOAC) which encourages farmers to plant trees. The program benefits not only individual farmers who obtain green credit or loan by using trees as a collateral for loan, but also the community as a whole because plants can help to sequester carbon from the atmosphere, and hence, offset greenhouse gas emissions.

For several other policies to help firms improve the efficient use of resources in the resource-based industries, the government has launched several structural adjustment programs, promoted and provided financial support for conducting research and development, encouraged cleaner industrial production and also provided selected incentives to firms to purchase automated production equipment and technology. All of this to improve product quality and productivity, reduce energy use, and provide necessary technical assistance to firms on waste reduction and minimization.

However, certain policies create market distortion that induces the economy to depend much more on resource intensive structure for growth. They come in different forms such as fuel subsidies and inappropriate price structure of transportation, which both make the usage underpriced and induce more consumption and production of materials and products that are far beyond the appropriate level. Another good example is the agricultural price-pledging policy in which the government set the pledging price at the level far higher than the average market price. Take rice price pledging scheme as an example. There will be an increasing demand for intensive farming because farmers are attracted to a high pledging price to grow rice so that they can sell to the government without considering much about rice quality. With this intensive farming method, it will unavoidably impair long-term soil fertility and productivity.

2.2 Policies for Reducing the Resource Intensity and Pollution Effects of Economic Growth

Due to the fact that Thailand is facing the depletion of natural resources and has to depend on the import of resources from other countries, there is thus a need to pursue resource efficient growth strategies to make use of resources more efficiently. In response to changes in national competitiveness, natural resources and environment, the current NESDP for the periods 2012-2016 integrates the principle of the Sufficiency Economy as a strategic guideline for sustainable development and also focuses on the human as the center of development. And there are two main objectives directly related to environmental implications: a) to develop efficient and sustainable economy by upgrading production and services based on technology, innovation and creativity with effective regional linkages, improving food and energy security, upgrading eco-friendly production and consumption toward a low-carbon society, and b) to preserve natural resources and the environment to be sufficient for maintaining the ecology and a secure foundation for development.

Specific to issues relate to the reduction of resource intensity and pollution effects of economic growth, the national plan provides some concerned development strategies that promote the concepts of energy efficiency, the efficient use of limited resources, the conservation of water, and the protection of the environment. They are as follows:

- To strengthen the agricultural sector and security of food by (1) reinforcing natural resources as the foundation for an agricultural production base through the conservation of productive arable land, the improvement of efficiency in land utilization, the restoration of natural resources for agricultural production, and the promotion of adopting good agricultural practices; (2) increasing agricultural productivity with support from research and development for technologies



and agricultural practices that are environmental friendly and suitable to socio-geographical conditions, and also more emphasis will be placed on the use of chemical fertilizers and pesticides; (3) enhancing food security and developing bio-energy at household and community levels at which people and communities will be encouraged to plant trees and utilize sustainable agriculture following the Philosophy of Sufficiency Economy and to apply a zero waste approach in agriculture; (4) establishing bio-energy security to strengthen the agricultural sector and support national development while increasing the efficiency in bio-energy production and utilization.

- To restructure the economy towards quality growth and sustainability by (1) using science, technology, innovation and creativity as fundamental factors for restructuring the economy, improving agricultural productivity, and promoting the development of green agricultural and industrial production processes; (2) developing science and technology, research, and innovation as driving forces for sustained and inclusive growth.
- To steer natural resources and the environment towards sustainability by (1) conserving, restoring, and creating security of natural resource and environmental bases such as forests, freshwater and marine resources, (2) shifting the development paradigm and direct the country to a low-carbon and environmentally friendly economy and society through the restructuring of the country's production and consumption behavior, the promotion of energy efficiency in transportation and logistics sector to reduce greenhouse gas emissions, and the development of eco-cities with the emphasis on urban planning that takes cultural, social and ecological concerns into account; (3) upgrading adaptation capacity to achieve a climate resilient society through enhancing knowledge and management tools for handling and responding to challenges of climate change; (4) controlling and reducing the amount of air pollution, improving the efficiency of solid waste disposal and community waste water treatment and of hazardous waste management systems; (5) enhancing the natural resource and environmental management system to be more efficient, transparent and equitable.

However, many of these development issues were already raised in the tenth NESDP or earlier plans; therefore, some of them have been taken into account by concerned government agencies and already incorporated into their policies and action plans accordingly. They are, for example, the fifteen-year Alternative Energy Development Plan (2012-2021) developed by the Ministry of Energy to promote energy conservation and develop alternative energy sources such as biomass, biogas, natural gas, ethanol, biodiesel, wind, waste, and the like; the four-year action plan of the Ministry of Natural Resources and Environment which aims at preserving, conserving, and restoring natural resources and the environment, increasing the efficiency in the prevention and control of pollution and the management of waste, creating awareness and inducing people's participation in the management of natural resources and the environment; the National Strategic Plan for Integrated Management of Forests (2004-2013) to conserve natural forest area in Thailand, to preserve and restore natural resources, and to enhance ecology and biodiversity of the forest; the Strategic Plan of the Ministry of Agriculture and Cooperatives to promote the restructuring of the agricultural sector, to develop, conserve and restore natural resources for agriculture production.

In the implementation of these development strategies, several policy measures are used to ensure their effective delivery. They are for example:



- The use of tax and non-tax privileges granted by the Board of Investment to promote resource-efficient and environmentally-friendly investment in sustainable development projects. They are such as exemption of import duties on machinery, 8-year exemption of corporate income tax without cap, 5-year 50% reduction of corporate income tax on net profit, 10-year double deduction of transportation, electricity and water supply costs, deduction from net profit of 25% of investment in infrastructure installation and construction costs in addition to normal capital depreciation.
- The provision of low interest rate loans for projects that promote the conservation and efficient use of energy such as the replacement of new energy saving machines, the utilization of alternative energy in generating electricity, etc.
- The granting of funds to support the research and development of cutting-edge green technologies, raw materials, production processes and practices through public organizations such as the National Innovative Agency (NIA), National Science and Technology Development Agency (NSTDA), etc.
- The promotion of awareness among all relevant development partners to ensure a common understanding and commitment in the development process.
- The establishment of systematic databases on resource use and efficiency (such as energy consumption, disposal of waste, land utilization, quality of freshwater and marine water resources, etc.) necessary for the follow-up, monitoring, and evaluation of the impacts.
- The capacity building of stakeholders so that they can take part effectively in the development process. In other words, communities and concerned authorities are empowered with knowledge and skills to improve their business practices.

2.3 Gaps in the Policy Framework that Require Action

Although Thailand has its first environment law called “the Enhancement and Conservation of National Environmental Quality Act” since 1975, environmental problems continue to worsen considerably. The rapid over-utilization of natural resources beyond nature’s ability to give is partly due to the following reasons which should be solved if the country aims to firmly protect the environment.

- Ineffective policy implementation and enforcement

Currently, there are a number of natural resources and environmental policies and action plans developed by various concerned government agencies. However, they lack integrative focus, enforcement and also policy coordination. It is therefore necessary to make the implementation more effective. In so doing, a holistic and more integrated approach to environmental protection and economic sustainability should be taken into account substantially in the future development of plans and strategies.

- Weak environmental management mechanism at the local level

Although local governments have already been given a greater role in administering natural resources and caring for the environment in their own localities, many of the local governments have limited resources in almost all forms including human, physical, financial resources. Due to lack of



adequate resources, the local governments cannot effectively act to attain the development goals of the local communities. For example, certain local governments are constrained by limited revenues and budget; therefore, they are less likely to be able to attract and compete for high caliber staff. Sometimes, tasks and responsibilities are transferred to local governments but create too high operating costs beyond the level they can manage efficiently.

- Limited uses of effective economic tools to encourage rational use of environmental resources

There are still limited uses of effective economic tools based on the “polluter –pays-principle” in Thailand’s various environmental related laws. Therefore, it is not easy and effective for the government agencies to alter public attitudes and create incentives for people and business enterprises to behave in such a way that helps reduce the impacts of environmental problems.

- Price distortion in the market

It is crucial for the government to have an appropriate pricing policy that allows prices to better reflect the negative externalities and environmental values of various activities. The reason is that the under-pricing of natural resource-based products such as water and energy normally bring about over-exploitation and inefficient use of resources. Therefore, it would be better to set prices that internalize the cost of adverse effects; however, they should not exclude the poor from accessing resources.

Last but not least, although government policies attempt to promote improvements in efficiencies particularly in production processes of business enterprises, the policies will not be effective if there is no shift of consumption patterns in people. It is normally understood that higher income can also stimulate discretionary consumption that may exert pressures on the environment. It is therefore, at the implementation level, equal attention should also be drawn to promote eco-efficiency in the consumption patterns. To be more effective in the implementation of future policies, the creation of consciousness, awareness and mindset shift about environmental issues and eco-friendly practices should be integrated into the school’s curriculum.

3. Ecological Policies in Different Economic Sectors

3.1 Industrial Sector

3.1.1 Background of Thailand’s Manufacturing Sector

The industrial sector has played quite a prominent role in the Thai economy as, during 1980 and 1995, manufacturing’s contribution to overall GDP increased rapidly, from 23% to 31% (Dhanani and Scholtès, 2002). During that period, the growth rate of manufacturing value-added accelerated from 5% to 15% per year between the first and second half of the 1980s, and continued to grow rapidly by 11% per year in the first half of the 1990s (Dhanani and Scholtès, 2002). Such growth was attributed to the growth of manufacturing exports, which increased from 6% to 38% year between 1980-1985 and 1985-1990, and which continued to grow by 23% per year during 1990-1995. However, this performance came to an abrupt halt in 1996, when manufacturing exports declined for the first time. In the period 1996-2000, manufacturing value-added and exports grew by an average of just 3% and 2% per year (see Figure 17).

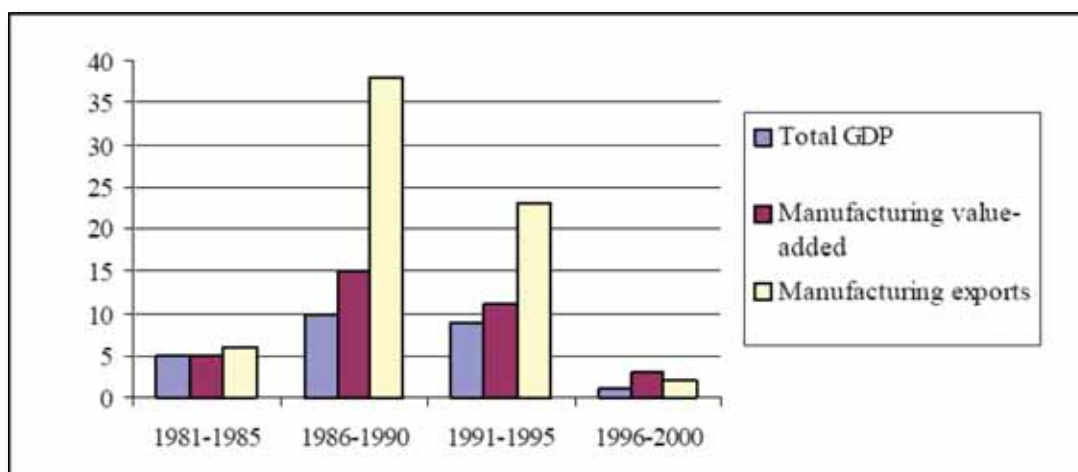


Figure 17: Performance of the Manufacturing Sector during 1981-2000
 Source: Dhanani and Scholtès (2002)

Among Thailand's export products, the top export categories consist of electronics, food and beverages, chemicals, including plastic products, electrical goods, machinery, garments, jewelry, furniture and vehicle parts. These product categories accounted for a large part of the country's manufactured exports.

During recent years, the Thai manufacturing sector has made some progress in upgrading its technology profile, with a declining trend in the share of resource-based industries, and increased shares in the technologically more-advanced differentiated industries and science-based industries. However, it is important to point out that this might exaggerate the technological capabilities of a country because, in Thailand's case, the import content of differentiated and science-based industries, including electronic goods, was relatively high, indicating a specialization in the assembly rather than the production stage of manufacturing.

3.1.2 Recent Developments and Greening of Thai Industries

Because the production and export of industrial products offer the Thai economy a number of opportunities for economic and social development gains, the developments in international trade could have far-reaching consequences on the Thai economy. According to our interview with the Federation of Thai Industries, due to rising awareness about climate change and the impacts of consumption and production on the environment, many countries have begun to impose more stringent standards and new requirements on exported products; for instance, the European Union (EU) implemented the Energy Efficiency Directive (European Commission, 2011). This new set of measures aims to step up the EU Member States efforts to enhance energy efficiency at all stages of the energy chain, from the transformation of energy and its distribution to its final consumption. These more stringent requirements on the energy efficiency should result in a reduction in the energy used in the production of commodities exported to those markets and often entail a transition to high-precision, more environmentally friendly production methods.

When these requirements take local conditions and capacities into account, compliance with them can offer benefits, such as reduced environmental impacts and improved occupational health for the workers in these industries. However, the new requirements also pose critical challenges for production and quality management and are particularly challenging for small and medium enterprises in Thailand, which often



lack the skills and financial resources necessary to meet stringent standards and regulations (United Nations, 2007). The growing use of these environmental requirements poses an important challenge to producers and exporters in Thailand. In response to more stringent standards and regulations, Thai manufacturers, especially the exporters, need to carefully study these regulations and adapt their production technology and process accordingly. At this stage, it would be vital that a constructive dialogue among all affected stakeholders is built for the exchange of technological know-how, experiences and supports. This requires concerted actions on the part of government, the Federation of Thai Industries, and the manufacturers.

Responding to this changing landscape, some Thai industries have started to embrace the environmental management tools, such as eco-efficiency and waste minimization. In addition, a family of international management standards, such as ISO 14000, ISO 26000 and ISO 50001, has been adopted by Thai enterprises. ISO 14000 is an international standard related to environmental management that aims to help organizations minimize the negative impacts of their operation on the environment and comply with laws, regulation and environmental requirements (ISO, 2012a). ISO 26000 is the international standard which provides guidelines for social responsibility (ISO, 2012b). It is intended for use by both public and private organizations. These organizations will be assisted to operate in the socially responsible manner that society increasingly demands. Provided that ISO 26000 contains voluntary guidance, not requirements, it is not for use as a certification standard. Last but not least, ISO 50001 is the international energy management standard (ISO, 2012c). It establishes a framework to manage energy for industrial plants, commercial, institutional or governmental facilities. This family of standard will assist the organizations in improving their energy performance, increasing energy efficiency and reducing climate change impacts. It provides a framework for integrating energy efficiency into management practices and framework for promoting energy efficiency throughout the supply chain. It allows the organizations to make better use of existing energy-consuming assets.

In what follows, we provide information on the extent of businesses in Thailand that have adopted the international management standards or schemes. Figure 18 contains information on the number of enterprises in Thailand that received certification for environmental management under ISO14000, classified by industries. According to the table, as of October 2011, there were 502 enterprises in Thailand that received this type of certification.

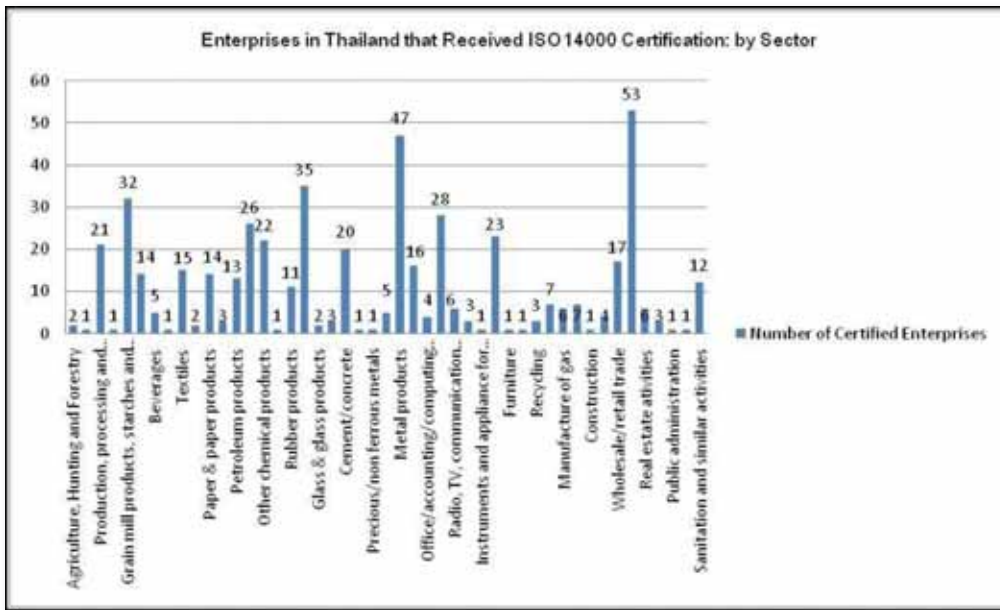


Figure 18: Number of Thai Enterprises that Received Certification under ISO14000 – by Sector
 Source: Thai Industrial Standards Institute (Data as of October 18, 2011)

With regards the implementation of ISO26000 in Thailand, no data is available as to how many enterprises in Thailand have adopted this management standard. However, the Department of Industrial Works initiated the CSR-DIW standard, which was designed to be an equivalence of ISO26000 in Thailand, to promote social responsibility among the Thai industries and enhance their competitiveness and sustainable growth. Similar to the ISO26000, the CSR-DIW standard covers 6 areas, namely organization governance, human rights, labor practice, environment, fair operating practices, consumer issues and community involvement and development. Figure 19 provides a summary of enterprises in Thailand that were awarded the CSR-DIW during 2008-2011. According to the latest available statistics of the Department of Industrial Works, the total number of enterprises in Thailand that were awarded the CSR-DIW is 321.

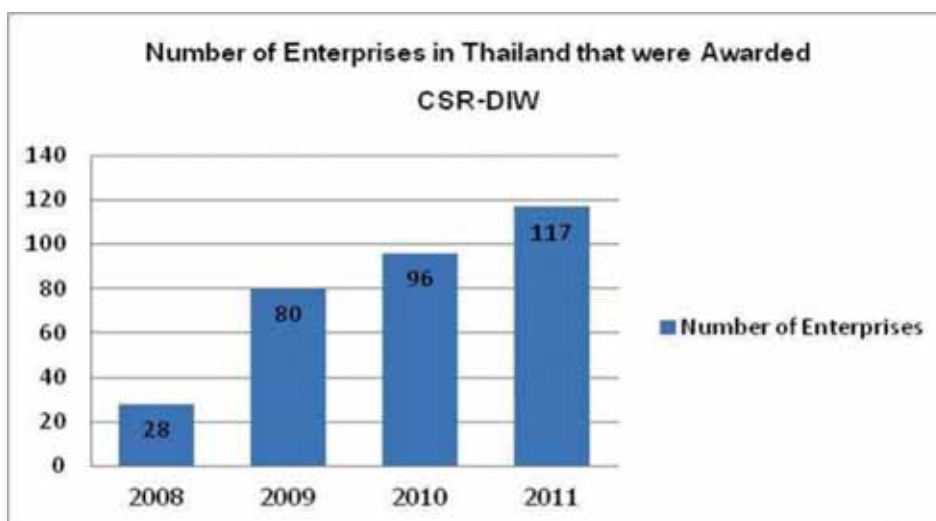


Figure 19: Number of Enterprises in Thailand that were Awarded the CSR-DIW
 Source: Department of Industrial Works



In what follows, we provide two examples of enterprises in Thailand that were awarded the CSR-DIW. The first enterprise is Charoen Pokphand Foods PCL. This enterprise has engaged with the local community and assisted the local residents in setting up cooperative selling local produce. The second enterprise is Southeast Asian Packaging and Engineering Co., Ltd. This enterprise helped trained women in the local communities to produce bags, dish washing liquid, etc.

For the energy management standard ISO50001, we provide here examples of enterprises in Thailand that have gained this recognition. First, the General Motors Thailand/SEA (GM) was certified ISO 50001, the first automotive company in Thailand to receive this certification. The energy saving initiatives of GM aims to achieve a 4,000 ton reduction in CO2 emissions per annum. Moreover, GM has also commitment to play its part in improving environmental quality in the vicinities within which it operates. The major works undertaken by GM Thailand include upgrading of office lighting, upgrading street lighting at the facilities, installing a heat recovery boiler, using air compressor with VSD control and using sky-light roofing at the warehouse areas (GM Thailand, 2012). Second, IMPACT convention and exhibition center at Muang Thong Thani is Thailand's first MICE operator who passed the ISO50001 assessment and was accredited with the energy management system (Green Meetings, 2012).

3.1.3 Policies that supports greening of industries

In order to deal with the environmental impacts associated with industrial expansion during the recent years, the Green Industry initiative was launched and implemented by the Ministry of Industry on 4th May 2011, following up on a Memorandum of Understanding signed at the end of 2010 with the Board of Investment (BOI), Industrial Estate Authority of Thailand (IEAT) and other industrial institutes (Board of Investment, 2011). This project aims to promote sustainability for businesses; enhance competitiveness for Thai industries on the global stage and reduce tensions between the industrial sector and the surrounding communities. The green industry initiative concerns sustainability and environmentally friendly production. It helps foster communication with people living in the nearby communities and portray a better image for the industries. Under this initiative, the industries, particularly small and medium-sized enterprises, are urged to develop in a sustainable manner by following a five-step development plan. Those industries which can achieve all the five levels within the year 2014 will be awarded the Green Industry Mark (GI Mark).

The five levels of green industry development consist of Green Commitment, Green Activity, Green System, Green Culture and Green Network. Five steps of Green Industry Development are shown in Figure 20.



Figure 20: Five Levels of Green Industry Development
Source: Board of Investment (2011)



Details of the Green Industry Development levels are summarized below (Board of Investment, 2011). To achieve the first step, Green Commitment, enterprises must make a commitment to reduce their environmental impact and undertake internal communication to promote this. Once the factories or enterprises adopt specific activities which help reduce the environmental impacts, they will reach the Green Activity level. In order to achieve the Green System level, it is required enterprises put in place systems for environmental management, which is comprised of follow-up, assessment and review for continued development. Moreover, enterprises must obtain recognition or award for their work on environmental management. Next, at the Green Culture level, enterprises must ensure that members of their organization cooperate in creating environmental awareness, and that this becomes part of the organization’s culture. At the highest level, Green Network, enterprises must work on extending their environmental network, trying to ensure that their supply chains become green, or promoting green industry concepts and practices among their business partners or suppliers. Table 4 provides information on the number of factories at each level of Green Industry Development.

The Department of Industrial Works and the Board of Investment (BOI) have provided a number of rights and benefits to industries or enterprises that make investment in projects which reduce environmental impacts. However, they stipulate that a set of criteria must be met before these organizations are entitled to the rights and benefits. Table 5 summarizes the rights, benefits and criteria of the Department of Industrial Works and the BOI.

Table 4: Number of Enterprises at Each Green Industry Development Level

Green Industry Development Level	Number of Enterprises
Level 1	1,160
Level 2	225
Level 3	190
Level 4	6
Level 5	9
Total	1,581

Source: Ministry of Industry (2012)

Table 5: Rights, Benefits and Criteria of the Department of Industrial Works and the BOI

Rights, Benefits and Criteria of the Department of Industrial Works	
Rights and Benefits	Criteria
Annual fee exemption for 5 years	<p>The project must obtain ISO14001 (Environmental Management Standard) and OHSAS (Occupational Health and Safety Management System)</p> <ul style="list-style-type: none"> • The project must recycle the remaining materials or waste from factory to produce biogas as alternative energy. • The project must be able to recycle waste caused by production process (waste recovery).



Rights, Benefits and Criteria of the Board of Investment	
Rights and Benefits	Criteria
<ul style="list-style-type: none"> • Exemption of import duties on machinery • 8-year exemption of corporate income tax with no cap • 5-year 50% reduction of corporate income tax on net profit • Application must be submitted within December 31, 2012 	<p>The investment in activities related to energy conservation and alternative energy, eco-friendly materials and products shall be eligible.</p>
<ul style="list-style-type: none"> • Exemption of import duties on machinery • 3-year exemption of corporate income tax on the revenue of existing projects, accounting for 70% of the investment excluding cost of land and working capital • Application must be submitted within December 31, 2012 and projects must complete the implementation within 3 years from the date of promotion certificate issuance • Application of existing projects of all investment sizes under this measure shall be considered by BOI. 	<p>The existing projects (BOI or Non-BOI promoted projects) are eligible to apply for the rights and benefits where they must submit investment plan for machinery change to save energy, using alternative energy into the projects, or to reduce the environmental impacts by upgrading the machinery 1) to reduce energy consumption, 2) to use alternative energy at the stipulated ratio to the total energy consumption, and 3) to reduce environmental impact</p>

Sources: Department of Industrial Works and BOI Announcement as of April 30, 2011 cited in BOI (2011)

According to the Ministry of Industry, as of May 2012, there are 609 enterprises in Thailand that are classified as "Green Industry". Figure 21 provides information about geographical distribution of these enterprises, where each group represents a cluster of provinces in Thailand. Table 6 contains information about provinces that fall into each group.

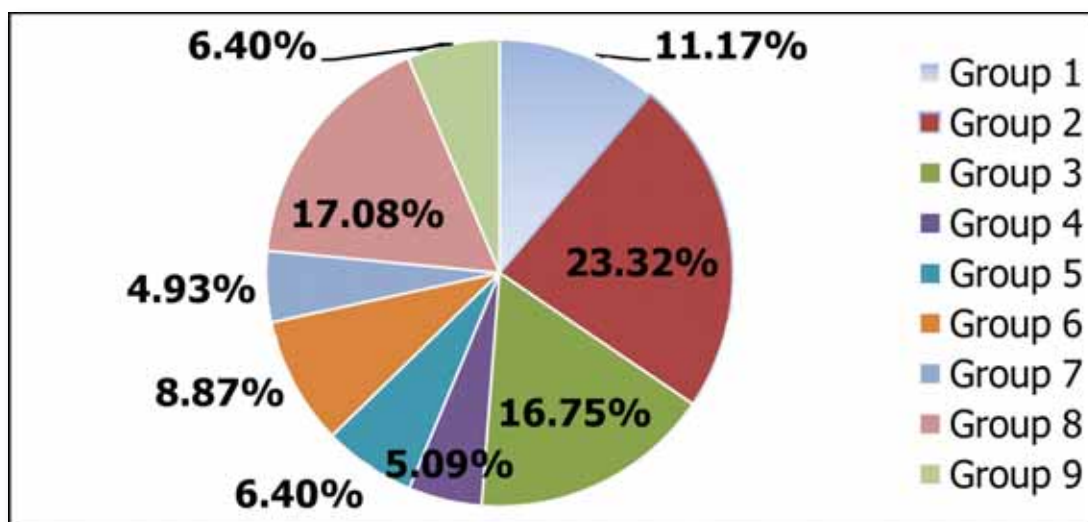


Figure 21: Geographical Distribution of Green Industry in Thailand
 Source: Ministry of Industry (2012)



Table 6: Breakdown of Provinces in Each Green Industry Group

Green Industry Group	Province	Number of Green Industry
Group 1	Nontaburi, Patumthani, Ayutthaya, Angthong, Lopburi, Singhaburi, Chainat, Saraburi	68
Group 2	Samutprakarn, Chonburi, Rayong, Chantaburi, Trad, Chachernsao, Prajeenburi, Nakorn-nayok, Srakaew	142
Group 3	Rachaburi, Karnjanaburi, Supunburi, Nakorn-pratom, Samutsakorn, Samutsongkram, Petchaburi, Prachuabkirikan	102
Group 4	Nakornsithammarat, Krabi, Pang-nga, Phuket, SuratThani, Ranong, Chumporn, Trang, Pattaloong	31
Group 5	Songkla, Satoon, Pattanee, Yala, Narathiwat	39
Group 6	Nongbualampoo, Konkaen, Udornthani, Lei, Nongkai, Maharakarm, Roi-ed, Kalasin, Sakon-nakorn, Nakornpanom	54
Group 7	Nakornratchasima, Buriram, Surin, Srisaket, Ubonratchathani, Yasotorn, Chaiyapum, Amnartcharoen	30
Group 8	Chiangmai, Lampoon, Lampang, Prae, Narn, Payao, Chiangrai, Maehongsorn,	104
Group 9	Utaradit, Nakornsawan, Utaithani, Kampaengphet, Tak, Sukhothai, Pitsanulok, Pichit, Petchaboon	39

Source: Ministry of Industry (2012)

3.1.4 Development of Eco-industries

With regards to the development of eco industries in Thailand, the Industrial Estate Authority of Thailand (IEAT) in collaboration with the German Technical Cooperation (GTZ), initiated the Development of Eco-Industrial Estate and Networks (DEE+ Net) Project in 2000, with the first phase of operation running between 2001 and 2004. The objectives of IEAT are to develop industrial estates under its supervision into eco-industrial estates and eco-industrial estate network. The ultimate goal of IEAT is to create a sustainable industrial network in Thailand. Under the DEE+ Net Project, five pilot industrial estates were selected to take part, comprising of the Map Ta Phut Industrial Estate, Northern Region Industrial Estate, Bangpoo Industrial Estate, Eastern Seaboard Industrial Estate and Amata Nakorn Industrial Estate (IEAT, 2012).

The goals of the DEE+ Net Project are as follows (IEAT, 2012). First, this project aims to reduce resource consumption, decrease environmental impact and improve environmental quality. It also aims to upgrade the quality of life of the community and minimize negative impact of the industrial operation on the community. Third, the project aims to enhance business success through reduced raw material costs, decreased energy consumption and minimized waste treatment and disposal expense. The ultimate goal of the DEE+ Net Project is to achieve an optimum use of resources so that no waste is generated and no negative impact on the environment results. Table 7 summarizes the tasks completed by the working groups at each of the five pilot industrial estates.



Table 7: Five Pilot Industrial Estates

Pilot Industrial Estates	Completed Tasks
1. Map Ta Phut Industrial Estate	Implemented pilot activities by displaying the Eco-Forum, Eco-Plant/Eco-Industry, Eco-Industrial Estate, and Eco-Networking
2. Bangpoo Industrial Estate	Implemented a pilot 'Industrial Estate Clean & Clear' activity by adopting environmental management tools such as Cleaner Technology, Green Productivity, EMS/ISO14001 and PREMA
3. Northern Region Industrial Estate	Implemented the 'Waste Management Center' by focusing on added value and waste exchange. Established the 'Eco-Center' as an information source on the Eco-Industrial Estate, a venue to exhibit value-added or processed products made from by-product waste and a permanent location for the Eco-Forum conference or seminar.
4. Eastern Seaboard Industrial Estate	Implemented integrated water management with a pilot project on the use of 'Constructed Wetland' treatment system to enhance the quality of treated wastewater discharged into the reused water production system, employing a process similar to the production of piped water.
5. AmataNakorn Industrial Estate	Implemented the 'Workforce Service Center', offering skill training and service network development for both industrial operators and the public.

Source: IEAT (2012)

3.1.5 Other Policies Related to Greening of Industries

We begin by considering the eleventh NESDP (2012-2016), followed by the Thai Government's industrial policies. The industrial development strategies outlined in the eleventh NESDP emphasize the utilization of science, technology, innovation and creativity as fundamental factors for restructuring the industries. The industrial development strategies also support the development of eco-towns, which are areas where urban planning and environmental management tools are applied to pursue synergies in resource utilization, waste management, environmental preservation and promotion of industrial and



economic development. It is emphasized that urban planning must integrate cultural, social and ecological aspects. In the eco-towns, the local residents, the industries and other commercial activities optimize their resource use by practicing recycling. This includes internal recycling (within the manufacturing process of the industries), inter-industries recycling and recycling between industries and residents. The other industrial development strategy is to utilize science, technology and innovation in value creation which helps enhance Thailand’s competitive edge, to improve the productivity and efficiency of production in order to prepare for a transition toward a low-carbon and environmentally friendly economy and to comply with the international requirements and standards.

Next, we describe the policies related to the greening of industries implemented by the Government under Prime Minister Yingluck Shinawatra. This set of policies helps enhance the competitiveness of the Thai industrial sector through an increase in productivity and efficient use of energy, which in turn help Thai enterprises to save costs and upgrade the quality of their products to meet international standards. The Government encourages the private sectors to engage in research and development (R&D) and commercialization of innovations. This involves focusing on adopting an environmentally-friendly technology with high productivity, cleaner production, waste minimization, pollution prevention, energy efficiency and providing benefits for neighboring communities. To facilitate the value creation through the use of cutting edge technology in industrial production and product designs, the government is committed to provide an enabling environment through the provision of appropriate infrastructure and incentives through the use of taxes and subsidies to promote energy saving and utilization of renewable energy and clean technology in the industrial sector.

In addition to the broad policies of the government and the Ministry of Industry other related agencies have also implemented policies to promote the greening of industrial sector. Table 8 summarizes the Ministry of Industry’s policies for promoting greening of industries, how the policies were implemented and the responsible government agencies.

Table 8: Other Implemented Policies Related to Greening of Industries

Policy	How the Policies were Implemented	Line Agencies in Change of Implementation
1. Encourage both private and public sectors to conduct research and development (R&D) in environmentally-friendly technology, reusing of inputs, biodegradable materials, etc.	1.1 Encourage the small and medium industries to embrace and implement energy-saving policies. 1.2 Encourage the manufacturers to internalize the environmental impacts resulted from their business operations and follow the concept of corporate social responsibility. 1.3 Encourage the transfer of knowledge on environmentally-friendly technology. 1.4 Encourage efficient utilization of water within the factories. 1.5 Encourage the small and medium enterprises (SMEs) to develop the environmental management system (EMS).	Department of Industrial Works



Policy	How the Policies were Implemented	Line Agencies in Change of Implementation
2. Impose stringent controls and regulations on waste, air, water, odor and noise pollutions, which are by-products of production and consumption.	2.1 Reduce the emissions of Volatile Organic Compounds (VOCs), sulfur dioxide (SO ₂) and nitrogen oxides (NO _x) within the industrial estates and reduce the releases of these substances into the non-industrial estate areas. 2.2 Reduce the amount of wastewater, solid and hazardous wastes generated in the industrial estates. 2.3 Promote community awareness on industrial pollution and its effects. 2.4 Encourage the recovery and re-utilization of industrial wastes, which reduce the amount of wastes entering landfills. 2.5 Encourage the transfer of environmentally-friendly technology in the recycling and reusing of 7 types of wastes to the manufacturers, including computer wastes, used mobile phone, automobile tires, plastic wastes, wood wastes, steel dregs and dusts.	Department of Industrial Works and Department of Primary Industries and Mines
3. Encourage the energy-efficient and environmentally-friendly production process	3.1 Improve production efficiency, which results in a reduction in the amount of energy use and emissions of pollutants. 3.2 Encourage manufacturers to set up their production plants and facilities in the industrial estates that provide good basic infrastructure and put in place effective pollution control system.	Board of Investment of Thailand

Source: Ministry of Industry and authors' own compilation

3.2 Energy Sector

3.2.1 Energy Conservation

The government has implemented measures to support energy conservation since the Energy Conservation and Promotion Act (ENCON Act) B.E. 2535 was initiated. In 1992, the Energy Conservation Promotion Fund (ENCON Fund) was established to support implementation of the ENCON Act. The ENCON Fund has been the key financing mechanism for the Thai Government in supporting energy efficiency and development of renewable energy (World Bank and NESDB, 2011). The source of funding for the ENCON Fund is a petrol sales tax with inflows of about US\$200 million per year (DEDE, 2010). The financial supports provided by the ENCON Fund are monitored under the framework of the Energy Conservation Plan. Three phases of the Energy Conservation Plan have been completed with Phase 1, Phase 2 and Phase 3 covering periods of 1995-1999, 2000-2004 and 2005-2011, respectively.

Some information about the content of the specific measures under these energy conservation plans are summarized in Table 9.



Table 9: Energy Conservation Measures – Content

Energy Conservation Measures	Content
1. Provision of financial support to the designated factories and buildings in preparing energy saving plans	Under this measure, energy-intensive factories and buildings must appoint an energy manager to recommend and implement energy conservation measures. Yet, this measure achieved limited success due to the lack of incentive among the designated buildings and factories to materialize the planned investments since there were neither mandatory targets for achieving energy saving nor penalties for not achieving them.
2. Appliance standards	Thailand has implemented appliance energy efficiency standards and labeling programs, including mandatory energy performance standards, voluntary high energy performance standards and voluntary energy performance labeling.
3. Provision of tax incentives for energy saving (fiscal measures)	Import duty exemption for energy efficient equipments and investment incentives were introduced by the Board of Investment. Through the Energy Efficiency Revolving Fund, tax rebates, grants and subsidies for demonstration projects and soft loans were granted.
4. Building codes	The first building code was issued in 1995, and was subsequently revised in 1997. Yet such building code achieved limited success, possibly due to a lack of differentiated standards and weak enforcement. In 2010, the new building code was promulgated, requiring new buildings to be designed with energy efficiency as a cornerstone of the construction.

Source: World Bank and NESDB (2011), pp.36-37

The current strategic plan in place for energy conservation is the Twenty-year Energy Efficiency Development Plan (EEDP) (2011-2030). This plan is used as a guideline for long-term energy conservation in different economic sectors. The target of EEDP is to decrease energy intensity and final energy by 25% from 2005 to 2030, or 20% from the business-as-usual case, equivalent to 30,000 tons of oil equivalent (ktoe) in 2030 (World Bank and NESDB, p.40). Table 10 provides a summary of Thai Government’s energy efficiency policy measures to achieve the EEDP.



Table 10: Thai Government’s Energy Efficiency Policy Measures to Achieve EEDP

Compulsory Regulations	Voluntary and Market-based Measures
<ul style="list-style-type: none"> • Enforcement of the new ENCON Act • Mandatory labeling and Mandatory Energy Performance Standards for electric appliances • Energy efficiency portfolio standards for large industries with a penalty for noncompliance and financial incentives for exceeding the target 	<ul style="list-style-type: none"> • Voluntary agreements with large energy consumers • Voluntary labeling • Mass transit and efficient logistics • DSM bidding • Subsidies for reducing peak load under Standard Offer program • Expanding energy service company (ESCO) Fund • Cost-effective energy pricing • Fiscal incentives
Awareness Raising and Capacity Building	Technology and Innovations
<ul style="list-style-type: none"> • Educating the public on eco-driving • Promoting a low-carbon society and economy agenda • Building capacity for human resources and professionals • Strengthening public and private organizations for planning, regulating, and promoting energy efficiency policies and measures 	<ul style="list-style-type: none"> • Increasing research, development and deployment

Source: World Bank and NESDB (2011) and DEDE (2011)

3.2.2 Promotion of Renewable and Alternative Energy

Thailand has been relying on fossil fuels, particularly oil, as its primary supply of energy (International Energy Agency, 2009). Figure 22 shows the share of Thailand’s total energy supply in 2009. To reduce costly environmental degradation and expensive long-term lock-in effects, this trend needs to be changed, with roles of oil, natural gas and coal being streamlined and the role for renewable energy increased (World Bank and NESDB, 2011).

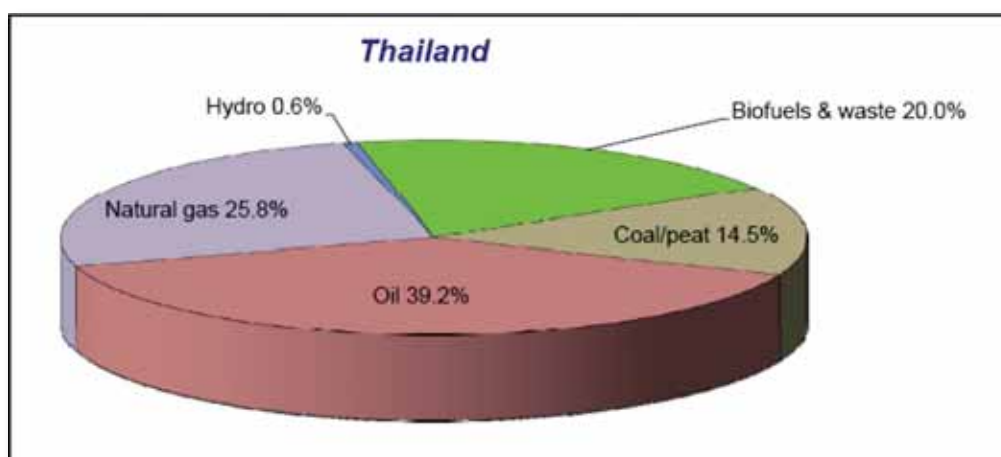


Figure 22: Thailand's Share of Primary Energy Supply
 Source: International Energy Agency (2009): IEA Energy Statistics

To scale up the use of renewable energy, the government puts in place the Renewable Energy Development Plan (REDP), which aims at achieving 20% of final energy demand from renewable energy by 2022. This target can be decomposed into four key components: (i) renewable energy for heating (biomass, municipal solid wastes, and solar); (ii) natural gas vehicles; (iii) biofuel (ethanol, biodiesel, and hydrogen); and (iv) renewable energy for power. Table 11 shows the potentials and targets for renewable energy in Thailand.

Table 11: Renewable Energy Potentials and Targets

Type of Energy	Potential MW	Existing MW	2008-2011		2012-2016		2017-2022	
			MW	ktoe	MW	ktoe	MW	Ktoe
Electricity		1,750	3,273	1,587	4,191	1,907	5,608	2,290
Solar	50,000	32	55	6	95	11	500	56
Wind Energy	1,600	1	115	13	375	42	800	89
Hydro power	700	56	165	43	281	73	324	85
Biomass	4,400	1,610	2,800	1,463	3,220	1,682	3,700	1,933
Biogas	190	46	60	27	90	40	120	54
Municipal Solid Waste	400	5	78	35	130	58	160	72
Hydrogen			0	0	0	0	3.5	1
Thermal		3,007		4,150		5,582		7,433
Solar Thermal	154	1		5		17.5		38
Biomass	7,400	2,781		3,660		5,000		6,760
Biogas	600	224		470		540		600
Municipal Solid Waste		1		15		24		35
Biofuel (mlt/d)			6.00	1,755	9.84	2,831	13.50	3,986
Ethanol (mlt/d)	3.00	1.24	3.00	805	6.20	1,686	9.00	2,447
Biodiesel (mlt/d)	4.20	1.56	3.00	950	3.64	1,145	4.50	1,415
Hydrogen (mill kg)			0	0	0	0	0.01	124
Total energy consumption		66,248		70,300		81,500		97,300
Total Energy from RE (ktoe)		4,237		7,492		10,319		13,709



Type of Energy	Potential MW	Existing MW	2008-2011		2012-2016		2017-2022	
			MW	ktoe	MW	ktoe	MW	Ktoe
Renewable energy ratio		6.4%		10.6%		12.7%		14.1%
NGV (mmscfd-ktoe)		108.1		3,469		5,260		6,090
Total energy from renewable energy + NGV (ktoe)				10,961		15,579		19,799
Alternative energy ratio (percent)				15.6		19.1		20.3

Source: Department of Alternative Energy Development and Efficiency (DEDE)

According to the World Bank and the NESDB (2011), the REDP is divided into 3 phases, with different focuses on each phase. Table 12 summarizes the content of three phases of the REDP.

Table 12: Three Phases of the Renewable Energy Development Plan (REDP)

Phase	Focus
Phase 1 (2008-2011)	Funding proven renewable energy technologies and the high-potential renewable resources
Phase 2 (2012-2016)	Promoting the renewable energy technology industry, supporting new renewable energy prototype development and encouraging new technologies in biofuel production, developing the green city model and strengthening local energy production
Phase 3 (2017-2022)	Promoting economically and financially viable new renewable energy technology, and promoting Thailand as the Association of Southeast Asian Nations (ASEAN) biofuels and renewable energy technology export hub

Source: World Bank and NESDB (2011), p. 58 and Ministry of Energy (2009)

Table 13 shows the increasing trend in the consumption of renewable energy during the period of 2008-2010.

Table 13: Alternative Energy Consumption 2008-2010p

Unit: ktoe

Alternative Energy	2008	2009	2010 ^p
Electricity (Solar, Wind, Hydro, Biomass, Waste and Biogas)	253	282	304
Heat (Solar, Biomass, Garbage and Biogas)	3,306	3,557	4,463
Biofuel (Ethanol and Biodiesel)	602	798	804
Total	4,161	4,637	5,571
(Natural Gas for Vehicle : NGV)	654	1,260	1,550
Grand total	4,815	5,897	7,121
(Final Energy Consumption)	65,890	66,698	71,125
Percentage of Alternative Energy Consumption	6.3	7	8
Percentage of Alternative Energy Consumption (Including NGV)	7.3	8.8	10

Remark: P = data as of 27th December 2010

Source: Department of Alternative Energy Development and Efficiency



In 2010, the Power Development Plan (PDP) 2010-2030 was introduced. This plan describes the decisions of the electricity industry on the type of fuel used in electricity generation. According to the PDP, electricity will be generated from natural gas and coal, cogeneration power plants, combined cycle power plants, hydropower plants, purchasing of renewable power and power program abroad. The plan also provides a guideline to use nuclear energy in the generation of electricity to serve increasing demands for energy.

In addition, the Department of Alternative Energy Development and Efficiency and the Electricity Generating Authority of Thailand (EGAT) support R&D on alternative energy at the industry and community level. Table 14 summarizes the current R&D supports for each type of renewable energy including biomass, biogas, wind energy, and solar energy. In addition, there is continuous R&D support for other alternative energy sources, such as hydropower in villages, geothermal energy, wave energy, hydrogen energy, tidal energy, wave energy, and fuel cells.

Table 14: Summary of the current R&D supports

Type of Energy	Current R&D Supports
Biomass	<ul style="list-style-type: none"> • Thermal generation from biomass • Electricity generation from biomass and wood residues • Biomass generation from agricultural residues
Biogas	<ul style="list-style-type: none"> • Electricity and thermal generation from wastewater of starch, food, beverages, palm oil, paper and rubber industries • R&D in biotechnology
Wind energy	<ul style="list-style-type: none"> • Electricity generation from wind energy • Identifying potential locations for installing wind turbines • Building models for water pumping wind mills that are suitable for wind speed
Solar energy	<ul style="list-style-type: none"> • Electricity generation from solar energy • Using solar cells for recharging batteries in the villages without electricity connection. • Encourage small enterprises in the generation of solar energy • R&D in solar energy

Source: Department of Alternative Energy Development and Efficiency (DEDE) and authors' own compilation

The average budgets allocated by DEDE for R&D, pilot projects, and training for renewable energy is 600 million baht per year during 2010-2012 (DEDE, 2012). Table 15 provides some examples of projects funded by DEDE during 2010-2012.



Table 15: Examples of Projects Funded by DEDE

Year	Project
2010	Installation of the solar cells power generation system for the 10 rural schools
	Promotion of energy production from the municipal solid waste
2011	Study project and installation of the wind turbine for power generation (capacity < 250 KW)
	Promotion project on the use of high efficiency biomass stove and cooking stove
	Project on hydropower generation at a community level
	Promotion project on solar hot water generation by hybrid system
2012	Project on reduction of production cost of commercial biodiesel plant
	Project on increase of efficiency of demonstration, and promotion of energy conservation and renewable energy

Source: Department of Alternative Energy Development and Efficiency (DEDE) (2012)

There are different financial measures to support energy conservation and the promotion of renewable energy technology (Sutabutr, Choosuk and Siriput, 2010).

Tax incentives through the Board of Investment (BOI)

The Board of Investment granted duty-free import of machinery and 8-year corporate income tax holiday to enterprises related to energy conservation, renewable energy and production of environmentally friendly products. The additional privileges include 50% reduction of corporate income tax on net profit for five years after the expiry of tax holiday, i.e. during the ninth to the thirteenth year, as well as a deduction from net profit the costs associated with facility installation and construction costs, but not exceeding 25% of investment capital in addition to deduction for depreciation.

Investment grants through the Ministry of Energy

Investors can apply to the Ministry of Energy for investment for a grant for design, consultant and partial investment to support three types of renewable energy projects, namely biogas projects, municipal waste projects and solar hot water projects. The maximum amount of investment grant is around 10% to 30% for biogas, 25% to 100% for municipal waste and 30% for solar hot water, with a maximum cap at 50 million Thai baht per project.



Funds under the ENCON Fund

The Energy Efficiency Revolving Fund and the Energy Service Company (ESCO) Fund are the two featured funds under the ENCON Fund. Details of each Fund are provided below (World Bank and NESDB, 2011).

- Energy Soft Loan through the Energy Efficiency Revolving Fund

The Energy Efficiency Revolving Fund provides credit lines to 11 participating Thai banks at zero interest. The requirements stipulated by the Revolving Fund are that the interest rate be no more than 4%, a repayment period of no more than seven years and the maximum loan size of 50 million Thai baht. In the circumstance whereby the projects require finance of over 50 million Thai baht, the commercial banks will also provide their own funds to cover the remaining amount. It is important to note that the loan repayment flows back to the ENCON Fund and not the Revolving Fund. During 2003-2010, the Energy Efficiency Revolving Fund has supported over 335 energy efficiency projects and 112 renewable energy projects, with the estimated total energy saving of over US\$154 million per year and the average payback period of approximately three year (World Bank and NESDB, 2011, p.78).

- ESCO Fund

The ESCO Fund was established in 2008 by the Ministry of Energy with the intention of addressing the need for start-up capitalization of energy service companies. The initial capitalization from the ENCON Fund was US\$30 million. Through the ESCO Fund, the government funds were used to co-invest with private developers. The ESCO Fund can provide equity investment, venture capital, and credit guarantees; facilitate equipment leasing; and support project development (World Bank and NESDB, 2011). The Energy Conservation Foundation of Thailand and the Energy for Environment Foundation were selected as the managers for the ESCO Fund, with the key tasks of ensuring that funding from the ESCO Fund is used to support investment in clean energy, renewable energy, energy efficiency and building retrofit projects (Energy Conservation Foundation of Thailand, 2012). As of April 2010, the ESCO Fund has supported 26 projects, mostly those related to investment in renewable energy, resulting in 32,000 tons of oil equivalent (ktoe) energy saved, or US\$18 million per year (World Bank and NESDB, 2011).

Feed-in tariff

The Department of Alternative Energy Development and Efficiency (DEDE) has implemented the feed-in tariffs, with the objective of promoting private investment in renewable energy. To provide an incentive to small power producers (10MW to 90MW) and very small power producers (under 10MW) so that the commercial viability of their renewable energy projects is enhanced, the Adder Program provides additional tariffs. Table 16 provides a summary of the Adder Program for small power producers and very small power producers.



Table 16: Thailand’s Adder Program for Small Power Producers and Very Small Power Producers

Types of Renewable Energy	Current Adder (Baht/kWh)	Additional for Diesel Substitution (Baht/kWh)	Additional for RE generators in the 3 southern provinces (Baht/kWh)	Period (year)
1. Biomass				
- Installed Cap <=1MW	0.50	1.00	1.00	7
- Installed Cap > 1 MW	0.30	1.00	1.00	7
2. Biogas (all sources)				
- Installed Cap <=1 MW	0.50	1.00	1.00	7
- Installed Cap > 1 MW	0.30	1.00	1.00	7
3. Waste (municipal waste and non-toxic industrial waste)				
- Fertilizer/landfill	2.50	1.00	1.00	7
- Thermal process	3.50	1.00	1.00	7
4. Wind				
- Installed Cap <=50 kW	4.50	1.50	1.50	10
- Installed Cap > 50 kW	3.50	1.50	1.50	10
5. Hydro (mini/micro hydro)				
- Installed Cap(50-200 kW)	0.80	1.00	1.00	7
- Installed Cap < 50 kW	1.50	1.00	1.00	7
6. Solar				
	6.50	1.50	1.50	10

Source: World Bank and NESDB (2011, p.58) and Energy Regulatory Commission (2011)

3.3 Transport Sector

The transport sector constitutes a large part of Thailand’s final energy consumption (World Bank and NESDB, 2011). According to World Bank (2009), the high level of transport energy intensity in Thailand results from the high level of motorization, heavy dependence on road transport, and a lack of fuel economy standards. Road transport dominates the transport mode and contributes to three-quarters of energy consumption in the transport sector. Moreover, the majority of vehicles in Thailand use diesel, and fuel economy standards are not applied to gasoline- or diesel-powered vehicles (World Bank and NESDB, 2011).

The EEDP of the Ministry of Energy also contains measures related to the transport sector. Provided that the transport sector has the greatest room for energy savings, accounting for 44.3% of the EEDP target (World Bank and NESDB, 2011). The potential energy savings in the transport sector could be achieved through improvement of fuel efficiency of vehicles. Examples of ways to improve fuel efficiency of vehicles include fuel economy standards, car labeling, eco-driving, and through a modal shift to public transport.

The Ministry of Industry and the public sector also support electric car and vehicles that use alternative energy such as NGV, biodiesel, and ethanol. As a part of the Biodiesel Action Plan, there has been support for the utilization of biodiesel in vehicles by enlarging palm oil cultivation areas up to 2.5 million Rai. The



biodiesel from plant residue and Jatrophais produced and consumed at the community level. Under the Gasohol Action Plan, to meet the increased demand for gasohol in vehicles, the Thai Government provided a strategy to support the production of sugar cane and cassava without expanding the cultivation areas. To encourage the greater use of gasohol, excise taxes and oil fund taxes, were reduced or waived, causing the prices of gasohol and E20 to become cheaper than benzene. To expand the use of Natural Gas for Vehicles (NGV) in vehicles, the automobile manufacturers have been encouraged to increase the number of NGV cars from 10,000 cars in 2005 to 500,000 cars in 2010, and increase the number of service stations to 740 stations.

Working with the Ministry of Energy to conserve energy in the transport sector, the Ministry of Transport and Communications established the Transportation and Traffic System Development Plan, which spans the period of 2011-2030. The main goal of such a plan is to support energy saving and environmentally friendly transportation in two ways. The first way is to change the mode of transportation from road transport to rail and water transport by developing infrastructure and providing services to make it more convenient and practicable for users. The second approach is to support and develop energy-saving and eco-friendly technology, and encourage the use of non-motorized mode of transport such as walking, biking, as well as more access and usage of the public transportation system.

There has been support for the manufacturing of eco-cars, which are cars with Euro4 emission standard, emit less than 120 grams of CO₂ per kilometer, with UNECE Reg.94. Rev.0 and UNECE Reg.95. Rev.0 safety standards, with engine size not exceeding 1,300 cc for benzene and not exceeding 1,400 cc for diesel, and with fuel consumption not exceeding 5 liters per 100 kilometers. At present, there are five eco-car manufacturers that have received supports from the Board of Investment. Table 17 provides a summary of Thai eco-car manufacturers.

Table 17: Thailand's Eco-car Manufacturers

Eco-car Manufacturer	Capital (million Thai Bahts)	Production Capacity	Start Date
Nissan Motor (Thailand) Co., Ltd.	5,550	120,000 / year	2010
Honda Automobile (Thailand) Co., Ltd.	6,700	120,000 / year	2010
Suzuki Motor (Thailand) Co., Ltd.	9,500	200,000 / year	2010
Mitsubishi Motors (Thailand) Co., Ltd.	7,731	200,000 / year	2010
Toyota Motor (Thailand) Co., Ltd.	6,642	100,000 / year	2011

Source: Thailand Automotive Institute (2011)

3.4 Agricultural Sector

The policies to promote greening of the agricultural sector are linked to the two strategic plans under the eleventh NESDP, namely improving productivity of agricultural production and conserving natural resources and environment. The three key green policies in agriculture are (i) promoting efficient use of fertilizer; (ii) organic farming, and (iii) soil and water conservation. Several government agencies have



embraced these policy agendas and developed their own plans under these three policy pillars. Table 18 summarizes the policies for promoting environmentally-friendly agriculture developed by each government agency.

Table 18: Green Agricultural Policies

Government Agency and Ministry	Green Agricultural Policy
Ministry of Agriculture and Cooperatives	Promoting organic farming
Land Development Department	Conservation of soil and water for enhancing productivity and contributing toward sustainable agricultural production
Department of Agriculture and Department of Agricultural Extension friendly agriculture developed by each government agency.	Encouraging a reduction in the use of fertilizer in agricultural production; promoting good agricultural practices (GAP), which leads to certification of agricultural products

Source: Interview with the Secretariat of the Office of Agricultural Economics

In what follows, we discuss in greater details each of the green agricultural policies outlined in Table 18, along with commenting on the employment and prospects for green jobs in agricultural sector as a result of these policies.

3.4.1 Organic farming

Organic farming puts emphasis on avoiding the use of chemicals in agricultural production and processing (including weeding and cultivating), improving and maintaining soil fertility with organic matters, and maintaining ecological system in the farm. With reduced reliance on machinery and chemicals, organic farming is very labor-intensive as it usually requires additional manpower than under the conventional systems.

The existence of organic farming in Thailand resulted from two key forces.⁷ First, the Alternative Agriculture Network (AAN) was established in the 1980s as a result of collaboration between farmers and NGOs to foster sustainable agriculture activism in Thailand and respond to the excessive use of agro-chemicals and economic pressure. The AAN provides a forum for discussion, experience sharing and policy advocacy for organic farming in Thailand. The second force is related to the increased awareness among the Thai consumers in health and environment, especially in healthy diets, during 1990-1991. The increased interests among Thai consumers in organic products had caught attention of a number of government agencies, causing them to become more interested in developing the domestic markets for organic agricultural products. As a result, some distribution centers for organic agricultural products were established, such as Health Products Center in Songkla Province and Im Bun Health Products Center in Chiangmai Province (Department of Agricultural Extension, 2012).

The development of Thai organic farming occurs in two streams (Green Net, 2012). The first stream is oriented toward rural development, with farmers and NGOs as the key stakeholders, and the second stream is oriented toward business and commercial purposes. The key objectives of the first stream include provision of support to small-scale farmers so that they can adopt sustainable farming practices, which would help

⁷ Sources: Thai Organic Trade Association, Green Net and Department of Agricultural Extension



improve their livelihood and agro-ecological conditions in the areas in which they live. The strategies used to achieve such objectives put emphasis on raising farmers' awareness on the negative impacts of agro-chemicals. Due to limited success achieved through these strategies, some NGOs had revolutionized the strategies by incorporating market-based incentive and, through the revised strategies, the local organic certification bodies were founded to provide inspection and certification services. The new approach has proven to be more effective as more Thai farmers have participated in the organic farming initiative.

With regards to the second stream, the key stakeholders are local entrepreneurs who have linkages or connections with the overseas markets. They saw the emerging organic market as a business opportunity so they started to engage the local researchers and government agencies in helping them convert the local Thai farmers to adopt organic farming practices. During the early periods, the pioneers were mostly large-scale companies with export facilities; however, when the domestic market for organic products emerged, more small-scale businesses and entrepreneurs started to come into the picture.

Although the development of Thai organic farming has gone through both up and down periods⁸, in general, Thai organic agriculture has been growing quite steadily, with the growth fueled by the expansion of export opportunities. In 2002, domestic certification for organic agricultural products "A.C.T." was launched and operated by Organic Agriculture Certification Thailand, an agency that was accredited by International Federation of Organic Agriculture Movements (IFOAM). The other factor that fueled the growth of organic farming in Thailand was the emergence of retail business that specializes in natural foods, organic products and macrobiotics foods, such as Lemon Farm Shop. The large-scale retailers, such as Tops Supermarket, Foodland, Imporium and Siam Paragon, also started to sell organic products (Thai Organic Trade Association, 2012).

In 2005, organic farming was put on the national agenda, and the Organic Farming Development Strategic Plan for the period 2006-2011 was implemented. At present, the Ministry of Agriculture and Cooperatives is preparing the new strategic plan for promoting organic farming in Thailand.

When it comes to assessing the progress of nation-wide implementation of organic farming, a clear picture still cannot be drawn. By referring to the fertilizer utilization and chemical fertilizer import statistics, it appears that the demands for fertilizer are still on the rise. We, therefore, refer to the organic farming database administered by the Land Development Department and the Office of Agricultural Economics. In 2011, there were 634,950 farmers who participated in the organic farming trainings. Among these participants, 3,767 farmers obtained organic farming certification, which comprise of 2,080 rice farmers, 1,670 vegetable growers and 17 aquaculture farmers (Sources: Land Development Department and Office of Agricultural Economics).

3.4.2 Soil and water conservation

Soil and water conservation also constitute important parts of the environmentally-friendly agricultural policies. The objectives of these policies are to conserve, rehabilitate and improve soil and water resources to be a safe agricultural production base and enhance agricultural productivity.

In 2002, the Land Development Department initiated the training for volunteer farmers to become local 'soil doctors' by providing them with knowledge on land development as a basis for sustaining livelihoods, particularly enhancing soil fertility and agricultural productivity whilst promoting long-term sustainability. After

8 See Green Net (2012) for chronology of key events related to evolution of organic farming practices in Thailand.



the training, the accredited volunteer soil doctors started providing their services in their own communities. In 2011, the total number of volunteer soil doctors in Thailand was 77,501 (Land Development Department, 2012). These are the types of jobs that are created under the soil conservation program.

3.4.3 Good Agriculture Practice (GAP)

Thailand has adopted the good agricultural practice (GAP) for on-farm agricultural production to assure safety and quality of fresh fruits and vegetables, rice, fishery and livestock produce. The core concept of GAP revolves around pesticide uses, production process, post-harvest handling, on-farm stocking and transportation of produce. The certification is divided into 3 levels: food safety, food safety and free of pests, and food safety, free of pests and quality. According to the Department of Livestock Development, as of March 2011, there were 13,706 livestock farmers who received GAP certification. For fresh fruits, vegetables and other plants, the data from the Department of Agriculture as of February 2012 shows that, there are 82,020 farmers who already obtained GAP certifications.

3.5 Service Sector

The service sector is a substantial component of the Thai economy, both in terms of its contribution to aggregate production and its stakes in national employment. According to Table 19, the share of service sector in Thailand's GDP in 2010 is 33.2% and the employment in the service sector accounts for 23.9% of the country's labor force. The service sector include the financial sector, education, hotels and restaurants. We scope our analysis to only two sub-sectors, namely the financial sector and hotels.

Table 19: Structure of Thai Economy in 2010

Sector	GDP by Sector (%)	Labor Force by Sector (%)
Agriculture	8.3	43.3
Manufacturing	40.0	13.0
Wholesale and retail trade	13.3	15.1
Construction and mining	4.4	4.8
Services	33.2	23.9

Remark: Service sector includes financial sector, education, hotels and restaurants

Source: Bank of Thailand (Based on data from National Economic and Social Development Board (NESDB) and National Statistical Office (NSO))

3.5.1 Hotel Industries

Hotels in Thailand are becoming increasingly aware of the impacts of their operation on the environment. They have adapted their operations to become more environmentally friendly. Some examples of the green initiatives include waste minimization, waste recycling, energy and water saving schemes, beach cleanups, utilization of biodegradable products, and support for several local initiatives, such as Mangrove Forest Conservation. These greening schemes are perceived as win-win strategies as getting involved in these activities help raise environmental awareness, at the same time, saving the hotels' valuable natural and financial resources.



Recognizing the ongoing efforts to achieve environmentally friendly operations and collaboration between hotels in Thailand, the Board of Environmental Promotion of Tourism Activities (BEPTA) established a certification program called “Green Leaf Program” that certifies those hotels according to the level of their efficiency in managing energy, the environment and other natural resources. This program supports promotion of environmental awareness and educates hotels so that they are capable of identifying problems, and addressing concerns about the environment in hotels. The “Green Hotels Fair and Seminar” was organized 5 regions across the country and over 1,000 hotels have accepted and adopted this practice under the program, the hotels receive widespread recognition both at national and international level, and the certification from The Green Leaf Program may be an influential factor among consumers and travel agents in their choice of hotels.

Supported by the International Labor Organization (ILO) and Japan Multi-bilateral Program, the Greener Business Asia Project initiated a pilot training program for hotels in Thailand. This program equipped the workers and management in the hotel industry with the tools and knowledge resources they need to establish mechanisms of cooperation to jointly create positive changes in their workplaces and enterprises. Collectively, the participants, ranging from hotel owners to workers in the housekeeping departments, explored options to improve the efficiency of hotels’ resource uses and address environmental problems in hotel operations (International Labor Organization, 2011). The emphasis was placed on energy, water and waste management.

3.5.2 Financial Sector: Banking

Some commercial banks in Thailand reduce the carbon footprint from their normal banking activities by launching online banking and mobile banking, providing other alternatives in addition to branch-and paper banking. These create a number of positive impacts on the environment, such as less paperwork, less mail, less visit to the branch offices, increased efficiency and profitability of banks due to reduction in costs that result from paper costs and bulk mailing fees. Moreover, the existence of online and mobile banking lessens the needs for expensive branch banks and customer service representatives. However, employment in the banking sector will potentially be affected. Many existing jobs, particularly in the branch offices, such as tellers or customer service representatives, will need to be transformed to prevent job loss. This implies changes in work methods and retraining. At the same time, some green jobs will be created. Call center constitutes an important part of the operation of mobile banking and this can offers employment prospects. More people need to be recruited to work as customer services representatives in these call centers.

In addition, the other green strategies embraced by commercial banks involve building more energy-efficient branches and implementing energy-efficient operational procedures. Some Thai commercial banks were awarded the Green Building status because their office buildings were designed and constructed in a manner consistent with environmental standards, such as the Leadership in Energy and Environmental Design (LEED) or the Thailand Energy and Environmental Assessment Method (TEEAM). For instance, the Chaeng Wattana Building of K Bank was recognized as green building (K Bank, 2012). Its architecture concept involves energy-saving and environmentally sustainable characteristics. The exterior glass of the Chaeng Wattana Building is insulated and laminated, a new technology preventing heat from entering the building. To reduce electric light use and increase ventilation to assist the standard air conditioning system, the interior of the building has been designed with the concept of openness to allow more natural light to



enter the building. The entire building is comfortably cool and consumes less energy. To save even more energy, all of the building's electric lights are energy-saving LEDs.

The other green aspect embraced by some Thai commercial banks is related to lending in environmentally-sensitive industries. In 2011, the International Finance Corporation (IFC) in collaboration with the Thai Banker s' Association (TBA) aimed to spread the international practice in environmental and social risk (E&S) management among the Thai financial institutions. Under this scheme, banks should raise their client s' awareness on the win-win mechanism when clients apply E&S standards in developing projects and help evaluate projects and support clients in pursuing E&S standards (IFC, 2011).

Last but not least, at present, some Thai financial institutions have been working with Thai enterprises to promote investment in green industries, renewable energy or socially responsible investment. They have provided loans for environmentally friendly projects, particularly promoting energy conservation and the development of alternative energy resources. The loan programs initiated by these financial institutions provide funding resources or working capital for projects or schemes involved in energy conservation, improving efficiency of energy consumption, use of alternative energy, renewable energy or clean energy, pollution reduction to conserve the environment, and improvement or renovation of a business establishment site, building construction, machinery and equipment. Table 20 contains examples of Green Loans initiated by Thai financial institutions.

Table 20: Green Loan Initiatives of Thai Financial Institutions

Financial Institution	Loan Type	Purpose	Interest Rate
1. Krungthai Bank	KTB – Green Loan	<ul style="list-style-type: none"> - Invest in pollution control - Use to invest in energy saving projects, clean or renewable energy projects. 	<ul style="list-style-type: none"> - Term loan: for year 1-2, MLR-1% and after year 3, MLR - Revolving loan: not less than MOR
	KTB – Energy Saving	<ul style="list-style-type: none"> - Use for the construction or improvement of building or factories to allow for energy saving - Use for the development of renewable energy 	MLR per year
	KTB – Environment Loan	<ul style="list-style-type: none"> - Use in the set-up of treatment system for air pollution or wastewater 	2 - 3%
2. Kasikorn Bank (K Bank)	K-Energy Saving Loan	<ul style="list-style-type: none"> - Support energy efficiency and renewable energy projects 	4% per year
	K-Green Hotel Loan	<ul style="list-style-type: none"> - Invest in wastewater treatment, waste management, and water saving - Invest in environmental management 	Not exceeding MLR-1.5% per year



Financial Institution	Loan Type	Purpose	Interest Rate
	K-Energy Saving Guarantee Program	<ul style="list-style-type: none"> - To support investment in projects related to energy management and improving energy efficiency through Energy Service Company (ESCO). - To provide guarantee for energy saving obtained from the investment projects. 	
3. TMB Bank	Energy Saving and Renewable Energy Loan	<ul style="list-style-type: none"> - To support the enterprise in saving the energy costs through implementation of energy saving and renewable energy projects. - To provide advice to enterprise about investment in appropriate technology. 	4 % per year
4. Bangkok Bank	Bualuang Green Loan	<ul style="list-style-type: none"> - To support investment in energy-saving projects, improve efficiency of energy consumption and produce environmentally friendly products. 	MLR per year or less than this

Source: Krungthai Bank, K Bank, TMB Bank and Bangkok Bank

3.6 Building Sector

Policies to support environmentally-friendly resources in the building sector under the Energy Consumption Strategy of the Ministry of Energy include the green building initiative, conservation of energy in public and private buildings, and equipment supports for energy conservation.

The main objectives of the green building initiative is to enhance the efficiency of resource utilization, both inside and outside buildings, including efficient uses of energy, water and environmentally-friendly construction materials. The Thailand Green Building Council developed Green Building evaluation systems, which are based on the following criteria: location, efficiency of water use, energy use, construction material use, quality of air, light and air flow. Participation in the green building initiative is voluntary, depending on the enterprise's own decision.

According to Sreshtaputra (2012), green buildings movement in Thailand comprise of the following key components:

- Building Energy Code (1995): cover overall thermal transfer value, roof thermal transfer value, lighting power density, cooling efficiency
- New Building Energy Code (2009)
- Environmental Impact Assessment (EIA) (Ministry of Natural Resource and Environment): cover large residential project (4,000 square meters) and large commercial complex (10,000 square meters), wastewater, garbage, and green area



- Thailand Energy Awards (Ministry of Energy): cover large buildings and non-residential buildings, new building and retrofitted building, and green building
- Number Five Electrical Appliances (EGAT): cover air conditioner, light bulb, refrigerator, portable fan, insulation and glass used in buildings
- Thai Green Building Institute: TREES Rating System
- Pollution Control Department: Green Government Building
- Green Label Program (Thai Environment Institute): cover paint, water closet (WC) and water faucet

The four key green building assessment tools in Thailand include Thailand Energy and Environmental Assessment Method (TEEAM), Pollution Control Department (PCD), Thai Green Building Institute (TGBI) and Leadership in Energy and Environmental Design (LEED). At present, there are 23 buildings in Thailand that are under the LEED assessment scheme, with 7 buildings being certified. Examples of buildings in Thailand currently under the LEED program include Energy Complex (LEED CS V2.2), Kasikorn Bank (LEED V2.2 NC); Park Venture (LEED CS V2009); Thai Health Promotion Office (LEED NC V2.2) and HSBC – BMA Library (LEED NC V2009) (Virulrak, 2011).

To date, the Association of Siamese Architects under the Royal Patronage of His Majesty the King (ASA) awarded the ASA Green Award to the following green buildings that passed the assessment: Electricity Generating Authority of Thailand; the Avenue building, Rachayothin; Bank of Thailand; K bank, Chaeng Wattana; Samui International Airport; Interface Modernform; Buddha Kodon Temple; Economic Department Building, Kasetsart University and Bangkok University's Museum.

4. Policies for Green Jobs

4.1 Policies for Promoting Employment: An Overview

We begin by providing some background on the general employment or labor policies. First, we describe the labor policies of the Government under Prime Minister Abhisit Vejjajiva. We then discuss the labor policies of the government under Prime Minister Yingluck Shinawatra and the labor development strategies under the eleventh NESDP.

4.1.1 Government's Labor Policies under Prime Minister Abhisit Vejjajiva (2008-2011)

On 30th December 2008, Prime Minister Abhisit Vejjajiva presented the labor policy to the National Assembly, which included the following policy statements.

1. Provide protection for both formal and informal labor according to Thai labor standards, especially in work safety, healthy working environment and conditions of employment, by encouraging business establishments to be certified in accordance to international standards on management of labor rights and protection.
2. Reform and strengthen the social security system by ensuring independent and transparent administration, and extend the coverage of health insurance to the insured's children and spouses in case of illness, and increase other benefits for the insured.



3. Develop and train all levels of workers to broaden their knowledge and skills with standards that meet technological changes and market demand by enhancing the training capability of labor skill development institutes and centers across the country. This can be done by mobilizing participation of the private sector in the forms of 'schools within factory', and integrating the efforts of public and private educational institutions.
4. Promote employment of Thai workers abroad in jobs that offer them dignity and decent quality of life. The roles of the Government include offering loans for going to work overseas, skills and language training, and monitoring and protect Thai workers against exploitation whilst working abroad.
5. Support welfare of workers, by establishing a work safety institute, setting up day-care centers in business establishments, and increasing the capability of the Workmen's Compensation Fund in providing care for workers injured due to their work; organize a welfare system for informal labor; and promote a tripartite labor relationship system to create good relationships among employees, employers and the public sector.
6. Manage the employment of foreign labor to respond to the needs of the manufacturing sector without affecting employment of Thai labor and national security. This can be done by categorizing the types of work permissible to foreign workers, systemizing foreign labor import, eliminating the problem of illegal foreign workers, and introducing a system for effectively regulating and monitoring foreign labor.
7. Encourage employment of senior citizens and persons with disabilities by providing various types of employment that are suitable to their capacities.

4.1.2 Government's Labor Policies under Prime Minister Yingluck Shinawatra (2011-Present)

On 23rd August 2011, Prime Minister Yingluck Shinawatra presented the labor policy to the National Assembly, which included the following policy statements.

1. Enable those labors who wish to work in the formal sector to conveniently access job information, at the same time encourage employers to obtain information on job seekers at every level, as well as enable those who seek work in the informal sector to choose jobs and work under appropriate conditions.
2. Provide protection for labor according to Thai labor laws, especially on work safety and welfare, as well as provide job security.
3. Promote a labor relations system for all parties involved to be able to address any labor relations issues efficiently, fairly and lawfully.
4. Increase social security benefits so those under the scheme could adequately access healthcare, as well as improve and expand the coverage of the scheme to entice informal sector workers to join the scheme.
5. Upgrade non-skilled labor to semi-skilled labor and semi-skilled labor to skilled labor through cooperation between the public and private sectors, with the aim of making Thailand a country that utilizes a wholly skilled labor force.



6. Prepare for the free movement of skilled labor under the 2015 ASEAN Community with priority given to an effective foreign worker management system, facilitation, supervision and monitoring of inflows and outflows, to attract skilled labor into the country, while preventing the effects of unskilled labor entering the country.
7. Establish appropriate measures to regulate the inflow of foreign labor, while considering the labor needs of the private sector as well as the peace and security of the country.

4.1.3 Development Strategies on Labor under the Eleventh NESDP

In dealing with a fast-changing, complicated and unpredictable environment, a set of development strategies related to labor are designed. Key human resource development strategies are as follows.

The core of human resource development aims at increasing labor's resilience for change. Skills for lifelong learning need to be developed, focusing on knowledge, innovation, and creativity, in order to be capable of working in various jobs over a lifetime, relevant to the changing labor market conditions. Workers should be instilled with the values of social responsibility, respect for the law, human rights, environmentally friendly production and consumption, and learn to cope appropriately with climate change and disasters (National Economic and Social Development Board, 2011).

For labor in the agricultural sector, the youth, new generations and skilled labor should be encouraged to engage in agriculture. They should be equipped with appropriate skills necessary for working with new technology. Skills and potentials of students in vocational education need to be developed and boosted to meet the market demand. In addition, regional economic partnership on human capital development and labor migration needs to be created. This will be pursued through accelerating the cooperation of international labor standards, and facilitating regional labor mobility. Support will be given to Thai entrepreneurs in undertaking investment abroad, especially in neighboring countries. In addition, protection of the rights and interests of Thai people and labor abroad will be provided.

4.2 Interaction between Policies: Greening of the Industry and Green Job Policies

During the transformation of industries towards a low-carbon, greater efficiency in the use of resources (i.e. energy, water and materials), and less waste and pollution in the industrial sectors in response to policies that promote greening of industries, this opens up green employment opportunities in a variety of fields. The green jobs that result from such transformation span a wide array of skills, educational backgrounds and occupational profiles.

In Thailand, green jobs, identification of green skill needs, and green skill development are mainly carried out by entrepreneurs, representatives of private sector (such as Federation of Thai Industries) and some government agencies not directly responsible for labor policies (such as DEDE and the Ministry of Industry) (see Section 4.3 for information on green skill development). In the private sector, the identification of the skill needs has been done by employers or establishments through in-house R&D on raw materials, process and products. The training courses are then designed and provided to staff to upgrade their skills so that they can operate with new skills. According to Rojvithee (2010), the trend of Thailand on green skills and green jobs can be found in the automotive industry, construction industry, refrigerating and air-conditioning industries and the production and application of alternative energy. For the public sector, the identification of skills needed is included in the proposed projects on alternative energy – production of



biofuel, installation and maintenance of wind turbine energy, and solar power generation – for operation and for the training courses for staffs who will operate the projects' new technology.

Despite the efforts and initiatives in the private and public sectors outlined above with regards to green jobs, there is still no integrated national plan and policy at national level on green jobs. This could be attributed to the lack of database on green skills and green jobs as well as the absence of government agency directly responsible for green jobs. Nevertheless, according to Smiti (2012), three departments under the Ministry of Labor are responsible to three aspects related to green jobs, namely the Department of Skill Development (green job training); the Department of Employment (green job placement); and Department of Labor Protection and Welfare (green working standards).

With regards to green job training, the Department of Skill Development provides and facilitates green trainings, which comprised of pre-employment training and workplace training (Section 4.3 provides more details on green training courses offered by the Department of Skill Development). To promote incentive for green training, tax incentives have been provided through the Skill Development Promotion Act 2002. Details of tax exemption or tax privileges for human resources development and training under the Skill Development Promotion Act 2002 are as follows. This Act grants a 100% exemption on corporate income tax from actual training expenses in academic or training institutes specified by the Ministry of Finance, and a 100% exemption on corporate income tax from actual expenses from in-house training as approved by the Ministry of Labor.

With regards to green jobs placement, the Department of Employment organizes such placement and provides work permits for experts in green technology or industries to facilitate transfer of knowledge.

Finally, the Department of Labor Protection and Welfare ensures and promotes satisfactory labor standards which incorporate both decent jobs and green jobs. Moreover, the Department also raises awareness for both employers and employees on the important connection between green jobs and environmental sustainability.

In addition to the three departments within the Ministry of labor that are proactively involved in green jobs promotion, there has been a proposal to establish a “National Green Skills Office” at the Ministry of Labor. The core activities that aim to be undertaken by the National Green Skills Office include the following.

1. Organizing training for National Green Skills Office staffs to equip them with knowledge on methodology, necessary tools and technology.
2. Analyzing, prioritizing and assessing expectation for green skills development for Thailand.
3. Encouraging close cooperation between Thailand and other countries in the development of good practices in green skill development.
4. Proposing policies, action plans and budgets necessary for the establishment of the National Green Skills Office.
5. Launching the pilot projects.
6. Raising awareness on green jobs and green skill development amongst the senior officials in Senate, Ministries, financial institutions, Chamber of Commerce and officials at the operational level in both public and private sectors.



7. Developing and operating the information system for green skill development, which may include data collection, development of database, reporting system and follow-up procedures.
8. Recommending the establishment of the National Green Skills Office.
9. Designing appropriate curriculum for green skills development.
10. Launching a National Green Skills website.
11. Organizing relevant activities to promote green skills development in Thailand and the region.

4.3 Programs for Promoting Green Skills

4.3.1 Identification Skill Gaps and Shortages in Thai Industries

According to the eleventh NESDP (2012-2016), to enhance Thailand's competitive edge and reduce threats to the country's development, Thailand needs to shift its position toward that of a technology creator. To this end, research and development of science and technology are the key driving forces. The production system should be revamped, changing from a dependence of natural resources, capital and cheap labor with low productivity, to focus on knowledge, science and technology with high productivity. To support these changing and evolving landscapes, the eleventh NESDP focuses on human resources development, aiming at increasing workers' resilience for changes. The emphasis on lifelong skill development is placed on knowledge, innovation and creativity. People will be instilled with the values of social responsibility, environmentally friendly production and consumption and learn to cope appropriately with climate change. Despite embedding concerns for environmentally friendly production in human resources development, there are no clear or specific skill development strategies in response to greening and green jobs; instead, the focus is more on promoting workers' skills and competencies in science and technology.

Even though Thailand's production structure is moving towards being more technology intensive, the shortage of skilled labor could pose a critical barrier, obstructing the promotion of innovations and movement toward the global technological frontier (World Bank, 2008). According to the outcome of the Thailand Productivity and Investment Climate Survey (2007), firms in the private sector have identified the issue of skilled labor shortage as the barrier in fostering science and innovation in Thailand. Table 21 summarizes the data on time to fill job vacancies in Thailand, classified by industry and type of enterprise. For the skilled production worker (primarily refer to skilled technicians involved directly in the production process), small enterprises and enterprises in the auto components industry take longest time to fill job vacancies, while for the professional worker (trained and certified specialists such as engineers), medium-sized firms and firms in the furniture industry take the longest time to fill job vacancies.

According to World Bank (2008), over 40% of firm managers who participated in the PICS 2007 survey reported that vacancies arise because many applicants lack the basic or technical skills that firms require. Information technology (IT) skills and creativity/innovation skills are skills that firm managers feel their current workers do not possess at a satisfactory level (World Bank, 2008, p.55). Shortages of capable staff can have both short-term and long-term implications. In the short-term, the inability to find sufficient competent and experienced workers could imply that firms could operate below full capacity, while in the long-term, the shortage of capable staff could limit a firm's effort to enhance productivity.



Table 21: Time to Fill Job Vacancies in Thailand, by Industry and Enterprise Type

	Professional Worker	Skilled Production Worker	Unskilled Production Worker
National Average (weeks)	7.4	5.2	2.2
By Industry (weeks)			
Auto components	7.6	6.0	1.9
Electrical appliances	7.1	4.4	2.1
Electronic components	6.6	3.8	1.8
Food processing	6.8	4.0	2.7
Furniture	10.1	5.1	2.1
Garments	8.2	5.3	2.2
Machinery	8.0	5.3	2.2
Rubber and Plastics	6.1	5.5	2.1
Textiles	7.2	5.4	2.2
By Enterprise Type (weeks)			
Small	6.9	5.4	2.4
Medium	7.9	4.9	2.0
Large	7.0	5.3	2.0

Source: Thailand PICS 2007 and World Bank (2008)

4.3.2 Green Skill Development Programs

Following the identification of the lack of labor with adequate technical skills and competencies, the question that arises is what programs are in place for promoting green skills? In the case of Thailand, the developments of green competencies and skills have been executed by line ministries, business establishments and representatives of private enterprises.

First, the Bureau of Energy Human Resource Development within the Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy has organized training courses, aiming at promoting green skills. Table 22 contains information on these training programs.



Table 22: Training Courses Offered by DEDE

Training Course	Course Composition
1. Training Courses on Energy Management for Efficient Energy Conservation in Factory and Building	1.1 Electricity Management Course 1.2 Thermal Energy Management Course 1.3 PRE Course in Designated Building 1.4 PRE Course in Designated Factory 1.5 Basic Course for Energy Operators/Staffs in the Designated Factory (4 th year) 1.6 Energy Conservation in Factory and Building 1.7 PRE Course: Ordinary 1.8 PRE Course: Senior 1.9 Energy Conservation by Practice 1.10 ESCO Project Administration in Thailand 1.11 Energy Manager Course 1.12 Monitoring and Assessment of Energy Consumption 1.13 Energy Audit and Establishment of Energy Conservation Plan and Target
2. Training Courses on Energy Technology for Energy Conserving Material, Equipment and Machinery	2.1 Air Conditioner Control 2.2 Energy Savings and Steam Boiler Maintenance in Factory 2.3 Energy Savings and Air Compressor Maintenance in Factory 2.4 Energy Audit in Large Air Conditioner for Energy Conservation 2.5 Supporting the Knowledge and Advice on Operation and Maintenance of Equipments in Government Buildings
3. Courses on Energy End-Use System by Designated Factory Classifications	3.1 Energy Conservation in Food Industry 3.2 Energy Conservation in Textile Industry 3.3 Energy Conservation in Ice making Plant
4. Training Courses on Energy End-Use System by Categories of Designated Building	4.1 Energy Conservation in Hotel 4.2 Energy Conservation in Hospital 4.3 Energy Conservation in Office Building and Department Store
5. Training at Educational Institutes (Training for Teachers/Lecturers)	5.1 Electricity Conservation Course for Vocational Instructors 5.2 Thermal Energy Conservation Course for Vocational Instructors 5.3 Training Project on Energy Conservation in Factory/Building for the Final Year Student in Bachelor Degree 5.4 Energy Management for Vocational Education

Source: Energy Conservation Technology Center, Training Division and Rojvithee (2010)



Second, the Ministry of Industry in collaboration with the Department of Skill Development organized training courses for industries, industrial establishments and SMEs on green curriculum. For the purpose of illustration, we refer to the training program that is related to the reduction of chlorofluorocarbon (CFC) and substitute the use of CFC by other substances. This training program resulted from a partnership between the Department of Skill Development, the Department of Industrial Works and United Nations Environment Program (UNEP). The aims of this training program were to help those providing repairing and maintenance services for refrigerator and automobile air-conditioning system so that the usage of CFC is reduced. Table 23 provides a summary on participation in this training program.

Table 23: Workplace Training Program – the Reduction of Chlorofluorocarbon (CFC)

Service Provided	Participation by Service Operators	Participation by Mechanics
Automobile air-conditioning system	3,052	3,889
Refrigerator	1,734	3,110

Source: Smiti (2012)

Third, the Ministry of Tourism and Sports organized various training courses on eco-tourism (Rojvithee, 2010). Under such courses, the villagers are trained about concept of eco-tourism, environmental protection, ecology of the surrounding villages, etc. before setting up a green long-stay village. Various skills related to eco-tourism include tour guiding, tour operating, being an environmentalist, a wildlife and environment conservationist and hotel management skills.

Next, the Federation of Thai Industries also offer training courses on clean technology, the application of Value Engineering (VE) approach in energy conservation, and various environmental standards, i.e. ISO 9000, ISO 14000 and Industrial Standard 18000. In addition, the Institute of Industrial Energy under the Federation of Thai Industries also offers in-house training courses for experienced staffs of industrial establishments to equip them with energy conservation knowledge so that they can transfer such knowledge to other staff members in the organizations. The ultimate aim is to promote sustainable and efficient energy conservation within the industries. The in-house training courses offered by the Institute of Industrial Energy include energy conservation in factory, self-assessment on energy efficiency utilization, energy saving based on the value-engineering (VE) approach, energy conservation in steam boiler, energy conservation in air-conditioning and refrigerating systems, energy conservation in pumped, motored and compressed air system, electricity cost saving in factory, and energy conservation in food, textile, steel, ceramic and general industries. These in-house training courses lasts only one day and have a minimum enrollment requirement of 30 participants. Upon completion of these trainings, the trainees will be awarded the certificate of training completion. [Source: Institute of Industrial Energy, the Federation of Thai Industries] During 2008-2011, the total number of in-house trainings organized by the Industrial Environment Institute under the Federation of Thai Industries is 168. Figure 23 provides the annual figures for the number of participants enrolled and took part in the trainings during 2008-2011.



Figure 23: Number of Participants in the Trainings Organized by the Federation of Thai Industries during 2008-2011

Source: The Industrial Environment Institute, the Federation of Thai Industries

In addition to the in-house training courses, the Institute of Industrial Energy, in cooperation with Japan External Trade Organization (JETRO) and the Energy Conservation Center, Japan (ECCJ), launched the Project on Establishment of Sustainable System for Practical Energy Efficiency and Conservation Promotion in Thai Industries (ESPEC) (two phases). The outputs and outcomes from the first phase (January 2007 – March 2009) are summarized in the following table.

Table 24: Outputs and Outcomes of the ESPEC Project – Phase 1

Outputs of the Project	Outcomes of the Project
<ol style="list-style-type: none"> 1. Creation 26 factory specialists <ul style="list-style-type: none"> - 19 specialists from 8 factories - 7 specialists who registered with the Institute of Industrial Energy Conservation 2. Collaboration with different agencies <ul style="list-style-type: none"> - Electricity Generating Authority of Thailand (EGAT) - The Energy Conservation Center of Thailand - King Mongkut's University of Technology Thonburi - Energy Research Institute, Chulalongkorn University - Metropolitan Electricity Authority 3. Production of two factory evaluation manuals for food and textile industries to be disseminated to SMEs, factories, etc. 4. Implementation of 32 energy conservation measures 	<ol style="list-style-type: none"> 1. The value of energy saving is approximately 11,377,000 Thai bahts per year, and the amount of energy saving is approximately 1.1 ktoe per year. 2. Increase the number of factory specialists

Source: The Institute of Industrial Energy, the Federation of Thai Industries

Fifth, the Electric and Electronics Institute in collaboration with the Department of Skill Development (DSD) provides training for DSD instructors on new technology and the application of the green substance in the refrigerant and refrigerator (Rojvithee, 2010). This training also aims to building capacity for workers in the electrical and electronic industries to solve the labor shortage and the rapidly changing technology.



This capacity building project contains 5 programs, consisting of curriculum development, issuing and updating content of skill standards in this field, instructors training, upgrading training for workers in new technologies and establishing a wage database system for workers in this industry (Rojvithee, 2008).

Lastly, at the local or community level, the NGO Border Green Energy Team (BGET) has proactively provided hands-on technology training and financial supports to village innovators in ethnic minority areas on both sides of the Thai-Burma border (Rojvithee, 2010). Moreover, the mission of BGET is to implement renewable energy and sustainable technologies – solar electricity, micro-hydro, bio-digesters, solar cooking, and water purification method – and also demonstrate how these technologies are integral in improving livelihoods (BGET, 2012). The following table provides information about the training courses delivered to villagers by BGET.

Table 25: Training Courses Offered by BGET

Training Course	Course Description	Output
Thai Solar Home Systems	Teaching about proper operation and maintenance and ensuring the proper removal and recycling of dead batteries	Trained over 300 Karen village leaders in 2 districts in Tak province on Solar Home System
Refugee Camp Trainings	Providing training on renewable and sustainable energy technologies: hydraulic ram pumping, micro-hydro power system, solar electricity, solar-powered water pumping, and solar cooking	n.a.
Community Micro-Hydro Systems	Helping rural communities in building and sustainably operating micro-hydro systems	Constructed and operate 7 micro-hydro systems
Refugee Camp Hybrid Power Systems for Computer Centers	Providing hands-on trainings on a variety of appropriate technologies (e.g. hybrid solar/diesel systems)	n.a.
Medical Clinic Solar Power Systems	Providing solar power systems and the necessary expertise to operate and maintain the systems for border medical clinics	Provided over 60 solar electric systems to ethnic medical clinics
Community Biogas System	Helping the rural communities to build and sustainably operate bio-digesters	Built and operate over 4 bio-digesters
Community Hydraulic Ram Pump System	Helping rural communities pump a constant water supply and deliver water to their village	n.a.

Source: Rojvithee (2010, p. 29) and BGET (2012)



5. Perception and Discourse

Given that the issue of green jobs has just started to gain ground in Thailand, there is not yet active public or policy debate on this issue. Thus, in this subsection, we provide background on what these key actors, who have been involved in the public or policy debates related to the promotion of green economy, are currently saying and how they are involved in green growth strategies for Thailand.

We begin by discussing the policy statements from the eleventh NESDP and the policy statements of the current government related to green economy to present the government discourses. We then discuss the existing institutional arrangements in Thailand, i.e. the current government agencies that are involved in the promotion of green economy and their responsibilities.

The eleventh NESDP (2012-2016) emphasizes the utilization of science, technology, innovation and creativity as fundamental factors for restructuring the industries. The industrial development strategies also support the development of eco-towns, which are areas where urban planning and environmental management tools are applied to pursue synergies in resource utilization, waste management, environmental preservation and the promotion of industrial and economic development. It is emphasized that urban planning must integrate cultural, social and ecological aspects. In the eco-towns, the local residents, the industries and other commercial activities optimize their resource use by practicing recycling. This includes internal recycling (within the manufacturing process of the industries), inter-industries recycling and recycling between industries and residents. The other industrial development strategy is to utilize science, technology and innovation in value creation which helps enhance Thailand's competitive edge, to improve the productivity and efficiency of production to prepare for a transition toward a low-carbon and environmentally friendly economy and to comply with the international requirements and standards.

The policy statements related to green economy presented by Prime Minister Yingluck Shinawatra include the followings. First, the government emphasizes the protection and conservation of natural resources, including forests, marine and coastal resources. The government also focuses on reducing air pollution, waste, waste water and noise pollution arising from production and consumption as well as enhancing the environmental impact assessment processes. Third, the government also encourages activities to reduce greenhouse gases with the aim of making Thailand transition into the low-carbon society with an appropriate balance of industrial development and environmental conservation. The government enhances public awareness and consciousness on natural resources and the environment by disseminating information and encouraging changes in behavior towards production and consumption of environmentally-friendly products and services. The government also calls for a development in the knowledge base on natural resources and environmental management through research and development of knowledge at the local and international levels, as well as encouraging the use of resource and environmentally friendly technologies.

To see how the above government's discourses and policy statements are implemented, it is useful to consider the existing institutional arrangements in Thailand at both national policy-making and sectoral levels (World Bank and NESDB, 2011). At the national policy-making level, the Office of the Prime Minister is responsible for the overall regulation of climate change management in Thailand. The National Economic and Social Development Board (NESDB) is responsible for medium-term National Economic and Social Development strategies. The Office of Natural Resources and Environmental Policy (ONEP) is responsible for overall coordination of the national climate change policy and planning. The Ministry of Finance Fiscal



Policy Office is responsible for fiscal policies, including taxes on motor vehicles and fuels, and the to-be-introduced environmental taxes. Table 26 provides information on the current institutional arrangement at the national policy-making level.

Table 26: Government Agencies and their Responsibilities in Green Economy Promotion

Government Agencies	Responsibilities
1. Office of the Prime Minister (OPM)	OPM is responsible for overall regulation of climate change management in Thailand
2. National Economic and Social Development Board (NESDB)	NESDB is responsible for developing the medium-term National Economic and Social Development Strategies. In the eleventh NESDP, transitioning to green and low-carbon society has been embedded into the national development strategies.
3. Ministry of Natural Resources and Environment (MONRE) and Office of Natural Resources and Environmental Policy (ONEP)	ONEP developed the National Strategy for Climate Change Management (2008-2012) for Thailand. This strategy was adopted in 2008. ONEP is responsible for overall coordination of national climate change policy and planning.
4. Thailand Greenhouse Gas Management Organization (TGO)	TGO is an autonomous governmental organization which is responsible for promoting low-carbon activities, investing and marketing on greenhouse gas emission reductions, establishing information center for greenhouse gas, reviewing CDM projects for approval (Designated National Authority for CDM office in Thailand) and promoting low-carbon activities.
5. Ministry of Finance (MOF)	The Fiscal Policy Office within the MOF is responsible for fiscal policies including excise taxes on motor vehicles and fuels and the environmental taxes which are in the pipeline.

Source: World Bank and NESDB (2011); TGO's website

At the sectoral level, various agencies are involved and should be responsible for setting policies and strategies to green the economy, including the Ministry of Agriculture, the Ministry of Energy, the Ministry of Industry, the Ministry of Science and Technology, and the Ministry of Transport. Table 27 provides information on the government agencies in the transport and energy sectors.



Table 27: Current Responsibilities of Government Agencies in Transport and Energy Sectors

Government Agencies	Responsibilities
Energy	
National Energy Policy Council (NEPC)	NEPC is responsible for setting national policies and strategies on energy and promoting energy conservation and management of the Energy Conservation Promotion Fund (ENCON Fund)
Ministry of Energy (MOEN)	MOEN is responsible for promoting energy conservation based on the Energy Conservation Promotion Act (1992), the Fifteen-year Alternative Energy Development Plan and long-term energy intensity and energy efficiency targets.
Energy Policy and Planning Office (EPPO)	EPPO is responsible for implementing voluntary energy conservation programs and promotion of natural gas vehicles for transportation.
Department of Alternative Energy Development and Efficiency (DEDE)	DEDE is responsible for energy efficiency promotion, energy conservation regulation, development of alternative energy and dissemination of energy technologies. It also oversees the Energy Efficiency Revolving Fund and the ESCO Fund.
Transport	
Ministry of Transport (MOT)	MOT has increasingly focused on national transport strategy on sustainable transport including reducing energy consumption while improving efficiency in the transportation system.
Bangkok Metropolitan Administration (BMA) and Local Administrative Organizations (LAOs)	BMA and LAOs in major cities have developed policies and plans to improve urban transport to be more sustainable, with focus on mass transit.

Source: World Bank and NESDB (2011), pp.72-73

In addition to the main responsibilities and agenda of the Government agencies with regards to green economy, “sufficiency economy” has also constituted a part of the government discourses. This philosophy has been integrated into the national strategies for development, starting from the ninth NESDP (2002-2006), and it has been emphasized in the eleventh NESDP (2012-2016). The concept of sufficiency economy was formulated by His Majesty King Bhumibol Adulyadej of Thailand and is based on the principles of moderation, reasonableness and self-immunity. It provides the communities, corporations and governments a set of tools and principles which help them in managing globalization by making wise decisions that promoting sustainable development, equity, and resilience against shocks (UNDP Thailand, 2012).

For communities, this principle is fundamental to empowerment and building resilience. The UNDP report entitled “Thailand Human Development Report 2007: Sufficiency Economy and Human Development” provides names of some communities developing long-term self-help schemes such as



savings groups, revolving credit lines, and local safety nets, organizing with other communities and moving towards sustainable economic activity to build immunity to outside shocks. For private businesses, the sufficiency economy principle encourages firms – both large and small – to focus on sustainable profit, to adhere to an ethical approach to business, to pay special attention to their employees, to respect nature, to have careful risk management, and to grow where possible from internal resources (UNDP report, 2007). For governments, this principle is central to alleviating poverty, promoting good governance, and guiding macroeconomic policies to immunize against shocks. The governments should support communities in their own self-help schemes, conserve the environment, promote sustainable development, and maintain a stable macroeconomic course that minimizes risks (UNDP report, 2007).

In the public sector, transitioning to green and low-carbon economy has started to become embedded into the eleventh NESDP, the government discourses, responsibilities and agenda of different government agencies at both national and sectoral levels. However, it has not yet successfully been integrated into the national policies for development (Jarusombat and Nutmon, 2002). Political instability leads to lack of policy continuity. Politicians rarely use green and environmental policies in election campaign. These policies are never used as the policy showcases for the government. As a result, there is a lack of the ‘big push’ for environmental policies, and a small budget has been allocated to support them. The other important issues that need to be highlighted are as follows. First, the implementation of environmental and green policies is usually based on top-down approach, lacking participation by local communities. Second, there is a lack of coordination between government agencies in implementing these policies, together with a poor enforcement of the existing environmental laws.

Next, we discuss what the private sector has done with regards to promoting of green economy (Jarusombat and Nutmon, 2012). Currently, some firms in the private sector have adapted and changed the way they conduct their businesses, making them more socially and environmentally responsible. We provide here some examples of actions already been taken by firms in the private sector that are conducive to the greening of the economy. First, after the Rio Summit, the Thailand Business Council for Sustainable Development (TBCSD) was established in 1993 consisting of representatives from 32 leading business organizations (Holliday et al., 2002). TBCSD operates as a non-profit group aimed at promoting sustainable development. The Green Label scheme, initiated by the TBCSD, provides certification for products that are shown to have minimum detrimental impacts on the environment. In addition to its engagement in the Green Label Scheme, TBCSD projects and activities also involve capacity building, advocacy and awareness, such as the renovation project for Klong Lod and the environmental management plan for the community of Koh Kret (Bunyagidj, 2007). Second, the Thailand Network of Eco-efficiency and Cleaner Production (TNEC) was founded in 1999. TNEC has approximately 700 members from various professions.

Green activities, projects and schemes initiated by the private sector in Thailand can be broadly grouped into 3 categories (Jarusombat and Nutmon, 2012). The first category comprises of activities in response to laws or regulations, consisting of, for examples, the Enhancement and Conservation of National Environmental Quality Act (B.E. 1992) and the Hazardous Substance Act (B.E. 1992). All organizations are required to comply with these laws. The Second is referred to as voluntary schemes with supports from the public sector. This scheme includes Clean Development Mechanism (CDM), Green Label Scheme (Ministry of Industry), Energy Efficiency Labeling No.5 Program, Green Building, Green Leaf Hotel Program, Green Procurement Program, Certification for Environmental Standard (ISO14001), etc. The third category includes schemes and activities that were initiated by the private sector. The activities in this category



include development of environmental management system, investment in cleaner technology, greening of the supply chain, green packaging, CSR projects (ISO26000), etc.

Thirdly, we discuss the existing position of Thai citizens with regards to the greening of the economy. At present, the general Thai public still lacks awareness about the benefits of preserving the environment and ecological system despite the recent movements by some green consumer groups and green voters, which constitute quite a small minority.

Fourthly, the academic institutions in Thailand have also been involved in the areas of green economy. Academic researchers from a number of these institutions have contributed opinions and perceptions in different meetings and seminars on green economy. Moreover, some of these academic institutions and grant bodies have supported academic research on green economy. Table 28 provides some examples of green economy related research that has been undertaken in Thailand.

Table 28: Examples of Academic Research Projects on Green Economy in Thailand

Name of Research Project	Academic Institution
Carbon footprint and management of rice products for carbon label to promote low-carbon economy for climate change mitigation	Department of Environmental Science, Kasetsart University
Roadmap for environmental technology in the context of Thailand	Department of Engineering, University of the Thai Chamber of Commerce
The Study on Greenhouse Gas Accounting for Thailand	King Mongkut's University of Technology Thonburi
Thailand's Climate change policies in the context of sustainable development and low-carbon economy	SeaStart, Chulalongkorn University

Source: Authors' Own Compilation

The non-governmental organizations (NGOs) have also engaged in the greening of Thai economy. Representatives from these organizations have shared opinions in different forums, seminars and workshops on green economy. Moreover, some of these NGOs have supported and initiated green projects. The Good Governance for Social Development and the Environment (GSEI) supports the project on "Institutional Preparation and Capacity Building for Thailand's Adoption of Clean Development Mechanism". The Bio Thai Foundation promotes organic farming as well as encourages Thai farmers to use organic fertilizers and insecticides instead of using chemical ones. Thai Beverage Carton Group educates and enhances awareness among the general Thai public to separate the used beverage cartons before disposing.



6. Action-oriented Conclusion on Green Economy and Green Job

6.1 Green Agenda and the Existing Political Strategies and Discourse

In order to examine the extent and possibility in which the green economy agenda can be linked or integrated into existing political strategies, it is important to begin by discussing the key discourses and political strategies. The current government is prioritizing populist policies, especially policies to raise people's standard of living by enhancing purchasing power and alleviating their difficulties as a result of inflationary pressure (Policy Statement of the Council of Ministers: Prime Minister Yingluck Shinawatra, 2011). The urgent policies implemented by the government contain both social security and poverty alleviation dimensions, including the reduction of the general public's burden of purchasing essentials such as their first house or first car; provision of monthly allowances for senior citizens; an increase in the minimum wage to THB300/day and provision of assistance to low-income earners in tackling households' debts. These policies have been framed in the existing discourses.

Although transitioning to the low-carbon and green society has been incorporated into the eleventh National Economic and Social Development Plan (NESDP) and strategic plans of related government agencies, this green agenda still lacks political will and support. This could perhaps be attributed to a lack of connection or linkage between the green agenda and the agendas that are the prioritized by the political elites and the government. Very recently, establishing a linkage between the issues of green economy and poverty eradication has become one of the key themes of the Rio+ 20 public policy dialogue. Thus, in order for green economy issues to have some prospects of being framed in the existing discourse, it might be necessary to integrate and position social dimensions at the center of green economy development (United Nations Research Institute for Social Development, 2012). It might still be unclear how "social dimensions" will be interpreted and applied in practice, but in the context of our discussion, one of the important social dimensions is to provide social protection for different social groups, particularly those negatively affected by the transition from high- to low-carbon system. The issues of vulnerability and inequality need to be addressed. As the economy transition towards a green system, it is vital to ensure that the low-income groups are able to access the renewable energy and environmentally friendly products and services. In designing the policies to green the economy, the issues of poverty alleviation and reduction of inequality must also be taken into account.

Given that the green economy agenda has just begun to gain foothold in Thailand, it is difficult to develop coalitions or key alliances to centralize green issues within discourses. At this early stage, an open-access and participatory public forum could help facilitate gradual integration. Such a forum must be initiated so that the discussion on green economy is not only contained within an exclusive circle of academic researchers. Representatives from the key political alliances and key voter groups should be encouraged to take part in the public forum so that these actors become aware that the green agenda can indeed be framed to relate it to the high-priority policies of the government.

6.2 Creation of Political Will and Policy Synergies

We begin by providing a brief overview of Thailand's political processes, examining whether preferences of the private sector are represented in public decision making or factored into policy making. According to Christensen (1992), the elected Cabinet Minister participates in nearly all aspects of policy making at the national level. The policy measures available to elected politicians are concentrated primarily in the Cabinet. Thus, there is a great pressure on the elected ministers to deliver favorable policies to a vast



strata of interests. Thus, to establish a foothold for green economy on the political agenda of Thailand, it is important that one puts emphasis on issues that are attractive for key stakeholders and the key voter groups. Synergies between green economy policies and social policy goals are necessary. An example of such issues is the promotion of energy efficiency at the household level, such as the No.5 Energy Saving Label scheme for electrical appliances and the campaign which supports solar water heating system in the households (i.e. using solar energy for heating water). Such campaigns seem to have impacts across all income groups and stakeholders and open up opportunities for green job expansion, as it is likely to stimulate jobs in the manufacturing of energy-efficient appliances and in the installation and maintenance of solar energy equipments.

6.3 Employment Potentials

After examining the potentials of different economic sectors in Thailand in promoting green economic development and green jobs, we find that the energy sector, the industrial sector and the service sector offer high potential for generating green jobs. According to the Alternative Energy Development Action Plan (2008-2022), the implementation of this plan would result in over 40,000 jobs being created in energy-related sectors (Ministry of Energy, 2012). Moreover, provided that industrial and service sectors constitute quite a large part of non-agricultural employment as shown in Figure 24, these two sectors also offer opportunities for generating green jobs, particularly in green industries and in hotels that embraced green initiatives.

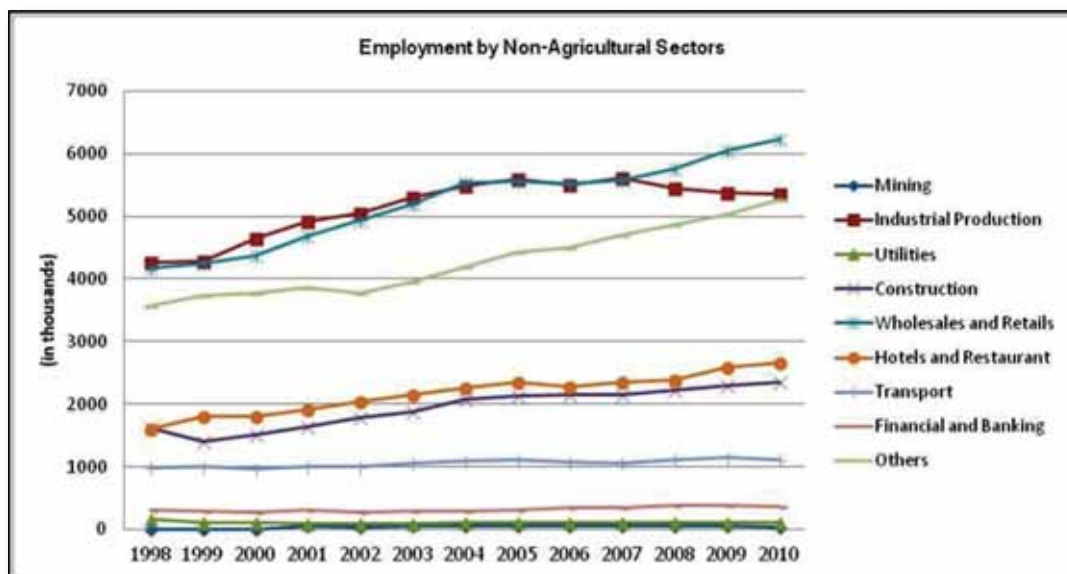


Figure 24: Employment Composition in the Non-Agricultural Sectors during 1998-2010
Source: National Statistical Office

To support the green jobs that would result from the greening of the energy, industry and service sectors, the following areas of skill development could be necessary. First, the skill developments in the energy and industrial sectors include, for examples, training on energy management for efficient energy conservation in factories and buildings, training on renewable energy technology installation and maintenance, and training on energy conserving materials, equipment and machinery. For the service sectors, training courses focusing on improving efficiency of hotels' resources utilization, addressing environmental problems in hotel operations, general knowledge on environmental protection and ecological preservation, and eco-tourism-related skills such as tour guiding and tour operating offer potentials for promoting green development in hotels and tourism.



6.4 Governance Tools and Policy Instruments

A functional green economy necessitates a broadening of the institutional tent to incorporate market and citizen institutions into the governance enterprise. Under this governance approach, the public sector's responsibility is not replaced by other institutions, but rather evolves to become more an enabler of actions by non-state actors and to develop the ability to work in concert with non-state institutions (Boston University, 2011). The government should learn to create a space and at the same time retain its role as rule-setter and enforcer. Multilevel governance from major intergovernmental forums down to town halls and households is necessary to bring decision-making and implementation as close as possible to citizens.

An example for the adoption of this type of governance tool can be found in the area of waste management. The Pollution Control Department has played the role as the enabler and facilitator by providing capacity building on '3Rs' (Reduce, Reuse and Recycle) to the general Thai publics and local communities, through the organization of 3Rs trainings, engagement in awareness raising campaigns and provision of waste-specific containers (Pollution Control Department, 2012). This 3Rs campaign has been well received by the general Thai publics. Figure 25 illustrates some outputs of the 3Rs campaign in terms of household waste utilization.

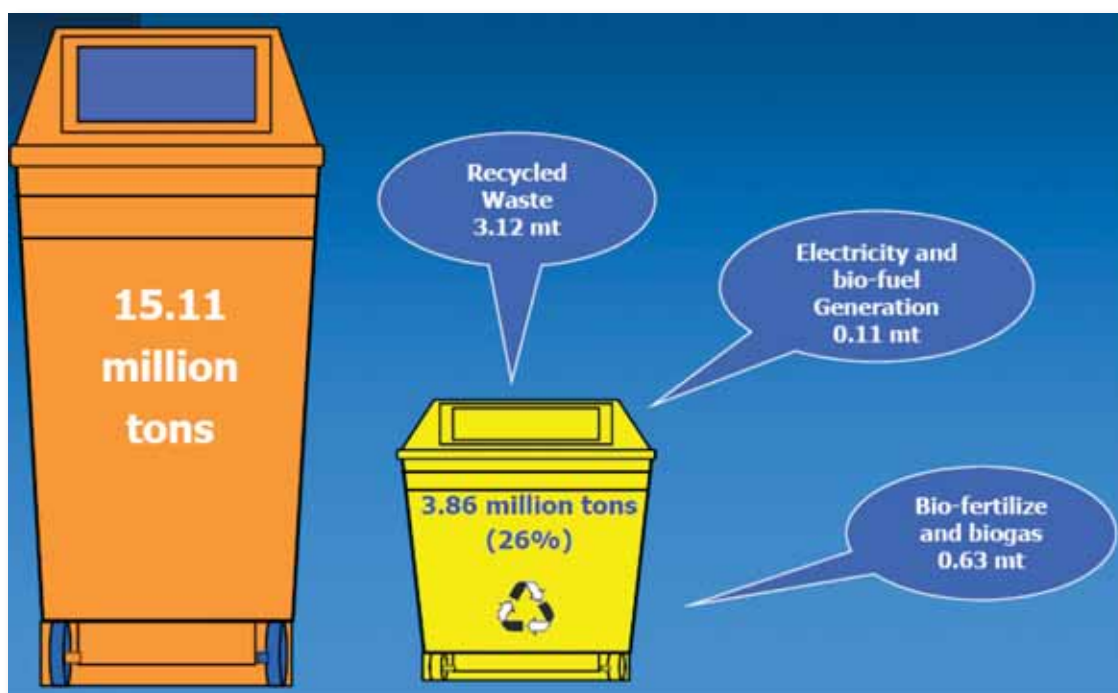


Figure 25: Household Waste Utilization
Source: Pollution Control Department (2012)

6.5 Remaining Challenges in Green Jobs

As different sectors in the economy become greener, this opens up green employment opportunities in a variety of fields and the green jobs that result from such transformation span a wide array of skills, educational backgrounds and occupational profiles. Although green employment has started to gain foothold in Thailand, the growth of green job is not yet rapid and some pressing concerns need to be addressed.



The Central Government should integrate green job and green skill development into its development agenda and plans. In addition, the government should designate an organization or line ministries to be directly responsible for green jobs and upgrading skills for the workforce. There should be a follow-up on the proposal to establish a “National Green Skills Office” at the Ministry of Labor. Such an organization, once established, should promote and cooperate with other related line ministries and private organizations in green skill development. This organization should also maintain up-to-date data, information and database on green skills and green jobs. Moreover, according to Rojvithee (2010), it should also conduct an analysis on the demand for green skills in the labor market, which should help reduce skill mismatch and skill shortages through green skill trainings.



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The Thailand Development Research Institute (TDRI) was established as a public policy research institute in 1984. Its legal form is that of a private non-profit foundation. It provides technical analysis (mostly but not entirely in economic areas) to various public agencies to help formulate policies to support long-term economic and social development in Thailand.