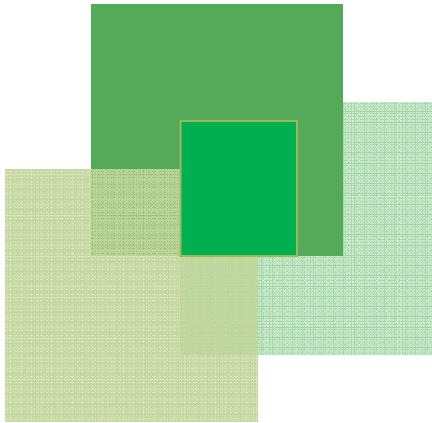




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Labour
Office
Geneva

Skills for green jobs in Thailand

Unedited background country study

Areeya Rojvithee

ILO Skills and
Employability
Department

2010

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Foreword

The world finds itself in a slow recovery after the deepest recession since the Great Depression. The world is also coping with a host of environmental problems and the urgent need to reduce carbon emissions. A greener future also promises an enormous potential in a much needed employment growth. However, without suitable skills, this potential cannot be realized. Today, skills gaps are already recognized as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs. Effectiveness of training measures is decisive not only for the economic recovery but also for a longer-term sustainability agenda.

This report was produced in the framework of the project, ‘Skills for green jobs’. The project was implemented in cooperation between the International Labour Organization (ILO) and the European Centre for the Development of Vocational Training (Cedefop). The project identifies skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The ‘Skills for green jobs’ study is embedded in the Green Jobs Initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyze and promote the creation of decent jobs as a consequence of the needed environmental policies. The global study was jointly funded by the Skills and Employability Department of the ILO and the Green Jobs Initiative.

The following countries have been included in the study: the ILO covered Australia, Bangladesh, Brazil, China, Costa Rica, Egypt, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Thailand, Uganda and the United States. In addition, Cedefop covered six European Union (EU) member States: Denmark, Estonia, France, Germany, Spain and the United Kingdom. The ILO global synthesis report,¹ which analyzes the situation in all 21 countries involved in the study and the European synthesis report,² which covers the six EU countries, as well as all individual country reports, are available at: http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm (the ILO website) and <http://www.cedefop.europa.eu> (Cedefop website; look under *Skills Needs* theme). The unedited background country studies have been published in the electronic form in order to make them available quickly. The summaries are published as part of the synthesis reports.

The global project in the ILO was coordinated by the Skills and Employability Department and, in particular, benefited from comments and technical guidance by the team under the leadership of Olga Strietska-Ilina, Christine Hofmann, Mercedes Duran and Shinyoung Jeon. The ILO coordinating team would like to express great thanks to the author of the report, Areeya Rojvithee, for this background country research which contributed to the global study and Carmela I. Torres, Senior Skills and Employability Specialist, ILO Decent Work Team Bangkok for her technical inputs and guidance in the finalization of this country research. Special thanks also go to the ILO regional and country field offices for the project support and the ILO colleagues who assisted research at national level.

Christine Evans-Klock, Director
Skills and Employability Department, ILO

¹ Strietska-Ilina, O.; Hofmann, C.; Duran Haro, M.; Jeon, S. (forthcoming 2010). *Skills for green jobs: A global view. Synthesis report based on 21 countries* (Geneva, ILO Skills and Employability Department).

² Cedefop. (forthcoming 2010). *Skills for green jobs: European synthesis report* (Luxembourg, Publications Office of the European Union).

Abstract

Skills and qualifications of people are critical to achieve a green and sustainable society and reduce global warming. People at all levels attend training courses offered by both public and private organizations to equip themselves with skills for green jobs. These skills allow people to deal with the reduction of the environmental impact in the process of employment. Workers are trained by employers while others are trained by both public and private organizations such as the Ministry of Energy which has provided training on solar, wind, biofuel, biomass and hydrogen. These are components of the Alternative Energy Plan for the country. While Thailand has strong green policy, there is no comprehensive plan to train people on green jobs, no database and labour market information (LMI) for existing green jobs, new green jobs and the new green collar jobs. There is a need, therefore to analyze the skills gap and to forecast the demand of the labour market in relation to green jobs. This report is a preliminary study of skills for green jobs in Thailand in order to improve and strengthen the creation of more green jobs for sustainable development.

Executive summary

Globalization, technological change, demographic and climate change, and the current economic recession will increase the pace of change in labour market and skills needs, for both current and new jobs. The shift to a low-carbon economy will also require new skills and qualifications that create green jobs and transformation of existing jobs.

The objective of this country report on Thailand is to identify strategic skills development responses of the country in the light of environmental degradation, climate change and the global call for greening economies and to study the formation of green jobs, greening existing occupations and green collar occupations. These definitions are quite new in terminology but in practice they have already provided training, upgrading skills of their workforces on new green jobs, and green occupations for the quality and productivity of their production. Most of the training for green jobs is upgrading training courses from the existing skills to green skills. Training is organized in the workplaces or training institutes with cooperation between public and private sectors.

Thailand has strong policy on environmental conservation, reducing carbon emission into the atmosphere, using alternative or renewable energy and campaigning for energy efficiency for response to reduction of global warming. But in practice it is still a long way to go to fulfill the objective since there is no focus on green skills development of people to work. Human resources development (HRD) is the key strategy to achieve a green and sustainable society.

His Majesty the King of Thailand initiated various green projects with the aim of transferring these projects to the general population. He has previously alerted the world about global warming. Initiation of the alternative energy is one good example but people seem to pay less attention until the price of fossil energy has become very expensive and then people turn to His Majesty's renewable projects. His Majesty introduced the "Sufficiency Economy" Philosophy to his people to practice. This philosophy is the balanced way of living and integrate green practices in their daily lives.

Multinational corporations have already trained their workers to acquire knowledge and green skills to work. The blueprints of training are drafted by the mother companies abroad and sent to branches in Thailand. These include the training courses and instructors whom will train the workers of the company and their supply chains. Most of them said that the in-house training for specific green technology, processes or services are internal and confidential.

Alternative energy, the automotive industry, the manufacturing, construction and the services sectors were selected to study. Green production starts with research and development (R&D) for green process or product, design of products that use the green materials easy to recycle for reducing the waste and CO₂ emissions. Strictly control the production as the International Standards such as European Union (EU) standards.

The most effective public organization that works with alternative energy is the Department of Alternative Energy Development and Efficiency (DEDE) and this report highlights the work of this Department. The green projects of solar energy, wind turbine, biogas, biomass, etc., started through Research & Development (R&D) followed by pilot implementation. The courses were then developed for all concerned people. They also provide training for foremen and workers in industry for the electric efficiency, reducing defects and operational costs for industry.

Public training institutes such as the Department of Skill Development (DSD) of the Ministry of Labour organized various training courses for people for the whole country in

coordination with many organizations. The Skill Development Promotion Act 2002 is a tool to encourage establishments to train their employees and non-employees which include training courses on green jobs and the green technology demanded by establishments and the labour market. The representative of employers and employees expected the Ministry of Labour to play a more active role on green skills development.

In Thailand, there is no database for green skills and green jobs so it is difficult to see the whole picture of green skills, the demand and supply of green jobs, green collar jobs, and analyze the mismatch and forecast for the demand of green skills and green occupations in the labour market. There is also no National Skills Development plan to integrate all skills training to make it more explicit and effective to train people. Since green skills and green jobs are the future and has become important sources of employment, the Thai government should make skills for green jobs as the National Agenda, give priority on green human resources development by training people at all levels for a green and sustainable society. This will also develop the competencies, skills standards and certification systems to ensure the quality of skills of the people and be able to work greenly and productively. The successful achievement of a green environment is through the quality of human resources with the green consciousness to choose to consume green products, practices in their green daily life, etc. The strategy is by integration of all line Ministries and the private sector to cooperate and work together on green skill development to become a green society, reducing global warming and sustainable development.

Abbreviations and acronyms

AIT	Asian Institute of Technology
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ASEM	Asia-Europe Meeting
a-Si	Amorphous Silicon
BBFD	Bureau of Biofuel Development
BCA	Bureau of Central Administration
BEEP	Bureau of Energy Efficiency Promotion
BEHRD	Bureau of Energy Human Resource Development
BER	Bureau of Energy Research
BERC	Bureau of Energy Regulation and Conservation
BETTD	Bureau of Energy Technology Transfer and Dissemination
BGET	Border Green Energy Team
BMA	Bangkok Metropolitan Administration
BOI	Board of Investment
BSC	Bangkok Solar Company Corporation Ltd.
BSED	Bureau of Solar Energy Development
CAD	Computer-aided design
CDM	Clean Development Mechanism
CEERD	Center for Energy Environment Resources Development
CEO	Chief Executive Officer
CER	Certified Emission Reduction
CFC	Chlorofluorocarbon
CHP	Coal-based hydrogen production
CO ₂	Carbon dioxide
CSR	Corporate Social Responsibilities
CTF	Clean Technology Fund
DEDE	Department of Alternative Energy Development and Efficiency
DMS	Document Management Solutions
DPS	Data Protection Services
DSD	Department of Skill Development of the Ministry of Labour
ECOT	Employers' Confederation of Thailand
ECP	Energy Conservation Promotion (ECP Act)
ECTC	Energy Conservation Technology Centre
EGAT	Electricity Generation Authority of Thailand
ESCO	Energy Service Company

EU	European Union
FAO	Food and Agriculture Organization
FFV	Flexible Fuel Vehicle
FIO	Forestry Industry Organization
Four Rs	Reduce, Reuse, Recycle and Recover
FTI	Federation of Thai Industries
GHG	Greenhouse Gas
GPS	Global Positioning Systems
HRD	Human Resources Development
ILO	International Labour Organization
IOE	International Employers Organization
IT	Information Technology
IT Centre	Alternative Energy and Efficiency IT Centre
JICA	Japan International Cooperation Agency
ktoe	Kilotonne of Oil Equivalent
LMI	Labour Market Information
MOL	Ministry of Labour
MSW	Municipal Solid Waste
NESDB	National Economic and Social Development Board
NESDP	National Economic and Social Development Plan
NGO	Non-governmental organizations
NGV	Natural Gas Vehicle
NQF	National Qualifications Framework
OECD	Organisation for Economic Co-operation and Development
OTOP	One Tambon One Product (OTOP) Project
PEA	Provincial Electricity Authority
PR	Public Relations
PRE	Personnel Responsible for Energy
R&D	Research and Development
RDF	Refuse Derived Fuel
SDS	Secure Destruction Services
SEC	Specific Energy Consumption
SHS	Solar home systems
SMEs	Small and Medium Enterprises
SPS	Sanitary and Phytosanitary Measures
SSHE	Safety, security, health and the environment
TAI	Thailand Automotive Institute
TAS	Thai Agricultural Standards
TD	Training Division of DEDE

TOR	Terms of reference
TSAE	Society of Automotive Engineers – Thailand
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economics and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
VET	Vocational Education and Training
WPD	Work Plan Division
WTO	World Trade Organization

1. Introduction

The International Labour Organization's (ILO) International Labour Conference of June 2008 stated that skills development should form part of an effective response to changing conditions with climate change among others. Identifying skills requirements for adaptation to climate change and mitigation measures via reduction of greenhouse gas (GHG) emissions has therefore an important role to play in policy development. Meeting skills needs is a critical factor for productivity, employment growth and development.

The objective of the report is to identify strategic skills development responses of the country in the light of environmental degradation, climate change and the global call for greening economies.

In this country report, the definitions of green jobs, skills and green collar jobs are those used in the Terms of Reference issued by ILO Geneva (UNEP/ILO/IOE/ITUC 2008) as follows:

- **“Green jobs”** are jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. The Green Jobs Report defines “green jobs” as work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting requirements of decent work – adequate wages, safe conditions, workers rights, social dialogue and social protection.
- **The term ‘skills’** is used throughout this document as an overarching term which refers to the knowledge, competence and experience needed to perform a specific task or job. Skills development in this context comprises all forms of HRD: lifelong learning including initial and continuing vocational education and training (VET), and lifelong learning including formal and informal/non-formal learning.
- **“Green-collar jobs”** - “...like traditional blue-collar jobs, green-collar jobs range from low - as we define them, are well paid, career track jobs that contribute directly to preserving or enhancing skill, entry-level positions to high-skill, higher-paid jobs, and include opportunities for advancement in both skills and wages.” (idem.)

In Thailand, there is no formal definition of green jobs and green-collar jobs, so there was always the need to clarify these terms before discussions in the focus groups.

Methodology of the study

- (a) Thorough desk research and data research via trusted sources, which are both the companies' own web sites and related Thai Government websites, have been applied. Data has been collected through literature review, interviews, and visits to the enterprises, governmental organizations, social partners and institutes.
- (b) Face-to-face interviews and actual site visits with key contact persons responsible for green management of each establishment, Industrial Professional Associations, local government, research institutes, related Ministries such as the Ministry of Education, Ministry of Energy, Ministry of Environment, Ministry of Labour (MOL) and Ministry of Industry.
- (c) Organized focused group discussions and seminars with related persons and experts for collecting information, discussed and brain-stormed ideas with them.

Thailand has a strong commitment on green policy which is even mentioned in the Constitution, Sections 85 and 86, which is the supreme law, and cannot be violated. The

policies have been implemented by public and private organizations that deal with the issues. But there is still no integrated plan for skills development for green jobs. Also, there is no labour market information on existing green jobs. It is difficult to get information on skill demand for green jobs as well as analyze skills mismatch and forecast future demand.

Training for green jobs involves retraining and upgrading training to acquire green jobs skills. These are often done by employers through workplace training. In the villages, people are trained by line Ministries, such as the Ministry of Energy which provide training on alternative energy like biofuel, wind, solar, biogas, biomass, and hydrogen. The Ministry plans to extend the scope of application of alternative energy to the whole country in 15 years. Therefore, there will be high demand for skills on alternative energy. The skills that were acquired from training can later be their occupation, for example as the technician for installation and maintenance of alternative energy projects.

Skills for green jobs is a new concept as seen from the outcomes of the focused group discussions. Even while such skills exist and people trained in new skills for green jobs, this terminology has never existed before. Therefore, the initiative of the ILO to make skills for green jobs explicit and encourage each country to promote this, especially in the developing world and to continue study and concentrate on the issues, is a wise strategy of the ILO. This will support the reduction of global warming, and skills for green jobs will be in the forefront of all occupations.

Thailand has much work to do to be able to catch up to the trend and approach on the green jobs. Through international cooperation, Thailand will be able to learn from various countries on these issues and also through the transfer of the green concept, idea and technologies from the multi-national corporations. These are most welcome to support the development to a Thai green society whose final goal is a green world.

2. Policy context

2.1 Key challenges and priorities for a green economy in the context of Thailand

Thailand has joined many other countries facing the global crisis on energy and economic crisis, environment, natural resources, demolished ecology, pollution and increasing natural disasters, etc. which are the effects of global warming.

Thailand's 10th National Economic and Social Development Plan (2007-2011) (NESDP) alludes to a great overuse in natural resources. The statistics show as follows:

“In 40 years, 67 million Rai (10,720,000 hectares) of forests were destroyed, and now forests cover only 33 per cent of the country, resulting in more frequent and more severe problems of flooding, drought, and natural disasters... Marine and coastal resources have deteriorated. Mangroves have declined from 2 million to 1.5 million Rai (320,000 hectares-240,000 hectares).

The seafood catch has been reduced to one third. The conditions of coral and sea grass have deteriorated. Biodiversity is rapidly being destroyed. Human activity that destroys the habitats of various living organisms is changing the ecology and increasing the incidence of extinction of species.

The main reasons for the decline in the quality of the environment are the increase in population and inappropriate lifestyles resulting in increased pollution. Air and water quality is below standard. The volumes of refuse and hazardous wastes are increasing faster than the capacity to dispose of them. Hazardous substances used in production are being imported in increasing volumes without adequate mechanisms for controlling production processes, storage, or transport. As a result, these substances have seeped

into the environment, and contaminated the food chain. In addition to the complexities, deficiencies, and failures of implementation, the use of economic and legal measures has been limited.”

Thailand’s energy situation

According to the Government of Thailand’s Clean Technology Fund Investment Plan for Thailand³, Thailand relies heavily on fossil fuels for all its energy and transport needs. With demand expected to continue growing to serve economic growth, Thailand faces supply constraints. More than half of primary energy supply is imported, with crude oil accounting for over 70 per cent of total imports, mostly for transport and industrial use. Electricity generation relies mainly on natural gas and coal, with the latter generating high GHG emissions. In 2008, 91.9 per cent of total power generation came from fossil fuel sources, mostly natural gas (70.5 per cent) with development of coal-fired power generation faces numerous challenges, including local community resistance, local air pollution concerns, and of course high GHG emissions.

2.2 The response strategy

2.2.1 General environmental strategy

The Thai Government’s policy on natural resources and environment, policy on alternative energy and reducing carbon emissions for reducing global warming, etc., which in this report are called green policies, can be considered in the Constitution of the Kingdom of Thailand 2007, the Policy Statement of the current government by the Prime Minister, Mr. Abhisit Vejjajiva, and also in the 10th NESDP (2007-2011).

The appearance of the context of the environmental and the energy policies in the current Constitution of the Kingdom of Thailand 2007 can be explained that though the Constitution is the supreme law, whenever the military seized power and succeeded, they abrogated the existing constitutions and promulgated new ones. The current one is the 17th Constitution of the Kingdom of Thailand. Since the environmental and the energy problems are the critical issues that Thailand is facing, the junta appointed drafting groups to put these issues in the current Constitution and was approved by a public referendum. This reflects the political instability and in the meantime the content of the Constitution is flexible and updated to the critical problems that the country is facing.

As the supreme law, there is no violation against the Constitution, so in the policy of the government, the NESDP and the old and new laws and regulations and any action should be abided by the Constitution. This means that Thai government has strong commitment on the environmental issues for reducing global warming.⁴

So, the current government committed to implement the green policies that appeared in the current Constitution by the line related ministries, organizations both public and private, central and local government and stakeholders in the society. (More detail in Appendix 2).

The **10th NESDP (2007-2011)** of Thailand states that:

“Thailand must upgrade its standard of environmental management in order to protect the resource base and maintain the natural balance in the natural environment. Thailand must also adjust processes of producing goods and services to become more

3

<http://www.nesdb.go.th/Portals/0/home/interest/09/CTF%20Investment%20Plan%20Thailand%20final.pdf>

⁴ http://en.wikipedia.org/wiki/constitution_of_Thailand#1932_constitution

environment-friendly, and must increase efficiency in energy usage and develop alternative energy sources to meet the domestic demand for energy”.

Policy of the current Government on environment and energy

The current government’s policy has been derived from the present NESDP (2007-2011) so that there is an overall consistent policy. The objective is for a successful implementation.

Policy on energy

Prime Minister Abhisit Vejjajiva has presented the policy on energy which included energy security, alternative energy, supervision of energy prices and safety, energy conservation and efficiency, and environmental protection. The policy includes extending knowledge to the people and continuously enhance institutional capability at all levels As well as enable concerned people to gain skills and efficiency in using the body of knowledge and techniques required through their ministerial roles and missions.

As a result, the Government, through the Ministry of Energy, issued various measures such as campaigning for energy conservation efficiency, campaigning for people to use public transportation, car pools, green labels for electric appliances, controlling the use of alternative substance instead of the ozone depleting substances in refrigerators and air conditioning, and issuing the 15-Year Alternative Energy Plan. The Ministry of Industry is campaigning for restructuring establishments on process, products and environment to be green. On the other hand, the Ministry of Agriculture is controlling the products from the rice field and plantation to be green while the Ministry of Tourism and Sports is promoting eco-tourism and a campaign for the green hotel.

The above-mentioned policies can be achieved by the **people** at all levels so the content of skill development is integrated in the comprehensive strategies and practicable action plans (2007-2011) of the responsible related line ministries. They will get budget to implement the policies by drafting programmes and projects proposal to request budget from the Budget Bureau. They will be provided some budget for those projects in response to the policies of the government and compatible with the strategies of the NESDP on green projects. There is a system for monitoring and evaluation on the utilization of the budget and the indicators to show the success of the implementing of each project. Concerning the green policies the good example is the action plan of the DEDE which included the skill development for people working related to the construction, installation, maintenance of the various projects of the Alternative Energy Development. Details are in Appendix 3 “DEDE Projects – Activities by 2008-2011 Budget, Activity: Training, Dissemination and Transfer of Energy Conservation Technologies.”

For other Ministries there is no clear policy on green skill development. Even the action plan of the Department of Skill Development (DSD) on green skills were not highlighted, but were still integrated in the whole plan of skill development. When there was requested to train people on green skills such as the technician on solar energy then can utilized the budget of the Electric Section which was the part of the total budget for training. The training of DSD is on demand driven.

But the most important is the consciousness and awareness of all concerned people to change their behaviour on resources consumption, try to reduce carbon emissions in order to make the global green.

Analyzing the development of the green policies

The green policies in Thailand have been developed gradually since 1977-1981 which appeared in the 4th NESDP. By that time, there were policies for ameliorating the conditions of forest, soil, land settlement, natural resources, water, etc. As the result of resource based production development, Thailand as many other countries, consumed all natural resources for the economic growth of the country with no limit and destroyed natural resources, ecology and environment of the country.

In 1992, the United Nations (UN) organized the 1st Earth Summit in Rio de Janeiro. Thailand was one of the 178 countries which attended the meeting and had signed the action plan which was called Agenda 21 for balancing the social economic and environment for sustainable development. Unfortunately, even after signing, in Thailand, there was still continuous destruction of the natural resources and environment. Therefore, the direction of development was changed from market orientation to more on the balance of economic growth with ecology and environment and fair distribution of benefit for the well beings and social sustainability.

The current 10th NESDP (2007-2011) has focused on sustainable development in order to solve all the problems of energy, ecology and environment crisis and also to rehabilitate natural resources as well as reduce global warming.

To fulfill the objectives of the plan, there is need for a strong commitment from line ministries, public-private organizations, NGOs (non-governmental organizations), local government and community at all level working together for reducing global warming, create green jobs and rehabilitate the current economic crisis for sustainable society.

Besides the line ministries, the development of green policies were also initiated by the private sector, the multinational corporations and the global conditions such as The Vienna Convention for the Protection of the Ozone Layer, The Montreal Protocol on Substances that Deplete the Ozone Layer, the UNEP, WTO, FAO, ILO and the various regional cooperation like EU (European Union), APEC (Asia-Pacific Economic Cooperation), ASEM (Asia-Europe Meeting), ASEAN (Association of Southeast Asian Nations) and OECD (Organisation for Economic Co-operation and Development).

In order to try to survive from the serious natural phenomena that increasingly are faced day by day, strong action has been taken by the government with the support of all stakeholders in the society for saving our society and world. There are records from various measures, projects and programmes that have been implemented.

But as past experience has shown, that although they have strong policies and action plans for implementation, problems still exist, as the comment of Kingkorn Narintarakul of the Thai Climate Justice Network. She said that the UNFCCC (United Nations Framework Convention on Climate Change) ranked Thailand as "... 22nd among countries with highest outflows of greenhouse gases and has done little in the past decade to prevent anthropogenic global warming [and that] while Thailand does not have the compulsory emissions reduction target, it should set its own voluntary target to combat climate change."⁵ There is still deforestation, the inefficiency of controlling of hazardous substances in some industrial areas which affects humans, etc.

This means that we cannot enforce bylaws and regulations. but we should educate people and try to raise their awareness and be responsible. Practice in their daily life should start in the family for all children who are the future of society and will face the effects and suffer as a result of global warming.

⁵ <http://www.thaiclimate.org/Eng/index.cfm?cat=8&news=107>

2.2.2 Green response to the current economic crisis

The strategies to respond to the economic crisis of the Thai government appeared in the Policy Statement Delivered by Prime Minister Abhisit Vejjajiva to the National Assembly on the 30 December B.E 2551(2008). The Prime Minister presented that country needed to urgently rejuvenate the economy by introducing a short-term restoration plan covering issues of farmers and agriculture, industries, services and tourism, export and real estate sectors, job and income creation in rural areas; developing natural sources of water and revival of resources; preparing an additional budget plan with an aim to inject public expenditure into the economic system and to alleviate the difficulties faced by the people and business sector; raising the quality of life of the people, upgrading of the quality of education at all levels, development of mass transit system; and developing water management and irrigation system with importance being attached to people participation and environmental conservation.

The Government's economic stimulus plan is a package comprising three sets of measures to bring money directly into the hands of the people – ranging from farmers, workers outside the agricultural sector, parents, low-income and regular salary earners and senior citizens to business sector – in order to boost domestic consumption which will in turn help boost manufacturing, agriculture and other businesses. The package on restoration and enhancement of economic confidence comprised of three sets of measures as follows:

1. Increase people's income
2. Reduce people's daily expenses
3. Specific programmes to address the unemployment problem with the package which covers those at risk of being laid off, the unemployed and newly graduates entering the labour market.

The report highlighted only the training for generated employment and income of people and some of the training courses were the green skills.

Training and skills enhancement

There were urgent measures to address the problems of unemployment in industrial sectors. The unemployment rate of the sectors was as follows: electronics and telecommunication 33.7 per cent; vehicle manufacturing, 30.2 per cent and garment manufacturing 7.8 per cent. The government proposed training courses for unemployed people and young university graduates. About 500,000 were unemployed labourers during 2009, who were preparing for reintegration by returning to their home regions. This was the under the 'Tonkla Archeep' training project which was valued 6.9 billion-baht. These courses assured the beneficiaries that after completing their training, they would have jobs. This project were run by line ministries, public and private training institutions including the DSD. The training courses in DSD were mostly those for self employed and are usually short courses that last for 20 days such as Thai food cooking, Thai traditional massage for relaxation (one module), local product making, dress making, computer training, mobile phone repairing, were also offered. The courses depended on the background of the trainees and most of them were those for upgrading training courses. Some examples of training courses dealing with green skills were those on "local product making" using raw materials and processes of production to save the environment. These were on using cassava, banana leaves or lotus leaves to produce small container for food with some techniques that make them last longer, do not harm human and easy to recycle since they are a kind of plant. Other courses included making natural soap and cream from tamarind, mangosteen or, papaya. These kinds of courses provided them with skills to produce natural products, and combined with Entrepreneurship Development including packaging skill. After graduating, they now have skills on production and running business which is green business. The indicator for

success of this project was the employment of people, reduction of the number of unemployed persons and income generation of people. The results of the evaluation of this project and indicated by the government that this project achieved its goals of creating employment and generating income for the people. It terminated on January 2010.

Capacity building to sustain growth

Given the strategies of economic stimulation, there were projects that combined the environment and economic crisis strategies which were implemented to create employment and income for people both in rural and urban areas. There were projects concerning the rehabilitation of the environment, natural resources and alternative energy. These kinds of projects proposed by local communities' committees which know better what they wanted for their villages. They were on irrigation and reservoirs in the villages, solar generator, mangrove plantation, herbal plantation, biofuel, biomass, by employing villagers and laid off people who went back home in the rural area to work with the instructors from responsible organizations and from the training institutions. These kinds of projects are practical training and is learning by doing. They gained knowledge and skills for working, received stipends from government and the output of the projects were green products, process and the utilized for construction in the village. The trained people, especially the agriculturist can utilize their skills to work as a supplementary occupation and these are green jobs. Some example of skills training for the above mentioned projects were plumbing, masonry, iron-binding, asphalt and concrete mixed skills, carpentry, eco-tourism management in the village, competency in conservation in the village, tour guide, basic computer, English and other foreign language for communication, bio-food, hydroponic vegetable, food preservation, packaging and entrepreneurship development.

Hygienic and the national standards for food and drink, skills on installation and maintenance of solar and wind turbine energy were some courses and where the ex-trainees could attend the upgrading training courses in any training institution for more proficiency in any skill and be a technician in the village.

Government initiatives for capacity building to sustain growth

Table 1. Government initiatives for capacity building to sustain growth

Programme / Project	Budget (million baht) / (approx. USD)	Target group
1. Plan on restoration and enhancement of economic confidence		
1.1 Water supply development for farmers	2,000.0 (USD 57.5 m)	Farmers
1.2 Local road construction in villages	1,500.0 (USD 43.1 m)	People / communities
1.3 Tourism promotion, seminars in the provinces of government and other organization	1000.0 (USD 28.7 m)	Tourism and other related industries
1.4 Development of small reservoirs for water management	760.0 (USD 21.8 m)	Farmers
1.5 Promotion and support for food industry and SMEs	500.0 (USD14.4 m)	Private sector

Source: The Bangkok Post, 2009.

Some examples of skills training for the above-mentioned projects were plumbing, masonry, iron-binding, asphalt and concrete mixed skills, carpenter, eco-tourism management in the village, competency in conservation in the village, tour guide, basic computer, English and other foreign languages for communication, bio-food, hydroponic vegetable, food preservation, packaging, entrepreneurship development, hygienic and the

national standard for food and drink skills on installation and maintenance of solar and wind turbine energy, etc. The ex-trainees could attend the upgrading training courses in any training institution for more proficiency in any skill and be technician in the village.

Labour market information (LMI)

In May 2009, the total labour force in Thailand was 37.51 million people. Of those, the corporate employee work status was the biggest number of the labour force or 14.08 million people, followed by the entrepreneur work status with 11.56 people (see Table 2 below).

Table 2. Thailand's labour force (millions)

Work status	Dec. 2008	May 2009
Total	36.62	37.51
1. Employer	1.01	1.07
2. Government employee	3.22	3.4
3. Corporate employee	13.68	14.08
4. Entrepreneur	11.58	11.56
5. Family business	7.43	7.31
6. Joint work	0.04	0.09

Source: Ministry of Labour, 2009

The total labour force in Thailand had increased from December 2008 to May 2009 due to the improved political situation and the success of the Economic Stimulation Plan. Despite most of the number of labour force according to work status has increased only entrepreneur and family business work status have decreased in May 2009.

The above stimulation plan related to people by reducing regular expenditure, increasing income through public employment in various projects in the rural area and the skill development project which some of them concerning the green jobs as explained above.

2.3 Skills development strategies in response to greening

Strategies concerning skill development in response to greening of the Thai Government can be considered by the NESDP (2007-2011), as follows:

“Extend knowledge to people and continuously enhance institutional capability at all level. Enable concerned people to gain skills and efficiency in using the body of knowledge and techniques required by their ministerial roles and missions. Promote research and development that support policy development, plan formulation and implementation at all levels. Campaign and encourage public awareness for all groups of people, including building participation networks to facilitate careful and continuous implementation.”

(1) From the above policy, there is no clear or specific strategy on skill development for people in response to greening. Even in the policy of the current government that was mentioned earlier indicated that there was no focus on skill development on green jobs but focusing more on science and technology and research and development which are good. But in reality all the work should be done by workforce through their skills and competencies acquired by re-training and upgrading skills training courses. Although there are various training courses organized by various formal and informal and public and private organizations, academics, institutions, establishments, professional associations and employer and employee's confederation, for people at

different levels and target groups, with different objectives in order to achieve green jobs, still there are no database or center for information. These show that there is no clear policy on green jobs and therefore, the reason why there is no **National Training Plan for Green Jobs**. Such Plan should show the importance and commitment and success of training people for green jobs, for reducing global warming in all dimensions. Each government organization that is responsible for greening has to develop their action plan for training people to acquire skills and competencies on green jobs. A good example is the action plan of the Department of Alternative Energy Development and Efficiency (DEDE) of the Ministry of Energy attached in Appendix 3.

(2) The private sector, also followed the government policy on greening as well as the conditions of international trading that controlled the raw materials, process of production and the product which should be green. The priority has been set to train workers in their workplaces, workers in the supply chain and also people in the country for the goodwill of Corporate Social Responsibility (CSR).

(3) Professional associations such as the Thailand Automotive Institute (TAI) and the Electric and the Refrigeration and Air Condition Association, work closely with universities and training institute to provide upgrading training courses to achieve green jobs. Some examples are the training of DSD instructors and teachers of vocational schools on green substance for air-conditioning refrigeration, modifying auto machines for LPG, NGV.

(4) Through consultations with the Secretary General of the Employers' Confederation of Thailand (ECOT), Ms. Siriwan Romchattong, and Mr. Panus Thailuan, the President of the National Congress of Thai Labour, they have both tried to build awareness on greening, and to reduce global warming among their members. They organized various training courses for their members in the meeting room of the Employer's Confederation office in order to raise their awareness and understanding of green industry. Some courses organized for members of labour unions were: Concept of Environmental Industry, Treatment of Waste in Industry, Biomass and Biofuels, Motor Exhaust Systems, Solar Technology, Products and Innovations of Traditional Industry, Green Investment, (Environmental Junk Bonds), Green Rating Services, etc.

(5) Mr. Panus Thailuan expressed his intention to campaign to all employees that they should submit the request to employers on greening training as priority such as Operation Skills to be Green factory and Green Products and Process, instead of submitting a request on increasing wages, or working conditions. Employers should sincerely respond by organizing workplace learning or training for workers in order to show the mutual spirit of greening to reduce global warming.

(6) The representatives of employer and employee's confederation expressed their views that "They had seen the need for the Ministry of Labour to provide more attention to green issues in the light of decent work, quality of working life and sustainable societal interventions in reducing global warming. It was suggested further that the Ministry of Labour (MOL) should put priority on the green policy, develop an action plan for operation and monitor for success."

(7) In Thailand, there is no database or labour market information (LMI) specific to green jobs, forecasting for skills demand in the future and analyzing the skill gap of green jobs. Each organization should keep records individually. Usually the Department of Employment should be the responsible organization for this task. But up to now there is no such plan or activity, so this is the weak point which needs to be improved.

(8) Greening skills have been developed by the needed and demanded occupations which gradually developed from the original to the greening occupation and jobs for achieving the green ecology and environment process and products.

(9) In Thailand, there are various ministries responsible for implementing the green policy such as Ministry of Energy, Ministry of Natural Resources and Environment, Ministry of Industry, Ministry of Agriculture and Cooperative, Ministry of Education, Ministry of Interior and the Ministry of Labour. They work both independently and in collaboration with other public and private organizations, establishments, professional associations, employer and worker confederations and NGOs, etc. The above-mentioned ministries have set up plans to work for responding to the national policy on green environment.

(10) The University in Thailand provides a curriculum on Environmental Management and Conservation at the undergraduate and post-graduate levels, and as basic knowledge in the Engineering Faculty. Mr. Chaiwat Pollap, Energy Specialist, Energy Research Institute, Chulalongkorn University explained that he is working as the consultant with private companies on biogas and with employed students who have engineering background on Environmental Engineering, Mechanical Engineering, Electric Engineering and the Civil Engineering. They were trained how to design the system of the production of Bio-gas and the system to bring those gas to use in the factory as well as the waste water treatment of the establishments. They learned by doing through the guidance of the supervisor of the team. The government has strong policy to campaign on the use of alternative energy so there will be high demand for people to work on alternative energy with the consultant companies. There is the compulsory condition for establishments which are requiring financial subsidy from government and must also have consultant to work with. He was thinking to propose to universities to open special courses to train graduate students on skills to work on various projects on alternative energy. This is still a proposal because the application of alternative energy in Thailand is on a voluntary basis even though the government has strong policy to convince people for its use. He is worried about the employment of trainees after training, and if they do not have jobs after graduation, this will create bad reputation on the university. The Naresuan University has set up the Solar Energy Research and Training Center which will later be transformed into the School for Renewable Energy Technology. This university has good technical cooperation with the German and Japanese governments on research and development. The Srinakarinwirot University has set up the International College for Sustainable Studies which focuses on Eco-Tourism. Most of the courses are basic on renewable energy and the Electrical Efficiency. They are not deep in technology or specific skills and competencies and therefore, the students will be trained on upgrading training courses before working.

(11) The Green Jobs Programme of the International Labour Organization (ILO), the Regional Office in Bangkok had initiated to cooperate with the Asian Institute of Technology (AIT) in Thailand and organized "The Internship the Green Jobs Programme for "interns coming from the region" to work for the ILO, Bangkok for three months during September to November 2009. The objectives of the programme were to assist the Green-Jobs Team of the ILO on desk studies, information collection, and production of background documents. In particular, this involved writing of background and analytical notes on technical and social issues, including green/clean technologies, green procurement policies, energy efficient appliances, environmental and energy efficiency standards, employment impacts and social costs of environmental policies. The background of the interns must be Masteral and PhD students in Environment with background on Decent Work, a first level university degree in environment, economics or social sciences from Asian countries. This project will assist in building up the network among Asian countries since the effects

of global warming has no boundaries. All countries are concerned. However, this programme did not focus on technical green skills development.

(12) In response to the policy of green environment and from pressure of international trading, some establishments both Thai and multi-national companies invested in human resource development on green skills by providing fellowships or scholarships to students from vocational schools and university students to study and internship in the companies to learn specific green skills related to the operation process of those companies. It also aimed at building the consciousness and awareness of environment conservation. After graduation, they have to work with the sponsored company for some period of time as indicated in the contract between them. Some examples are the Toyota Co., the Canon Hi-Tech (Thailand) Ltd., the Siam Cement Group, the BIG C Group Company and the Tesco Lotus Group Co. The main objective is to achieve the green environment for reducing global warming. They also get people who have competencies and as they are required to work for them.

(13) Some companies give priority to research and development so they have a project working with university students on research and development for innovation of process, products or even on the raw materials that have been used. The BOSCH company which produces automotive spare parts, electric appliance and the equipment for security system has invited students to send their innovation projects on green products as the concept of the company is encourage competition among the people so that they are alert on global warming and also develop skills and competencies. Since the project has committed to produce on commercial basis, they should employ people to work for this green skills project. This kind of project has been done by Thai and multinational companies in response to the policy on Corporate Social Responsibility (CSR).

(14) The Department of Skill Development (DSD) under the Ministry of Labour has the main function to train in practical training in basic pre-employment training and the upgrading training courses for the workforce so that they are able to acquire knowledge and skills as skilled workers. There are several training courses on green curriculum offered to people in 76 provinces of the whole country run by training institutes of DSD by the demand of labour market. Some examples are:

- Solar cells knowledge: designed as one of the subjects in electrical pre-employment training courses implemented in all Institutes/Centers of DSD.
- Training for technician: to install automobile engine for LPG/NGV fuel for vehicles trainings as conducted in some Institutes/Centers.
- Refrigeration training: conducted under the cooperation programme with Ministry of Industry under the World Bank programme of reducing non-CFC (chlorofluorocarbon) substance in refrigerant and refrigeration system.
- Waste Treatment from the Manufacturing.
- Training for Recycling Material Design and Development, Herbal Juice Making, Herbal Soap Making, Thai Traditional Massage and Spa.

Altogether the number of trainees is around 5,500 persons per year for the above training courses dealing with green skills while DSD trains approximately 220,000 persons per year in technical and non- technical trades and services to supply to the labour market.⁶

(15) To encourage establishments in organizing training courses for their employees and non-employees, the Ministry of Labour, in particular, the DSD applied “the carrot

⁶ Sandod Tamsawanglert, Director of the Technology and Curriculum Development Division, DSD.

and stick policy” and issued the Skill Development Promotion Act 2002 which provided tax incentives for the establishments that organized training for their workers and non-employees (students from vocational schools and universities for in-plant training). This Act allows the cost of training to be deducted when declared as tax payment up which can reach up to 200 per cent of the cost of training. As a compulsory measure, establishments that have at least 100 employees have to train at least 50 per cent of the number of employees. If this is not implemented, the establishments will have to pay a contribution to the Skill Development Fund which is on the average about 483 baht per head per year. The objective of this act is not to make it a required contribution to the Skill Development Fund but to encourage establishments to train their people. The government would like these establishments to focus on building up the awareness and behaviour on environment under ISO 14000. Specific training on skills for green jobs courses identified although the industries confirmed during our focus group meeting that they provided upgrading skills for their workers on specific products and process. However, these are kept confidential by the companies since there is high competition for the innovation of green products. The educational background of the trained workers was at least lower secondary level up to degree level. But it also depended on characteristics of their job.

This is a good opportunity for the establishments to train workers, specifically supply chain workers and SMEs’ staff who have their business related to **greening courses**. At the same time, they are able to avail of the benefit of the Skill Development Promotion Act 2002 which is eligible to all types of training in the workplace. This also promotes productivity and competitiveness in establishments, industries and economy as a whole and the world can be safe as well.

3. Anticipation and provision of skills

3.1 Green structural change and retraining needs

In the UNEP/ILO/IOE/ITUC study, *Green jobs: Towards decent work in a sustainable, low-carbon world*, (2008, pp. 43-44), it was found that employment shifts from a broad conceptual perspective, and that employment will be affected in at least four ways as the economy is oriented toward greater sustainability:

“First, in some cases, additional jobs will be created—as in the manufacturing of pollution control devices added to existing production equipment.

Second, some employment will be substituted—as in shifting from fossil fuels to renewable energy, or from truck manufacturing to rail-car manufacturing, or from land filling and waste incineration to recycling.

Third, certain jobs may be eliminated without direct replacement—as when packaging materials discouraged or banned and their production is discontinued.

Fourth, it would appear that many existing jobs (especially such as plumbers, electricians, metal workers, and construction workers) will simply be redefined as day-to-day skill sets, work methods, and profiles are greened. It goes without saying that this last aspect is by far the hardest to document and analyze, and the hardest for which to foresee the full implications.”

Lifelong learning/training for employability is the strategy to help people become employed or be self-employed by attending upgrading training courses on green jobs which gives them more opportunity to work and be employed. In Thailand, the trend for skills demands is for automotive operators, assembly and maintenance technicians and repairing for hybrid cars. Construction works on green houses and buildings include air-conditioning repair and maintenance. Further, there are solar energy, wind energy, biogas and the biomass technicians who understand the system of installation, maintenance and repair for alternative energy.

For private companies, the demand on green skills and upgrading existing skills to green skills planned is organized by the companies. There is no record that workers have lost their jobs because of the production technology change to green technology. There is no reliable labour market information system (LMIS) concerning obsolete skills that were changed to green skills. The training for green skills was mostly demand driven.

3.1.1 Green restructuring and its impact on the labour market

In Thailand, the need for re-training for green jobs has taken place when people realized that we are facing serious problems in the destruction of the atmosphere, environment, ecology and the natural resources. These have been caused by global warming which affects human beings. So, to tackle the problem, people who are conscious of the issues have designed to consume Green products, to spend their daily life in Green way, campaign and sanction the products whose process of production cause pollution to the environment and are harmful to people. As the result of the green way of living, jobs are created for people to achieve green life for sustainable society. The issues have been placed in various high international forums for all leaders of countries which have attended the meetings to recognize and be alerted to solve the problems of global warming in their countries. All economic sectors and industries, agriculture, services or all establishments were alerted and various actions have been taken by modifying and improving all processes and products to be green. For the multi-national corporations, the policy to be green has

been assigned by the mother companies abroad. If not, they will be sanctioned by the world community on trading and the business could not survive.

It is not only in trading but also the management of our society to be green is the main task of the government and to issue a clear policy to tackle problems which are the causes of global warming. Further it improves the situation and provides the opportunity to create jobs for the people.

In the case of Thailand, the new green competencies and skills have been planned by line Ministries and establishments to organize training courses for people. This includes the Ministry of Agriculture which organized training courses for agriculturists to use the Bio fertilizer in their fields and plantation. They are trained to make the Bio fertilizer, then know the formula on its use, how to take care of their plants, when harvesting the products and also packaging the products to market them both in the domestic and overseas markets.

The work of the Department of Alternative Energy Development and Efficiency (DEDE) is another good example. This Department conducted research on alternative energy and how to generate and apply it. It also has an action plan to train people in the villages where some of them were laid off people and went back to their villages to get training on skills of production and installation and maintenance of alternative energy such as process of making biomass, installation and maintenance of solar energy, hydro and wind energy.

For private companies, the demand for green skills and upgrading existing skills to green skills were planned and run by the companies. There is no record that workers lost their jobs because of the shift from production technology to green technology. There is no reliable labour market information system concerning obsolete skills which were changed to green skills. The training for green skills was demand driven.

3.1.2 Identification of (re)training needs

To identify re-training needs in the private sector, firstly the company conducts in-house research and development for the new green technology which may be based on indigenous wisdom and appropriate or advance technology. They also do the research on innovative ways of working which may apply to nature, new process, new production, new products or even raw materials to achieve the green environment. As result of the researches, green skills are identified and acquired to work on new green technology. Then training is provided for their employees. For the public sector, this can be considered from the action plan of each Ministry.

People of all occupations require knowledge, competencies and skills for greening. They can acquire green skills from their basic or higher education or by attending upgrading training courses to be qualified to work. Their work is called Green Jobs. At present in Thailand, there are no tools to identify training needs for green skills. It depends on the requirement of establishments, industries and companies which announce the recruitment of people,. After employing them, they are provided upgrading training. All new employees have to know the concept of green and have green skills for specific task in that establishment before they start working.

In discussions with Mr. Chaiwuth Suthiruangwong, Director of the Energy Human Resources Development Bureau, DEDE, Ministry of Energy, he said that the training of people at all levels to understand and apply various technologies reducing operation cost in the establishments, produce and apply alternative energy is his main responsibility. There are various target groups for the whole country to be trained and depends on the delivered projects or the courses of training and transfer of energy conservation technologies. These are the villagers and the representatives of the communities that apply for the alternative energy, the technicians of establishments, teachers and instructors from schools and training institutions and universities. His strategy is cooperation with line Ministries, schools,

universities, academics, establishments, local community and training institutions by training instructors and letting them expand the scope to all target groups. People who have attended the training courses should have various backgrounds depending on the courses of training. Such are training courses on energy efficiency in the factory which require those who have background in Electrical, Diploma from Vocational School and up to Electrical Engineering level. The training is practical training.

When the labour market is alert on green jobs, the impact will affect directly existing workers and the new entrants to the labour market. Since Thailand still has no data base and labour market information on green skills and green jobs, the employer is responsible for providing upgrading green skills to new employees in their establishment by organizing in-house training or cooperating with training institutions to organize training for employees in greening and productivity. Nowadays, the companies that have a strong policy on greening would organize orientation for their new workers so that they are educated on the concept and practices to achieve greening in the company. So the retraining is very important to equip skills and knowledge of people to work for green jobs.

The restructuring of the process of work to be Green can be achieved by applying the technology. So that people do not become unemployed, the employers should initiate upgrading their employees to get skills and be able to work in other occupations. There are a number of options for new green collar occupations such as training them to be village technicians for solar energy and wind turbine, as the project of Ministry of Energy. Or as a result of greening, people who are laid-off can be provided further training to acquire skills in changing the occupation from, for example, an office clerk become an entrepreneur or be self-employed.

3.1.3 Skills response

As the result of focused groups discussions with establishments that were awarded on Thailand Energy Awards 2009, the focused group with Thailand Automotive Institute (TAI) and the focused group with Electric and Electronic Institute found that they all put priority on human resource development especially the retraining courses for greening for their employees. Training can range from the general broad scope on green such as the vision and green policy of the company to building up the awareness of green environment which is followed by the four Rs – Reduce, Reuse, Recycle and Recover, ISO 14001 and ISO 9001, team work and occupational safety and health and then focus on specific skills on green jobs that they are going to work depending on the process, raw material, product or services as the focus in that industry. Some examples of establishments which received Thailand Energy Awards 2009 were Suwan Spinning & Weaving Co. Ltd., the Grand Mercure Fortune Hotel and the Thai Ceramics Industry Co. Ltd. They all said that the industrial sector has recorded high consumption of energy equal to 38 per cent of total energy consumption of the country. And therefore, the operation cost on energy was very high. To reduce the operation cost, they campaigned for energy efficiency in their establishments, improved the process of production and had major change in their equipment. To achieve this goal, they provided training at all level of employees on the above mentioned courses. Another interesting example was the Daikin Industries (Thailand) Ltd., which produces refrigerators. It has a skills shop to train employees from day one to know basic policy on green, recycle, reduce reuse, and the discipline of utilizing electricity in the factory. This is then followed by the training on specific skills in jobs where the new employees will be placed or to work on spot. They have continuous training for the workers at all levels with different training courses for difference target groups of employees, such as courses for the engineering team on R&D, engineers as supervisors, technicians and operators. All employees have career paths while working with the company.

Most of the establishments set up green committees to look after the green management and environment of the factory which is part of the Personal Management and Training section. The committee consists of representatives from each section or each production line.

The proposed training plan is developed to acquire green skills and consists of training courses, the qualified instructors, and the place for training whether organized in-house or in cooperation with external training institutes. This plan has been proposed by the committee. They try to solve the weak points and strengthen the capacity of workers on the quality of work for the growth and reputation of the company and also as reward and incentive for all workers.

The vision and the policy of establishments to approach the green or to be green is most important to guide the direction and the process of working of establishments. The commitment of the Chief Executive Officer (CEO) and the top management of the establishments will make them achieve the green structural change. If the policy is clear, the action plan should be in response to this policy and budget is allocated to implement the green policy. In some establishments, the related top management sit as the Chair of the green committees to show the important role of this committee and the contribution to company.

The Ministry of Energy has trained people on green jobs between the years 2000 to 2009. This is approximately 76,906 persons as the target set in the Ministry's training plan. Most of the training courses were on energy efficiency in the establishments, buildings and production process. Trainees were the technicians working in industries, technicians in the villages, instructors of training institutions and teachers from the vocational schools. The training courses have been divided into five groups for people to capably choose courses they are interested in and able to apply. They are as follows:⁷

1. Training Courses on Energy Management for Efficient Energy Conservation in Factory and Building, i.e.

- Electricity Management Course
- Thermal Energy Management Course
- PRE Course in Designated Building, 3 Sessions
- Basic Course for Energy Operators/Staff in the 4th Year Designated Factory
- Energy Conservation in Factory and Building
- PRE Course: Ordinary
- PRE Course: Senior
- Energy Conservation by Practice (Mini Plant)
- ESCO Project Administration in Thailand (ESCO: Energy Service Company)
- Energy Manager Course
- Monitoring and Assessment of Energy Consumption
- Energy Audit and Establishment of Energy Conservation Plan and Target
- Energy Seminar for Building and Factory Owners /Executives

2. Training Courses on Energy Technology for Energy Conservation, Material, Equipment, and Machinery, i.e.

- Air Conditioner Control
- Energy Savings and Steam Boiler Maintenance in Factory
- Energy Savings and Air Compressor Maintenance in Factory
- Energy Audit in Large Air Conditioner for Energy Conservation
- Supporting the Knowledge and Advice on Equipment Operation and Maintenance in Government Buildings
- Heat Recovery
- Refrigeration System
- Lighting System
- Motor

3. Training Courses on Energy End-Use System by Designated Factory Classifications, i.e.

- Energy Conservation in Food Industry
- Energy Conservation in Textile Industry

⁷ http://www2.dede.go.th/bhrd/courseappthai_eng.html

- Energy Conservation in Ice Making Plant
- Energy Conservation in Metallic Industry
- Energy Conservation in Glass Industry
- Energy Conservation in Paper and Pulp Industry
- Energy Conservation in Tile Industry

4. Training Courses on Energy End-Use System by Categories of Designated Building, i.e.

- Energy Conservation in Hotel
- Energy Conservation in Hospital
- Energy Conservation in Office Building and Department Store

5. Training at Educational and Training Institutes

- Through developing the courses and organizing the training for teachers-lecturers who will be the ones to transfer the knowledge and skill on energy conservation to students whose future professionals are of energy managers, engineers, and technicians in factories and buildings.
- Electricity Conservation Course for Vocational Instructors
- Thermal Energy Conservation Course for Vocational Instructors
- Training Project on Energy Conservation in Factory/Building for the Final Year Students in Bachelor Degree
- Energy Management for Vocational Education.

3.1.4 Case studies

Selected case studies presented here focus on solving the energy crisis in Thailand. This is a serious problem for the country and which needs to be solved urgently. The Director General of DEDE, Mr. Krairith Nilkuha, said that in the 15th Years of Alternative Energy Plan, there were four groups of alternative energy resources:

1. Natural energy group (solar, wind and hydro);
2. Bio-energy group (biomass, biogas, MSW);
3. Biofuels group (ethanol, bio-diesel); and
4. NGV group (natural gas for vehicles)

The objectives of the plan are to make Thailand use alternative energy as the national main energy to replace oil import; promote the use of the above alternative energy for achieving integrated green community and to support the industry of the alternative energy technology production. The government plans to use alternative energy and increase to 20 per cent by the year 2022. The skills for alternative energy were different as the sources of energy. To promote the application of alternative energy, the Ministry of Energy conducted R&D, planning, training, promoting awareness to people at all sectors on the effects of global warming and cooperating in reducing carbon emissions for cooling the world by using alternative energy. Some examples of alternative energy projects are listed below. The Ministry had a strong policy to apply alternative energy. The steps of implementation started from recruiting consultant companies to run projects of various kinds of alternative energy. The companies conducted research and development, then run the pilot projects whether they worth to invest or not. If there were positive results in term of economic benefits, they extended the scopes by applying them in local communities which were suitable areas for various kinds of alternative energy. After deciding on the location with participation of stakeholders in that community, they then started training people or villagers to acquire knowledge and skills for the construction machines and the learning process of production; maintenance and other related skills. The skills for biofuel, biogas, biomass are different from skills for solar, wind or hydrogen energy. The identification of skills and the training courses and instructors were done and provided by the consultant companies. The training was practical training which was not limited to the background of trainees. They were learning by doing. If they have problems on application, they can consult with the officials

of Ministry of Energy who were on available on-the-spot. Below are the lists of alternative energy projects for consideration:⁸

- **Biofuel** - Producing Biofuel for Local Community, Build the Machine Model for Community, Biodiesel Produced from Crude Palm Oil and Palm Seeds. Management of Energy Self Reliance Project by Local / Community Biodiesel, Biodiesel Produced from Seaweed /Algae and Candlenut Tree.
- **Wind** - Wind Energy Development for Power Generation, Power Generation from Large Wind Turbine, Study the Design, Potential and Assessment of Using the Bailer (traditional water turbine) by Wind Energy, Demonstrate and Promote Power Generation by Small, Low Speed Wind Turbine at Community level, Demonstrate and Promote Power Generation by Large Wind Turbine in the Wind Zone at particular sources, Demonstrate and Promote Power Generation by Small, Low Speed Wind Turbine at Community level, Demonstrate the Hybrid Power Generation by Wind Turbine and Other Power Generation System.
- **Biogas** - Crude Palm Oil Extraction for Integrated Biodiesel Production for Medium Community Project. Biogas Production Project Using Wastewater from Palm Oil Extraction Plant, Promotion Project on Using Micro Hydropower (Household Level), Producing Ethanol from Cellulose, Develop and Demonstrate Machine Model for Ethanol Produced from Cellulose, Research and Test Using Gasohol as Flex Fuel for Car (FFV - *Flexible Fuel Vehicle*), Water processed from Treatment from Biogas Production System of Swine Farm to follow the Sufficiency Economy.
- **Solar** -Develop Solar Drying System-Greenhouse Type in Large Industry, Study the Potentials of Solar Cooling System Production and Consumption, Study and Develop the Power Generation System by Solar Thermal Energy, Study and Develop the Prototype of Solar Cell Water Pump Set by Deploying Domestic Assembling Parts, Project on Standard Testing Centre for Appliances of Solar Hot Water System, Develop the Power Generation System, Establishment of Solar Hot Water System for Health Project on Solar Hot Water Generation by Hybrid System.
- **Biomass** - Study, Design and Promote Biomass Thermal Generation for Small Industry, Develop and Promote Using the Brick Making Furnace and Biomass Furnace in Community Industry, Study and Develop Biomass Gas System for Agro-Water Pumping, Demonstrate Power Generation System by Biomass Gas, Study and Establish the Plan of Planting the Fast Growth Tree for Energy Production and Study the Promotion on Using and Producing the Biomass to Charcoal Processing, Establish the Prototype and Promote the Bio-Oil Production from Biomass.
- **Hydrogen** - Development on Hydrogen Production System at Community Level for Decentralization, Develop Using Hydrogen in Natural Gas (NGV) Car as for Prototype, Preparing the Infrastructure Readiness to Respond Using Hydrogen and Fuel Cells in Transport & Communication Sector.

LMI on green jobs

Since Thailand has no LMI specific to skills for green jobs, the intention to list the projects of Ministry of Energy in detail was intended to show the information for green implementation of projects by Thailand and the prospect of skills needed so that people are able to work on those alternative energy projects which extend to the whole countries. To forecast the demand for green jobs and skills need in Thailand, we may use the information of the new investment projects of related ministry such as Ministry of Energy and analyze the trends of the labour market. Mr. Krairit Nilkuha, Director-General of the DEDE said that Thailand expects the World Bank to provide the loans of USD 3.1 billion under the Clean

⁸ Adapted from [http://www.docstoc.com/docs/18424434/The-Four-Year-DEDE-Action-Plan-\(2008-2011\)](http://www.docstoc.com/docs/18424434/The-Four-Year-DEDE-Action-Plan-(2008-2011))

Technology Fund (CTF) in early 2010 since Thailand is qualified to get the loans because the country has "a clear direction to develop green energy projects in order to cope with climate change and has plentiful resources of materials". There will be biomass energy projects in 340 communities, wind turbines to generate 115 megawatts of power and solar cells of 50 MW, up from less than one MW at present. Majority of the state-owned projects using clean technology include a 224-MW wind-power plant, solar cells and mini-hydro power plants worth a total of 579 million baht developed by the Electricity Generation Authority of Thailand (EGAT). The Provincial Electricity Authority (PEA), meanwhile, is working with the Forestry Industry Organization (FIO), which is developing 100 biomass plants. These projects will use fuel wood and have a total capacity of 100 MW. The PEA is also working with the DEDE to develop an offshore wind-turbine power plant and mini-hydro power plant. Therefore, from the information above, there will be demand for skills for green jobs. The alternative energy projects for the whole country have estimated about 100,000 positions for the next 15 years. The required skills will be in electricity, welding, masonry, plumbing, basic carpentry, iron binding, plus other related competencies.⁹

3.2 New and changing skills needs

In Thailand, there is no official definition of the 'Green Jobs', 'New Green Collar Jobs' and the 'New Green Collar Occupation' and also there is no data base on the skills for green jobs although there are projects and programmes which have been implemented for long. But there is lack of focus on green human resources development that causes difficulties in getting exact information in the analysis of skills gaps and forecasts for the future demand of Green skills or green occupations.

3.2.1 New green collar occupations

In Thailand, there is no formal classification specifically on green collar occupations. But in the process, the private sector or companies initiated programmes by themselves for upgrading skills and retraining for their employees, the employees of the supply chain and services after sales which are mostly for SMEs, and for their customers. The training courses depended on the processes of products and services of each establishment. The companies set up training plan by themselves for productivity and survival of the companies. The Multi-national corporations are good examples such as automotive industry, companies that produce eco- cars or hybrid cars which upgrade their employees in new skills from existing skills to be green skills. But the technicians who repair and provide maintenance for the hybrid cars are important, as they provide after sales service. Those technicians are in green collar jobs. In the future, when the hybrid cars become popular in Thailand, there will be high demand for garages with technicians who have specific skills for different makes of hybrid cars or eco-cars to service. Another example is the mobile phone which is new technology and requires technicians to repair. The technician who repairs mobile phones is in a green collar occupation. The company provided training to their technicians and then extended the training to people who wanted to have skills and competencies on repairing the mobile phone. Those trained people, besides working with the companies, they are also self employed. The Department of Skill Development has this training course to train people who wanted to work in this occupation.

The identification of training needs for the new green collar occupations of government organizations has been set up by through activities of the project in response to the green policy delivered to people in consultation with community. This needs support from private sector institutions such as the alternative energy projects of the Ministry of Energy. They are on biofuel, wind energy, biogas, biomass, solar and hydrogen. In the Ministry of Energy's green action plan, it has included training for related people who have to work in the projects. The curriculum designed by the consultant companies that won the bidding to

⁹ Yuthana Praiswan, 2009. *The Bangkok Post*, Nov.

implement the projects, such as the project to develop Solar Power Generation Systems by Solar Thermal Energy, included the skills to operate, install, and maintain the solar system. The Ministry of Energy first trained the instructors who have existing background on electricity and topped up with the new green skills related to the Solar technology system. Then the trained instructors extended the training to people in the whole country where there are requirements to install the solar generator. The people who were trained by the Ministry of Energy acquired knowledge and skills to work in green collar jobs.

The green collar occupations that women in Thailand are doing are on recycling and reuse of materials in business and community enterprises which are producing products by using the raw materials in the villages. Some examples of Green businesses are production of bio-soap, cream from natural herbs or fruits. They also promote the eco-tourism in the village. The villagers have to decide on what they wanted to do, have training from the government officials in practical training in skills that they are required to work in including entrepreneurship development and on packaging and other skills that support the success of their business. (For more detail, see 3.2.6).

This is the example of green collar occupation though we still do not have data base or information existing right now. But in practice, they are actually implementing skills for green jobs and these are increasing.

3.2.2 Greening existing occupations

The awareness and the pressure to reduce the global warming have resulted with the current skills and occupations turn to be green. Such as in Thailand which is campaigning for the electric efficiency in buildings and houses which means that architects and designers are required to understand the various components involved in green building and adopted the advanced energy conservation technology by natural system of Thailand climatic weather and cooling environment. They should know the efficient standard of green materials, green label of electric appliances in houses and buildings.

The automotive industry which is the focus industry in Thailand is also required to provide green skills for the workers who are in manufacturing where the upgrading skills are provided by their employers. The alternative energy application is another focus policy for Thailand where the Ministry of Energy provides various training courses for technicians in industries, teachers from the vocational schools, instructors of the training institutes and villagers in the area of the application of alternative energy.

The agricultural sector is the main economic sector that creates the main revenue to Thai economy. Therefore, the campaign for green process and products is a strong concern of the Ministry of Agriculture which provides training for agriculturist to be aware and apply bio fertilizer that does not harm the consumers. To protect the Thai environment and ecology and make Thai society to be a green and sustainable society, His Majesty the King Bhumibhul Adulyadej of Thailand has initiated various pilot projects. The results were positive and the projects have been transferred to concerned ministries so that they are able to adopt and implement them, providing training to concerned people so that they can acquire knowledge and skills for operation. More details are provided in the example below:

The skills response to meet the challenge of the green economic restructuring should honour His Majesty the King Bhumibhul Adulyadej's Projects which have been implemented for more than 40 years. First, His Excellency conducted in-depth study and development on green projects such as conservation of watersheds, reforestation, rehabilitation of the drought and dry land to turn into green land, and using alternative energy from sugarcane, cassava, palm, renewable energy and Ethanol. as the pilot projects. Then the successful results are transferred to responsible line ministries so that they are able to extend the scope of implementation to the whole country.

The Mae Fah Luang Highland Agricultural Project stopped the deforestation caused by hill tribes who grew opium by providing education and training for them so that they can engage in other occupations. First, they were employed to plant trees to replace those that were destroyed and later employed them to look after the economic highland plantation and process the products from plantation to market. The products are coffee seeds and macadamia nuts. His Excellency's strategy as mentioned earlier was to let people participate from the beginning through pilot projects so that they have a sense of belonging in protecting their environment with the fair remuneration. These will allow them to live happily, stop them from growing illegal plants and have a good quality of life. This is the sustainable development strategy which was achieved by practice His Excellency. A Sufficiency Economy Philosophy was bestowed to Thai people as the way of living. All these projects enlightened the Thai people to be aware of the efficiency on consuming resources, balance the way of living and not to over consume in order to reduce and be concerned with global warming. The philosophy been accepted by the UNDP as the good strategy for sustainable development.

The policies of the current Prime Minister which was presented in this paper earlier covered the economic and environmental rehabilitation and some are integrated in the Ton-Kla Archeep project by helping laid off people especially women and men at the middle age and the young graduates to acquire skills and stay at home both in urban and rural areas. Some examples are training them to be self-employed in various occupations that offered short courses in 20 days. These courses are Sushi cooking (Japanese food), Mocketail (non-alcoholic juice drink), glass engraving, mobile phone repair, watch repair, air-conditioning cleaning with the green substances, car-care business with green chemical substance and green-painting training skills for house painting. All the examples are complemented with entrepreneurship development skill in order so that they know how to run business. They received seed money of 5,000 baht to start their business as self employed.

Agriculture: Thailand is the main exporter of rice and also fruits, vegetables, flowers, grains and various crops in the agricultural industry. Methyl Bromide is widely used for post harvest fumigation, quarantine, pre-shipment fumigation and soil fumigation for eliminating nematodes, pests, weeds and some types of plants pathogens. This substance has 0.6 times more as Ozone Depleting Substances compared with CFCs which cause global warming. So, the Ministry of Agriculture and the Ministry of Industry cooperated in a study to find and use alternatives substances to substitute Methyl Bromide. Later on, the government ran this same campaign among agriculturist, agro-industries, chain businesses and related people with local government playing key roles in this campaign to use alternatives substances such as Bio Fertilizer, pesticides, insecticides and the natural process to achieve the green products and at the same time can reduce the Ozone Depleting Substances. This will also revive the Ozone layer and reduce global warming and climate change as well as the quality of life of the consumers and the people. Using the greener substance can expand the markets both for domestic and overseas and generate employment. In the process of building awareness, also included training courses on competencies to select and apply alternative substances. Further, agriculturist officials were dispatched in each sub-district as mentor agriculturists in the area. The Ministry of Agriculture trained the people to make bio-fertilizer which is green and produces no harm to agricultural products, the environment and human beings. Examples of alternative substances and the natural processes are as follows (DIW, 2009):

1. Alternatives to Methyl Bromide for fumigating durable commodities i.e. rice, flour, cassava and corn etc.

- Heat Treatment: by heating products up to 50-70 degree Celsius and cooling them down to protect their conditions.
- Cold treatment
- Freezing
- Irradiation
- Phosphine
- Carbon dioxide or Nitrogen: for controlling and modifying atmosphere

- Phosphine with Carbon dioxide or Nitrogen
- Chemicals i.e. Sulfuryl Fluoride, Ethyl Formate, Ethyl Oxide, Carbon Bisulfide
- Insecticides i.e. Organophosphorous
- Pheromones

2. Alternatives to Methyl Bromide for fumigating perishable commodities i.e. vegetables, fruits and flowers etc.

- Cold Treatment: by cooling down to +2 to -1 degree Celsius.
- Heat Treatment: by using humidity or heated air at 40-55 degree Celsius.
- Carbon dioxide or Nitrogen: for controlling and modifying atmosphere
- Irradiation
- Sulphur Dioxide
- Chemicals Dips i.e. using diluted pesticides

The occupations that were involved are those in agricultural chemistry and biotechnologists who conducted research on green substance or green fertilizer including the whole system of production and application to plants. The results of study were extended to train agriculturists for the application of green substance products. The awareness of people on application of green substance which produces no harm to the environment and human health can create high demand in consumption, can be used widespread and can be practiced more in their daily life. As a result, the volume of export green products is increasing. As Thailand has joined the other 80 countries as the founding members of the World Trade Organization (WTO), their obligation on the WTO Agreement is on the Application of Sanitary and Phytosanitary Measures (SPS) covering food safety and plant health. These have increasingly become issues which need to be addressed widely as technical barriers to trade. The Thai Agricultural Standards (TAS) have been set up to ensure food safety for consumers worldwide and work closely with Food and Drug Administration for the quality of life of consumers and also protect the ecology and the environment of the Thai society.

Solar energy: In order to help reduce global warming, the use for alternative energy sources is widespread throughout the world. Solar energy is one source of green and clean energy, especially suitable for Thailand which has strong sun throughout the year. EGAT has conducted research and development for the application of the Solar Cell and produced solar grids for application as pilot project. However, this research by EGAT also stated that actual solar cell cost is too high for household use. Later on, Bangkok Solar Company Corporation Ltd. (BSC), which was established in May 2003, has challenged the study of EGAT by setting up a factory at Cha Choeng Sao province to produce the first Amorphous Silicon (a-Si) Photovoltaic in Thailand with the one-stop service which includes Installation, System Consultant and Designer for all sorts of projects such as Site Survey, System Design, and System Evaluation. All these services require specific skills and competencies of workers in Electrical Engineering and workers who graduated from the Vocational School in Electricity on the production of solar cell, solar grid, design, installation and maintenance. Although they have basic skills in electricity required by the company, they still need more depth in specific skills to work and operate on solar energy. Since solar energy is a new technology in Thailand, people need to work on installation and maintenance. However, this is lacking in the labour market so the company and the Ministry of Energy provided upgrading training courses for people who have background on Electricity to be solar technicians. The company has organized workplace upgrading training for employees in order to achieve the quality and productivity of the production, products and services of the company. This is an interesting case study for Thailand. Due to high demand of solar modules, BSC has increased its capacity to 20 MWp around the middle of 2006 and currently reach 50 MWp in 2008 to serve increasing demand globally.

Mr. Sompong Nakornsri, the President and the CEO of the company stated:

“We are aware of the fact that many people on earth, who really need to utilize free energy from the sun, cannot afford to buy solar modules. This is a part of our business and sales policy to help them by giving the opportunity to access and harness solar

modules at a reasonable price. Furthermore, we are confident that our business philosophy will contribute to preserve both world Environment and Natural Resources and will enhance Quality of Human Life.” Moreover, the Mission Statement of the company also states that “*put priority on Human Resources Development, Research and Innovation and the Socially Responsible in Education and Community to make a Better Quality of Life.*”

Manufacturing: Thailand has strong policy on Foreign Direct Investment (FDI) since the 2nd National Social and Economic Plan (1965-1970), aiming to transform from an agricultural-led economy to an industrial-led economy. Various incentives have been provided to attract the foreign investors including the Japanese investors. Here are some examples with regard to green manufacturing: the Fujikura (Thailand) Ltd., the Canon Hi-Tech (Thailand) Ltd. and the Daikin Thailand. These companies confirmed that they provided upgrading on specific emerging new green skills for their employees through training courses designed by their mother companies and also designed job descriptions of employees who work in occupations that will be transform to be green occupations.

The Fujikura (Thailand) Limited

The Best Factory Awarded 2001 was established in the 1984, located at Navanakorn Industrial Estate, Pratumthani province outskirts of Bangkok, producing Electronics spare parts for computer, mobile phone, Thermal Solutions, Metal Dome Switch Assembly and Cable and Cable Wire Assembly for computers. They have 4,536 Thai employees of which 70 per cent are women working in operation lines and some who have degree level education working in green purchasing. The company has committed to the environmental policy and strictly implementing an environmental conservation management programme since 1998 for the whole process of production, green procurement for the raw materials, pollution prevention, waste disposal emission and hazardous substance control, resource reduce/ recycle /reuse, waste minimization and energy conservation. All workers attended green training courses in general and specific skills to their production lines.

Mr. Minoru Makiyo, the President of the Company, said that the company believes in “quality through people” so that the company shall continue to train and building employee skills in all areas as well as supply chain of the company to understand the Green & Clean Environment and the green jobs as seen in the training plan of the company each year. The success of achieving green establishments as the ISO 14001 and ISO 9001 lies on the company’s Road Map and continuous training system for all workers. This is the first step from the time they joined the company and this is especially on the green environment and safety training courses. As a consequence, the company can save 5.02 million baht and save electrical usage 1.67 million KWH per year. They also have the activity to secure quality of work life for all employees by harmonizing business with society and the nature. These have resulted in increased productivity and the products are preferred by customers. Last year, although the market was affected by the crisis, the total sales as of 30 June 2009 was THB 6.58 billion (Euro 185M, USD 195 M, JPY 18B).

Recall Thailand

Materials Management: Sustainable Information Management and “Green” Jobs with Recall. If Recall’s growth is any indication, the company must be succeeding at caring for its customers, environment and community. A global leader in information lifecycle management, Recall is owned by Australian-based Brambles and was established in 1999. In the years since, Recall has grown to employ over 4,500 Team Members at approximately 300 dedicated operations centers in more than 20 countries. Recall supports a diverse customer base numbering nearly 80,000 clients.

Recall’s services include:

- Document Management Solutions (DMS), such as secure storage, indexing, and digitization of physical and digital files.
- Data Protection Services (DPS), such as secure off-site storage, rotation and recovery of computer system media and back up data.
- Secure Destruction Services (SDS), which include the destruction and recycling preparation of documents, media and other critical items.

With its DMS service offering, Recall provides, and encourages customers to use a digital solution. Electronic documents reduce the use of paper, waste, and the carbon emissions associated with paper manufacturing and distribution. Information that must be available in physical format are securely stored by Recall and made available to customers as needed, thereby reducing the need to produce multiple copies of important documents.

The closed-loop SDS process is tightly controlled from the collection of customers' locked containers to the destruction of materials - either on-site or in one of Recall's dedicated destruction centers. All destroyed paper documents and other items are prepared for recycling.

In fiscal year 2007, Recall sent approximately 200,000 tons of securely destroyed paper material for recycling, which is the equivalent of nearly 3,000,000 trees.

In Recall Thailand, securely destroyed tapes, computer disks and multi-media items are also recycled putting the four Rs – Reduce, Reuse, Recycle and Recover – into action.

Global Commitment to Zero Harm: Above all other priorities are Recall's commitment to ensuring the safety and security of its Team Members and assets it has been entrusted to protect and the communities in which it works. In addition to addressing the belief that every individual has the right to end the work day in as healthy a condition as when it began, Zero Harm calls for the following:

- zero environmental damage
- sustainable resource management
- minimizing waste.

The management of safety, security, health and the environment (SSHE) is an integral part of Recall's business objectives. To achieve this, the company adheres to global standards, programme-based strategies and training for all Team Members, and the setting and measurement of competitive targets to ensure continuous improvement.

Skills needed for “green” jobs

Given the nature of some of Recall's service offerings, such as digitizing files and recycling securely destroyed documents, tapes and multi-media items, the company offers its customers environmentally sustainable business solutions. As customers come under increasing pressure to securely manage their information, stay within regulations and choose “green” options whenever possible, they find attractive solutions with Recall. To perform the tasks associated with Recall's “green” jobs, Team Members need a variety of skills:

- basic IT skills, such as working knowledge of email systems and scanner technology.
- data entry skills, used in the digitizing of files.
- working knowledge of physical filing systems.
- working knowledge of satellite navigation, or global positioning systems (GPS). Many of our vehicles are equipped with this technology which is used to efficiently maximize our delivery routes.

While some of these skills are becoming ubiquitous, Recall is committed to providing training to its Team Members whenever necessary. And besides offering training programmes on topics specific to Recall systems, the company also offers training on general environmental and safety topics such as energy conservation and workplace safety.

In addition, Recall Thailand has recognized populations that can help fill some of the company's open positions – the physically handicapped. Recently, the company hired four persons with disabilities as Team Members in its facility in Bangkok to support the business using both “green” and regular job skills, and they are included in any ongoing training programmes. First, they received orientation on the vision-mission of the company to try to achieve the green company. Then trained them on soft skills such as team work, communication and specific skills to work on data entry, digital Indexing, preparation document for scanning, operation of scanning, 4 Rs, all process integrated safety on working. The section that they are working called “Document Management Service “work for conversion of paper to digital system. The company called this section “Green Section”, for trying to reduce the usage of paper by recording information by electronic system. Before they come to work with the company, their existing skill is on data processing but after working with the company they were trained for more skills including green skills and the awareness of reducing global warming through technology, the recycle process and the electric efficiency utilization which they can bring their knowledge and skills to apply in their house, their community and extend to society which supports the reduction of global warming as a whole.

Construction

UNEP et al. (2008) are clear to explain some of the green construction skills which can be applied in Thailand as follows:

“...most of the jobs created through green building practices are likely to occur from energy savings and reinvestment. The types of jobs will need to be redefined in terms of new skills, training, or certification requirements; however, many of these jobs are likely to be performed by people who are already working in the building sector.

Redefined jobs include green building architects and designers, who as part of the green building sector must consider the entire life cycle of the building and reduce raw material use, emissions, and water use and improve energy efficiency, indoor air quality, and occupant health. Because green buildings are designed as single, integrated systems, the architects and designers must understand the various components involved in green building: efficient cooling, lighting, cooking, appliances, and insulation; passive solar, thermal mass, renewable energy sources; and low-impact building materials. Understanding the green building process and local or national green standards require additional knowledge, training, and certification. In most cases, these new green design jobs replace already existing ones.”

Sirinthorn Vongsoa-sup, Director of Energy Promotion for People Division, Ministry of Energy said that government campaign for energy conservation house and set up the efficient standard of green construction materials, green label for electrical appliances and also set up energy conservation building. The objective in constructing this building is to be the training centre for technology transfer and energy conservation. The design and construction of this training center adopted the advanced energy conservation technology by natural system of Thailand climatic weather and cooling environment. The design of the building internal system and material selection capably block the external heat and moisture. Hence these minimize the building energy use by still maintaining the value and image of architecture.

Rubber plantation

Wooden toys have been considered as hygienic and safe for babies and children to play. The raw material, of course, comes from wood which causes deforestation and affects the ecology and environment.

Rubber tree is the economic plant of Thai economy. We use the latex from rubber tree to make many products. There was a study which found that after seven years the rubber tree will not provide high yield of latex which is used to make rubber and processed into many other products. The result of the study found that after seven years of scrubbing, the tree should be cut down and the wood recycled to produce any product. While growing the existing plant, young rubber plant should be grown in parallel. After seven years, the young tree will be in the state to producing high latex which increases yield and high quality of latex to agriculturists.

So, the Ministry of Agriculture organized training for agriculturists to change their beliefs, create understanding of the cycle of the rubber tree and how to get more value added from the rubber wood.

The rubber wood has been recycled to make furniture, paper and the wooden toy. The Thailand-based Plan Creations Co., Ltd is the world's first wooden toy manufacturer to successfully use recycled rubber wood that no longer provided any useful yield of latex after 25 years.

The wood is specially roasted and oven-dried to maintain the right moisture and prevent termites and bacteria. Children can connect with nature while playing with plant toys products. This factory generates employment for local 501-1,000 persons.

The skills of people for this green business are design, wood working skills, the nature of rubber wood, when and how to cut wood for reducing the waste, the material for assembly must be green as the international standard of food health and safety and the standard of the Office of the Consumer Protection. Packaging should attract children, and also efficiency logistics system. To increase productivity of the rubber wood industry, Thai government received technical assistance from Australian Government to send expert to train instructors of DSD and rubber wood manufacturing to analyze the causes of low productivity. They are then trained to improve their strategies. The skills of people in former times applied their indigenous wisdom by transferring them from generation to generation without any theory. After the R&D by the Australian resource person, he then designed the curriculum and courses of training to train instructors from training institutes, foreman in the industries and related people. For the designers who used to design the shape of toys manually, their skills and competencies are upgraded by working with CAD (Computer Aided Design). This is the example of changing techniques, technology and process of working from the existing to new green skills.

This business has been very successful because of the initiated idea of the owner to overturn the threat to opportunity by catching niche market on the green and innovation of the designed product. Also, deforestation was avoided and reforestation, recycling and keeping the green environment promoted.

3.2.3 Identification of skill needs

As mentioned earlier, Thailand does not have any data base and information on green skills, green jobs and green collar occupations. To identify green skills needs in the labour market, employers or establishments conduct research and development for the new process, products or services and then transform the process and the required skills to training courses for employees who are responsible for the jobs. Government identifies the skill needs in the proposed projects that require people and will be trained for the quality of the

work. Government, school, university and training institute play vital role to support people as the example of Ministry of Energy but there is no system for the whole labour market. The work of each Ministry is just a piece of the jigsaw puzzle which are not interconnected. They are unable to see the full picture because the Ministry of Energy provides training for Solar technician which is separate from the Ministry of Labour, EGAT, private industries, universities and vocational schools which also conduct the same training. They do not have a center to collect information which can give the whole picture of the country. They also do not collect information for demand of green skills jobs, green collar jobs and analysis of skills gap.

The Department of Employment, Ministry of Labour is responsible for labour market information (LMI). It collects information on demand and supply of labour market, analyzes the shortage of skill labour, estimates the unemployment rate and prepares the labour market situation report each month regularly. But they still do not have data base for green jobs, green collar jobs and cannot estimate the total demand and analyze of the skill gaps. Currently, the companies identified green skills needs themselves and the training institutes provide green skills training by demand of industries. There is no complete picture of the whole country as to the demand and supply of green skills in the labour market.

3.2.4 Skills response

In Thailand, there are many institutions organizing training for their own people using their own budget. The Government's fiscal year is 1 October to 30 September, but the private sector uses the calendar year which is from 1 January to 31 December. The DSD under the Ministry of Labour is one of them. It is the Secretariat of National Vocational Training Coordination Committee which coordinates the Skill Development Plan in order to avoid the duplication of all training courses including green training courses, target groups, areas to economize the budget and bring the services to people fairly. Unfortunately, the committee does not function well and, therefore, there is still no coordination among institutions. The system needs to be improved for better quality and efficiency of training.

The DSD's main function is to provide training and upgrading skills for workers in the labour market to acquire knowledge and skills in both the technical and non-technical areas and services. There are several training courses on green curriculum offered to people in 76 provinces for the whole country. Each year DSD could train approximately 220,000 persons nation-wide.

EGAT conducted R&D for the application of the solar energy and production of Solar Grids as pilot project. However, this research by EGAT also stated that actual solar grids cost is too high for household use. But the price will be cheaper if it is widely used by the people. So, DSD cooperated with EGAT and provided training to instructors of DSD to know the application and installation of Solar Grid which is the green energy and accessible to the people in the far and remote areas so that they can have green electricity. The trained instructors extended the competencies and skills to people in both rural and urban areas so that they are able to know the qualification of Solar Grid and apply it in their agricultural machines, such as the Solar Oven, the Solar Distiller and the Solar Fertilizer Distiller. To apply the solar machine, people must acquire skills to install and maintain them. They are trained by instructors in the training center of DSD in each province.

In the far and remote villages, the engineers of EGAT installed a solar generator and trained the villagers to be the solar electric technicians in the village in order to maintain and solve the problems on spot. This is in cooperation with DSD because EGAT does not have enough technicians. The training was practical and if they have problems they can consult the instructors of DSD.

The Ministry of Industry organized various training courses for industries and establishments on green curriculum. There was one project supported by the World Bank

which assigned the DSD to train SMEs who run businesses on air-condition repair and refrigerant, to use other substance instead of CFC which is Ozone Depleting Substance. The trainees received some money to modify tools and equipments from the World Bank after finishing the training and to implement what they have learnt.

Ministry of Tourism and Sports organized training courses on Eco-Tourism for the villagers to setup a green long stay village for people who stay in the villages. The villages that were selected were proposed by the villagers and which are tourist places. The training courses include the concept of Eco-tourism; protection of the environment and ecology of the surrounding village; management of the village with full facility but preserve the culture, indigenous wisdom and the way of living of people in the village; give warm hospitality; manage clean houses which are offered to tourists; have hygienic beddings, bathroom, food and drink; provide first-aid in case they are sick; and organize some cultural activities such as demonstration on how to grow rice with traditional way, Thai cooking and traditional massage. This is a kind of community enterprise which aims to generate employment and income for villagers. People in the village share responsibilities and look after the security of tourists. The laid off people went back to the rural areas and worked for this project in their villages. Most of villagers working in Eco-tourism are women. Mr. Supot Chunhachoti-ananta, the lecturer on Eco-tourism of the Srinakarinwirot University explained that there are various skills in Eco-tourism such as the Tour guide, Tour Operator, environmentalist, wildlife and environment conservationist and skills on hotel management,, as explained above. However, it is difficult to identify specific occupations in Eco-tourism at this stage since there is no data base to analyze and forecast for demand.

If we have good information, the University can plan for providing education and training in this field to supply to labour market. Universities, educational institutions and vocational schools can organize training courses for people as well.

In the university, students who have background in the Engineering fields can focus on research and development for the innovation on products and the process of Greening by working in cooperation with establishments. At the school level students can focus on green technical work.

The Ministry of Interior, in the Community Development Department is responsible to train villagers on OTOP (the One Tambon One Product Project) to acquire knowledge, skills complemented with entrepreneurship development in order to know how to run business and that business should be sustainable for the government support in marketing. There are more details in the 3.2.6.

The Federation of Thai Industries (FTI) is an upgraded body of the Association of Thai Industries which was created on 13 November 1967. The transformation took place on 29 December 1987 by the enactment of the Federation of Thai Industries Act, 1987 which requires the body to be under the supervision of the Minister of Industry. The FTI has gained the countrywide recognition as the only voice of the industrial community in Thailand in addressing the issues and in co-coordinating with the Government both internally and internationally.

The FTI also has training courses for their members on specific skills depending on the demand of members in cooperation with DSD and other line responsible ministries and academics. The Electric and Electronics Institute cooperated with DSD on designing updated curriculum for training and training of DSD's instructors on new technology and the application of the green substance in the refrigerant and refrigerator. The objective is to extend the updated knowledge, skills and technology to SMEs' technicians who can spread information and skills around the country through the training institutes and centers of DSD in all provinces with the concern of the safety of consumer and reducing the global warming.

The training in the workplace is the most efficient than other way of training. Some courses are confidential only for their workers so employers preferred to train by themselves. This project is not the same as the World Bank Project.

The Border Green Energy Team (BGET)¹⁰

The BGET is an NGO which provides hands-on appropriate technology training and financial support to village innovators in ethnic minority areas on both sides of the Thai/Burma border. There is still no electricity supplied to many of the villages in far-off regions in Thailand. In order to provide these villagers with basic lighting, the Thai government began an ambitious two-year US\$200 million programme to provide solar home systems (SHS) to 203,000 remote households. An estimated 15,000 Thai solar home systems are located in Tak province, mostly in the western part along the Thai - Burma border. However, there is no maintenance or repair programme in place to ensure that these systems will continue to work in the long term, nor are operations and maintenance instructions provided to system recipients.

The initial goal for this project was to complete training in each of the 11 tambons (sub-districts) within the two amphurs (districts) in Tak province with the majority of the SH systems (together, these districts contain 9,000 of the 15,000 SH systems). The intended outcome of the training in a given Tambon is that each Mooti (group of villages) within the tambon is represented in the audience, and that at the conclusion of the training at least two people from each mooti are qualified and equipped to act as technicians for their respective mooti. The training courses that were delivered to villagers were the following:

- **Thai Solar Home Systems (SHS)** - BGET aims is to improve system sustainability. This includes teaching villagers and local government technicians about proper operation and maintenance, helping to encourage a basic supply and support network, and ensuring the proper removal and recycling of dead batteries.
- **Refugee Camp Trainings** - BGET's work with ongoing refugee camp trainings is both a vocational and general education endeavour. The curriculum for the project includes the following renewable and sustainable energy technologies: hydraulic ram pumping, micro-hydro power systems, solar electricity, solar-powered water pumping, and solar cooking.
- **Community Micro-Hydro Systems** - BGET helps rural communities to build and sustainably operate micro-hydro systems.
- **Refugee Camp Hybrid Power Systems for Computer Centers** - BGET's hands-on trainings with refugee camp vocational education students cover a variety of appropriate technologies. The latest project builds **hybrid solar/diesel systems** that power computer classrooms rooms in the seven Karen refugee camps along the Thai-Burma border.
- **Medical Clinic Solar Power Systems** - BGET works with border medical clinics and their staffs to provide solar power systems and the necessary expertise to operate and maintain the systems.
- **Community Biogas systems** - BGET helps rural communities to build and sustainably operate bio-digesters.
- **Community Hydraulic Ram Pump System** - BGET helps rural communities pump a constant water supply, delivering the water to their village when the water source is distant from the village.

BGET works with local sub-district governments to provide 2½ day trainings on system maintenance, operation, and repair. From 18 to 22 August 2008, BGET, with funding

¹⁰ <http://www.bget.org>

from the Japan-based organization, Wakachiai Project, installed a 480 watt solar panel array for the Camp Committee office of Nu Poe camp in Umphang Province, Thailand.

The class consisted of 20 students who speak one or more of Burmese, Karen, Thai, and English. The students attend renewable energy training. Some students appear more interested than others but everyone is there because they chose to come. Students are aged 20-46 years and there are four women. Most of these people did not have jobs and some had been away from their home in Burma for 20 years. Students were given training on fundamental concepts like power, current, and voltage, as well as more specific knowledge like how to test to see if a battery is still good, how to use a multi-meter, and how to ensure the panels are collecting maximum energy. There are no records that they work outside the refugee camps.

Table 3. BGET performed trainings

Date	Tambon	District	SHS Systems #	No. of Students
2006 June	Mae Tuen	Mae Ramat	1,443	28
2006 May	Mae U Su	Tha Song Yang	1,065	19
2006 Mar.	Sam Meun	Mae Ramat	642	19
2006 Feb.	Tha Song Yang	Tha Song Yang	571	25
2005 Dec.	Mae CHa Rao, Phra Tart	Mae Ramat	250	19
2005 Dec.	Mae La	Tha Song Yang	847	30
2005 Nov.	Mae Wa Luang	Tha Song Yang	778	39
2005 Oct.	Mae Song	Tha Song Yang	1,728	29
2005 Oct.	Mae Tan	Tha Song Yang	964	16
Total			8,288	224

Source: <http://www.bget.org/> - Specifically:
http://www.bget.org/index.php?option=com_content&task=view&id=36&Itemid=68

Finally, there is no single organization to respond to training people on Green skills job. Each organization has its own objective and target group.

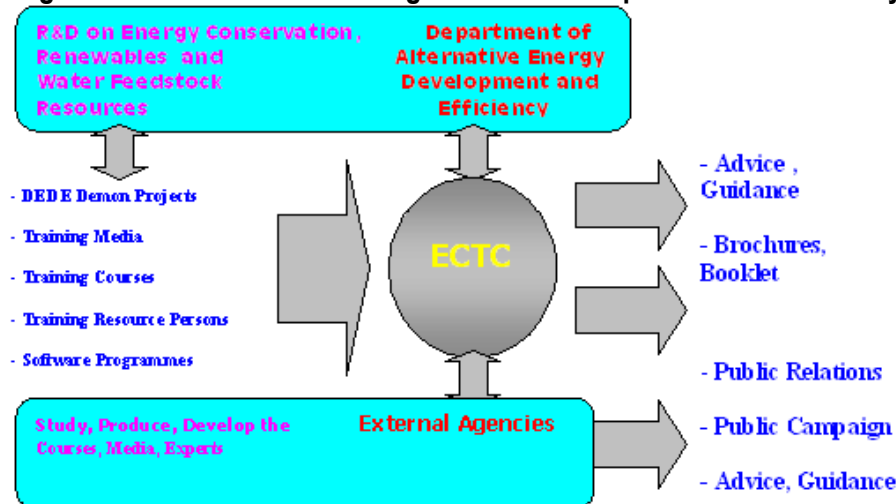
3.2.5 Case studies on new green collar occupations

In Thailand, there is no database of new green collar occupations nor a formal definition of it. So, it was difficult to provide this definition according to the Terms of Reference (TOR) of the study.

It is clear that Thailand has a strong policy to apply alternative energy as indicated in the plan of the Ministry of Energy in Appendix 3. Solar and wind energy are the trend technologies which people must work on, but they need skills training in order to operate, install and maintain such technologies. The consultant company decides on the training courses for the staff and instructors are sent to train people who are technicians on alternative energy. The background of people who are working as the supervisors is electrical engineering and mechanical engineering but for those working as technicians, their background is in electricity. They are trained in upgrading training courses and practical training for some period of time to be qualified for this work.

From the Ministry of Energy's project, there are plans to employ people to work in solar energy and wind energy but we do not know the exact demand in the labour market on how many people are required to work in these green collar jobs. If we know, we can train them in order to supply the people in the labour market.

Figure 1. Formation of the new green collar occupations of the Ministry of Energy



Source: DEDE, 2009.

This model shows the formation of the new green collar occupations of the Ministry of Energy.

Transport: Thailand is the base of automotive manufacturing and not only sale in the local market but also for export abroad, so automotive technology has to be modified to be green to reduce energy consumption and global warming.

Professor Phulporn Saengbangpla, Honorary President of the Society of Automotive Engineers – Thailand (TSAE), and Chairman, Auto and Auto Parts Standard Committee said that the trend of technology is eco cars, electric cars and alternative energy such as hydrogen, and bio gas which can be used for both fertilizer and fuel. The process of production, raw materials and spare parts of cars produced in Thailand is strictly on International and EU Standards. Those raw materials must be green and be recycled. The training of employees is at all levels: engineers, operators, workers, laymen, etc in the automotive industry and the supply chain is vital for the quality of the products and they are doing regularly. Concerning the green technology or hybrid car, the blueprint is sent from the mother company with the training courses and instructors who train Thai employees and the supply chain producing spare parts in order to transfer green technology. She said that one car consists of 30,000 pieces of materials that form a quality car. The training for producing hybrid cars requires upgrading to know the engine, the battery and the system. Her worry, however, is that disposal of used batteries should be strictly controlled.

Mr. Vallop Tiasiri, Director of the Thailand Automotive Institute, said that the automobile industry needs a clear policy for cars that is suitable to Thailand. Each company has its own technology to train its workers, which are confidential of the company. Skills of workers working for hybrid and electric vehicles require the same basic skills as normal cars, but the difference is the design which is usually the blueprint that comes from the mother company. The company organizes training courses to upgrade skills of their workers. The trend of skills should be basic electric and the electronics system, knowledge of green material, standard and testing and the knowledge of environmental conservation with their awareness and consciousness on greening. The training courses are designed by the mother companies abroad.

The new green collar occupations dealing with the automotive industry are the technicians working in the eco-car or hybrid car garages which provide services to repair and provide maintenance for all makes of eco-cars, as well as the technicians who modify the car engines to use LPG, NGV and hydrogen instead of fossil fuels.

The Thai Government decided in June 2007 to grant tax incentives to auto manufacturers that produce small, fuel-efficient “eco-cars.” The excise tax rate was set at 17 per cent (compared with the typical 30–50 per cent), and eco-car manufacturers will receive up to eight years of exemption from corporate income tax payments and machinery import duties. In order to receive tax breaks, a company must produce cars that do not surpass a certain engine size (1,300 cubic centimeters for gasoline engines and 1,400 cc for diesels), consume 5 liters per 100 kilometers (47 miles per gallon) or less, generate no more than 120 grams of CO₂ per kilometer, and meet Euro-4 emissions standards. Companies must make a minimum investment, produce at least 100,000 cars by the fifth year of production, and produce at least 80 per cent of parts domestically.

Japanese companies, Suzuki and Nissan are planning to produce 138,000 and 120,000 such cars, respectively per year. Honda is planning to double its production to 240,000 units. Thailand’s Board of Investment (BOI) is to consider similar proposals from Mitsubishi Motors, Toyota (which was initially skeptical about this initiative), Volkswagen, and India’s Tata Motors in January 2008. The cars are to be sold not only in the domestic Thai market, but also in other Asian countries, Australia, and Africa. Thailand could thus, become a regional hub of “eco-car” produced by qualified skills workforce. This is the strategy of skills development provided by the companies training their workers, supply chains manufacturing and the technicians and workers of the eco-garages. These are important due to the services after sales to all customers of different eco-cars.

Sudjit Inthaiwong, Deputy Secretary-General of BOI, says, “We are hoping the eco-car will be our next global niche.” Having seen output and sales boom since the late 1990s, Thailand produced some 299,000 cars and 896,000 commercial vehicles (mostly small pickup trucks) in 2005. But domestic demand weakened in 2006 and 2007. While partly designed to overcome the slump and attract new investment, this initiative has the potential to green a substantial share of the country’s car industry and thus a portion of the **182,000 jobs** in the sector which consists of workers on car assembly manufacturing, supply chain workers of SMEs and technicians of the eco-car garages.

The degree of greening will depend on whether the new eco-cars (whose retail prices would be reduced by the preferential excise tax rate) will displace conventional vehicle sales (a fear expressed by several companies) or will simply boost car ownership rates in Thailand. It appears that pickup trucks, which are taxed at a far lower rate than eco-cars, will remain popular. This raises the question whether an eco-car initiative is best focused on small cars only, or would better be applied to a broader class of vehicles.

3.2.6 Case studies on greening existing occupations

Some case studies on greening existing occupation are presented as follows:

The Eco-Town Project. One strategy to reduce global warming is to reduce waste in the production process of industry. So, the Department of Basic Industry and Mining, Ministry of Industry developed the website (<http://www.ecotown.go.th>) as the center for the recycling materials from industry and also disseminated technical information for the recycling methodology of various waste from industry, marketing, and showed the success cases. The case presented here is the waste mud from the recycling waste water treatment of the ceramic making industry. It used to be thrown away with no value but now the factory can sell the waste mud at 200 baht per truck to be produced as brick block. It is added value to the waste. The factory can have supplement income from selling mud at 560,000 baht per year. People who produced the brick block received technical skills training on masonry, on the kind and quality of raw material, how to use kiln and also included skills to run business. This case is one of the existing green occupations. There are SMEs which produced brick block for sale but this case has become green because of using raw material from the recycled waste mud. This occupation can be named the recycling manufacturing which utilizes different raw materials on recycling.

Green Logistics. Assistant Professor, Dr. Suwannee Aswakulchai, presented her study on Green logistics which was initiated for reducing Co2 emission to the environment which is the cause of global warming. She proposed to set up a Distributor Center as the one stop services to combine all processes in one area such as the repackaging and re-use in the center. So, there will be demand for people to work in the center, they need to be trained on the required skills. The skills required for these jobs are computer skills and recording and storage system for in and out products. Originally, they are done manually but now they have the barcode system which is the technology to facilitate work and reduce operation time. There is accuracy in controlling storage and packaging, encourages team work and green transport. People who are working on this system received upgrading skills organized by employers in cooperation with training institutes such as DSD, Purchasing and Supply Chain Association, Green logistics include upgrading skills of truck drivers. The training courses are upgrading training courses. The green logistics not only increases productivity of the company but also that of the supporting industry. It also increases productivity of the customers' establishments.

One Tambon One Product (OTOP) Project (Tambon is sub-district). The project was initiated by the former Prime Minister, Dr. Thaksin Shinawatr, in order to create employment for agriculturists and villagers who have free time working in the field and plantations. All OTOP projects are 'green' jobs. Government agents consulted the villagers on what occupation do they want to engage in or what product do they want to produce. Then this was followed with providing training programmes for the villagers on green skills in processing indigenous raw materials into finished products. The strategy is to encourage people to participate from the start and allow them to make proposals of the products which suit their interests. Government support is provided to encourage people and provide instructors to train them according to the specific skills they need in processing the indigenous products. The skills are different depending on the type of products selected. Training courses, aside from specific skill training on woodwork and ceramics also include Thai traditional massage and Spa, and food processing and preservation. These required different sets of skills but also considers innovative ideas for product development, designs, packaging, team work, entrepreneurship development, marketing, logistics, basic computer, international standards for raw materials, food, beverage, green products, and also know-how on the sources of funding. In general, OTOP businesses are mostly community enterprises and therefore, there is mutual sharing of responsibilities. People involved in these projects are largely women and elderly people. By virtue of the OTOP project, technologies are applied into indigenous wisdom in the production process of goods and services. These projects are sustainable development which helps to elevate the quality of life of the people at the grass roots. An example which may be cited is the use of indigenous herbs for the production of soaps, hand cream, aromatic oils for Thai traditional massage and spa, herbal medicine, handicraft, wood work, cotton and silk weaving with natural colour dying, ceramics, and food processing and preservation. All these products bear the stamp of approval of the Food and Drugs Standards of the Ministry of Public Health.

One explicit example that shows the difference of the existing skills and greening skills is that of herbal medicines. Since time immemorial, people have mostly been using unprocessed herbs as medicines. Now with the OTOP project in progress, villagers are trained to utilize the natural ingredients to be more attractive for marketing. Today, instructors from the Ministry of Public Health provide skills training to the villagers in the production of herbal medicines, starting from the selection of raw materials to use of hygienic processing techniques and, finally, to the packaging of the products. In days of yore, herbal medicines were mostly taken in raw form. Today, they are made into tablets and capsules, packed in handy and attractive packets with instructions for application inclusive of expiry date, or if they are ointment or balms are in bottles.

The current government has also endorsed the continuation of this project, perhaps as a rally for rural support.

Some example of five stars OTOP which are distributed in local markets as well as overseas markets. They have their own website (<http://www.otop.org>) to receive orders and communicate with customers abroad through internet.

Hydroponic vegetables do not contain chemical residues and they are highly nutritious. They are grown in mineral solutions instead of soil. Vegetables, during their growth cycle, are covered with nets as protection from insects. Hydroponic vegetables are fresh, sweet and juicy without chemical residues. For the cultivation procedure, mineral solutions for seedlings are prepared. Then seeds are prepared and the sponge is watered. When the seed has grown, the seedling bears leaves and roots and are removed from the saplings to a vegetable patch. After 25-30 days, the vegetables will be ready for marketing.

Sunflower seeds are health foods which can strengthen the eyes and reduce cholesterol in the bloodstream while preventing Alzheimer's disease. The process of production involves coating the sunflower seeds with chocolate or coffee after baking them. Then, recoat them with syrup to prevent the chocolate/coffee coating from melting. Then, design nice packing to attract customers with instruction and expiry date.

Presently, there are altogether 570 items of 5-star OTOP products. Of these 29 items are grouped as food; as beverage 122 items; as clothes and garment 85 items; as ware and decorations 33 items; as handicrafts and souvenirs 37 items; and the rest are herbal supplements. Different items require different skills of people such as wood work, which is different from ceramics or food production. The Government provided training for them and organized OTOP bazaars occasionally for marketing and sale of their products.

4. Conclusions

4.1 Main greening shifts in economic and labour markets

The ILO discussed and considered that skills development should form part of an effective response to changing environmental conditions like with climate change among others. Identifying skills requirements for adaptation to climate change and mitigation measures via reduction of GHG emissions have therefore important roles to play in policy development. As a result, the study on Skills for Green Jobs has been initiated.

The Methodology of the study involves thorough desk research & data mining via trusted sources, which are both the companies' own websites and Thai government and other related websites. Literature review, interviews, and visit to the enterprises, government agencies have also been conducted. Focused group meetings have been organized with representatives from employers and employees confederations, and professional association and the social partners.

Thailand has joined many other countries facing the global crisis on energy and economic crisis, environment, natural resources, demolished ecology and pollution and the serious disaster phenomena, which are effects of global warming.

The Thai Government has a strong commitment on green policy, which is even mentioned in the Constitution in Sections 85 and 86 (2007) and also in the NESDP (2007-2011). The most active organization in implementing green policy is the Ministry of Energy, the Department of Alternative Energy Development and Efficiency (DEDE).

4.2 Skills implications and development

4.2.1 Anticipation and identification of skill needs

As Thailand still has no database on green skills and green jobs, the identification of the skills needs in the private sector has been done by employers or establishments as the result of in house research and development on raw materials, process, and products. Then courses of training are decided and provided through upgrading skills of workers and also workers of supply chain in order to operate with new skills. In case of Multi National Corporations such as the automotive industry, the blue print on the courses of training and instructors are sent from the mother company. The trend of Thailand on green skills and green jobs can be found in the automotive industry, construction, refrigerator and air conditioning as well as in the production and application of alternative energy.

For the public sector, the identification of skills needed is included in the proposed projects for operation and the training courses for concerned staff who will operate the new technology of the projects of Ministry of Energy. These projects are on producing biofuel from crude palm oil, the installation and maintenance of the wind turbine energy and solar power generation by solar thermal energy. All these projects require different skills so the training of concerned people is important for the success of these projects.

4.2.2 Response policies and programmes

Thailand is facing the energy and environment crisis and is trying to reduce the importation of expensive crude oil and reduction of carbon emissions which causes global warming and which will improve the environmental and ecological conditions. So, line ministries issued the action plans in response to the policy of the government through various programmes and projects. Some examples are the 15th year Alternative Energy Plan

and the DEDE Four-Year Action Plan (2008-2011) which have been implemented. The plan includes green skills development for responsible people to operate the new technologies. Line ministries have their own training plan which are not integrated with others. However, integration and coordination is important to avoid duplication and should share resources to make training to accessible to all target groups.

In the private sector, most of the industries respond to the policy of the government and the global campaign on producing green products by green raw materials and green processes. These should also not be harmful to the environment and ecology surrounding. The training for green skills is organized by the company through the employers. However, the curriculum is confidential specially those on green skills for production and services.

The problem of Thailand is on the effective implementation of policy which still needs to be improved.

4.2.3 Effective delivery mechanisms

The effective delivery mechanisms for skills for green jobs are:

- (a) Strong commitment from the government and company CEOs.
- (b) Build up the “green mind”, “green behaviour” and the awareness of the effect of global warming on people at all levels starting from childhood; at, community level and the nation as a whole.
- (c) Develop a National Skill Development Plan for Green Jobs which includes the training for green skills jobs of all concerned organizations and NGOs. The designation of the key organization responsible for this plan is important for its success. At this stage, the DSD of the Ministry of Labour is proposed.
- (d) Establish a database for green jobs and green occupations, including a clear definition of green jobs, green collar jobs and green collar occupations for people to know the demand and supply, identify the mismatch of green skills and gaps/shortage of green skills in the labour market.
- (e) Enforce laws and regulations strictly.
- (f) Monitor and evaluate the implementation of the plan which is important for the success of a green society.
- (g) Conduct R&D and promote them for the innovation of raw materials, processing of production and products and implementation of strategies to achieve greening. Then to follow these up with designing the curriculum and then organizing the training.
- (h) Revise the current National Skills Standards and Testing System or the competency of people so that they are able to work on various green jobs. This also includes revising the current National Qualifications Framework (NQF) so that they will cover green skills.
- (i) Support the establishment of a database and analysis and forecast of the trends of the labour market on green jobs and green skills through International technical cooperation for Thailand.

5. Recommendations

5.1 Policy recommendations

- Government should integrate skills for green jobs into the National Development Agenda to holistically support its green policy.
- Make available the National Human Resources Development Plan for Green Jobs and implement by all concerned parties and monitor its implementation to ensure success.
- The study showed that the critical factor to implement a green economy to reduce global warming is human resources. They should be conscious, develop a mindset and awareness to practice greening in their daily lives in their homes, workplaces and communities. Therefore, these should be learned youth--starting from pre-school, and at all levels of schooling, in vocational schools, and in universities.
- The key to success is the commitment of government and the CEOs of establishments on reducing global warming through integration of the work with all concerned stakeholders, line ministries and public and private organizations. People should participate from the beginning and at the local levels.

5.2 Recommendations for education and training

- Designate a responsible organization which may be the DSD of the Ministry of Labour, to be the key organization which will upgrade the skills of the workforce into green skills in cooperation with line Ministries and the public and private sectors.
- University students and vocational school students should focus on innovation on green products and process of green skills working in cooperation with the private sector.
- Seek international cooperation assistance for technical support and sharing of best practices on skills for green jobs.
- Create awareness of green skills and prepare for future scenarios in both government and private organizations. It is a good opportunity to provide for green skills scholarships so that these scholars will be key and focal resource persons in their organizations to bring to live the green skill integration.
- The training institute for workforce development to be DSD under Ministry of Labour should play a vital role in training people for green jobs.
- In order to implement the green policies effectively, the key training institution should educate or train their people in the organization first acquire knowledge, skills and competencies on greening. These people should then extend their scope to external organizations/institutions including providing for workforce.
- The DSD should be the key organization which will develop the green competencies, skills standards and certification system.

5.3 Recommendations for further research and data collection

The National Skill Development Plan for Green Jobs should be developed and should set up a database on skills for green jobs, analysis on the demand for green skills in the labour market which should lead towards the reduction of the mismatch and the shortage of skills and plan for training on green skills to supply the labour market.

At present, it is clear that Thailand is lacking in ‘up-to-date’ data, information and database with regard to “green skills” practice and training within the country. In order to

move forward and keep the development continuing, it is necessary that the administration should invest and give priority to this matter. Besides, the private sector should be encouraged to increase and improve green skills development. Without doubt, the world's labour and industries are going in this direction. This should be the task of the Department of Skills Development to coordinate with the Ministry of Energy and the Ministry of Industry and other organizations who should establish a database, collect information for the existing green jobs, analyze skills gaps, and forecast the demand for green jobs in the future.

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List of key resource persons

Mr. Krairith Nilkuha, Director General, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy

Mr. Chaiwuth Suthiruangwong, Director, Energy Human Resources Development Bureau, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy

Ms. Sirinthorn Vongsoa-sup, Director, Energy Promotion for People Division, Ministry of Energy

Mr. Warachai Waratham, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy

Ms. Siriwun Romchatong, Employer's Confederation of Thailand (ECOT)

Mr. Panus Thailuan, International Trade Unions Confederation (ITUC)

Mr. Savijj Akkrayut, Director, Alternative Energy Office, Cement Thai Holding Co. Ltd.

Dr. Somsakdi Wiwatpanachart, Vice Chair, Committee on Energy, Chamber of Commerce, Thailand

Mr. Somsit Moonsatan, Chairperson, Environmental Management Industry Club, Federation of Thai Industries (FTI)

Mr. Sompong Nakornsri, President, Bangkok Solar Company Corporation Ltd.

Mr. Anont Simakulthorn, Chairperson, Electrical and Electronics Institutes, Federation of Thai Industries (FTI)

Dr. Chirapat Popuang, Director, Electrical and Electronics Institutes

Mr. Naruebet Wankadee, Electrical and Electronics Institutes

Mr. Chaiwat Pollap, Expert on Energy, Energy Research Institute, Chulalongkorn University

Dr. Supawat Vivanpatarakit, Energy Research Institute, Chulalongkorn University

Mr. Ruengrith Duangtongsuk, Thammasat University

Dr. Suthiporn Chewasatn, Deputy Governor, Research & Development for Sustainable Development, Thailand Institute of Scientific and Technological Research (TISTR)

Mr. Supot Chunhachoti-ananta, Srinakarin Wirot University

Mr. Sanya Philangam, SCG Cement

Dr. Chaiwat Munchareon, Thailand Green House Gas Management Organization.

Mr. Padungsak U-Nontakarn, Bright Management Consultant Company Ltd., CDM & Renewable Energy

Prof. Poonporn Saengbangpla, Honorary President, Society of Automotive Engineers-Thailand and Chairman, Auto and Auto Parts Standard Committee

Mr. Wallop Tiasiri, Director, Thailand Automotive Institute (TAI)

Ms. Chureerut Suwanwithaya, Secretary, Thailand Automotive Institute (TAI)

Mr. Kosuke Takeda, Labour and Environment Attaché, Embassy of Japan

Mr. Furukata, Director, Environment Division, Canon Hi-Tech (Thailand) Ltd.

Mr. Minoru Makiyo, President, The Fujikura (Thailand) Ltd.

Mr. Chatchai Winaisathien, The Daikin Industries (Thailand) Ltd.

Ms. Alisa Udom, Managing Director, Recall Thailand

Ms. Rangsimma Polsri, Financial Director, Recall Thailand

Ms. OnAnong Sanengjit, Executive Director, International Business and Logistics, Parisa International Co. Ltd.

Mr. Thanongsukdi Tulyathamrong, Director, Tourism Office, Sukothai Province Office, Tourism Authority of Thailand

Mr. Sandos Temsawaenglert, Director, Curriculum and Technology Development, Department of Skills Development (DSD), Ministry of Labour

Mr. Santi Bumrungkunakorn, Director, Skills Standard and Testing Division, Department of Skills Development (DSD), Ministry of Labour

Ms. Panida Thanaporn, Director, Skill Development Promotion Division, Department of Skills Development (DSD), Ministry of Labour

Prof. Thierry Lefevre, Director, Center for Energy Environment Resources Development (CEERD)

Mr. Francois Lefevre, Center for Energy Environment Resources Development (CEERD)

Mr. Manish Pant, Country President, Schneider (Thailand) Co. Ltd.

Mr. John Clendon, Managing Director, Univanich Palm Oil Public Co. Ltd.

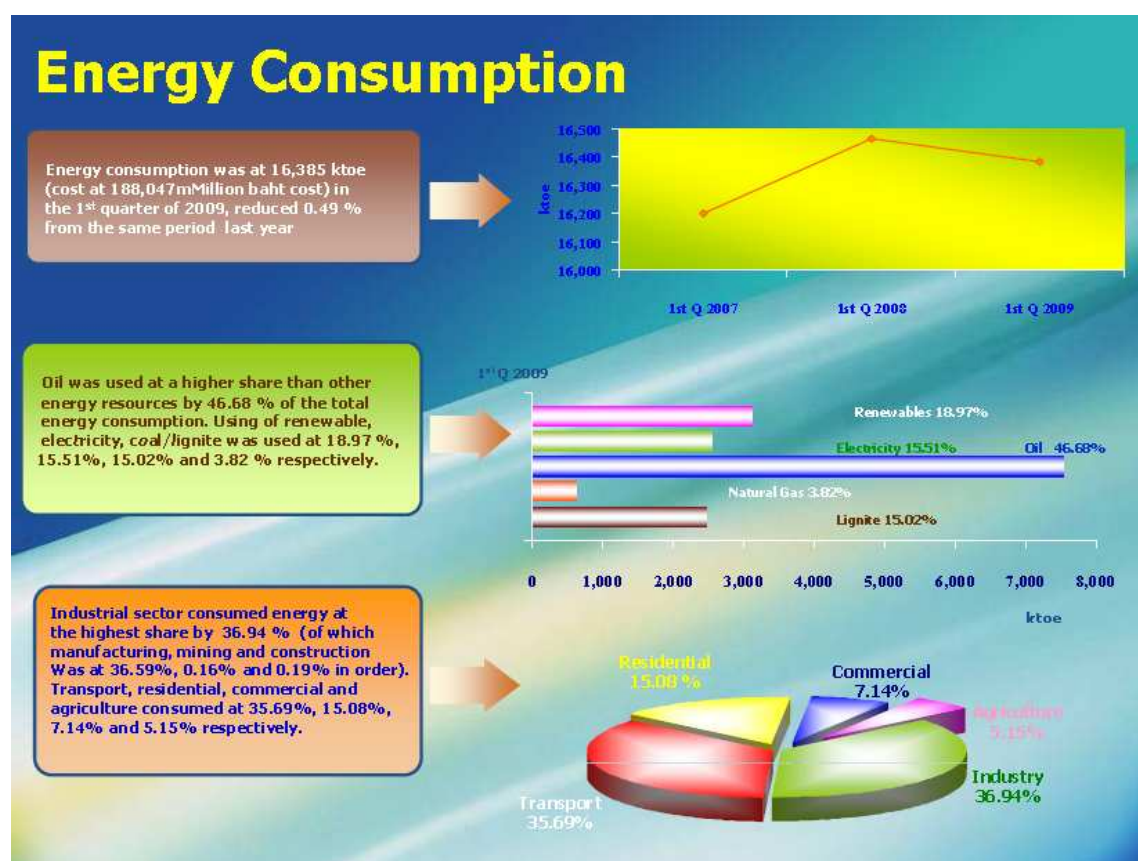
Ms. Ploy Dumrongpol, Researcher

Appendix 1. Thailand's energy situation

The Ministry of Energy provided information on Thailand's energy situation as follows¹¹:

“Thailand relies heavily on fossil fuels for all its energy and transport needs. With demand expected to continue growing to serve economic growth, Thailand faces supply constraints. More than half of primary energy supply is imported, with crude oil accounting for over 70 per cent of total imports, mostly for transport and industrial use. Electricity generation relies mainly on natural gas and coal, with the latter generating high GHG emissions. In 2008, 91.9 per cent of total power generation came from fossil fuel sources, mostly natural gas (70.5 per cent) with development of coal-fired power generation faces numerous challenges, including local community resistance, local air pollution concerns, and of course high GHG emissions.”

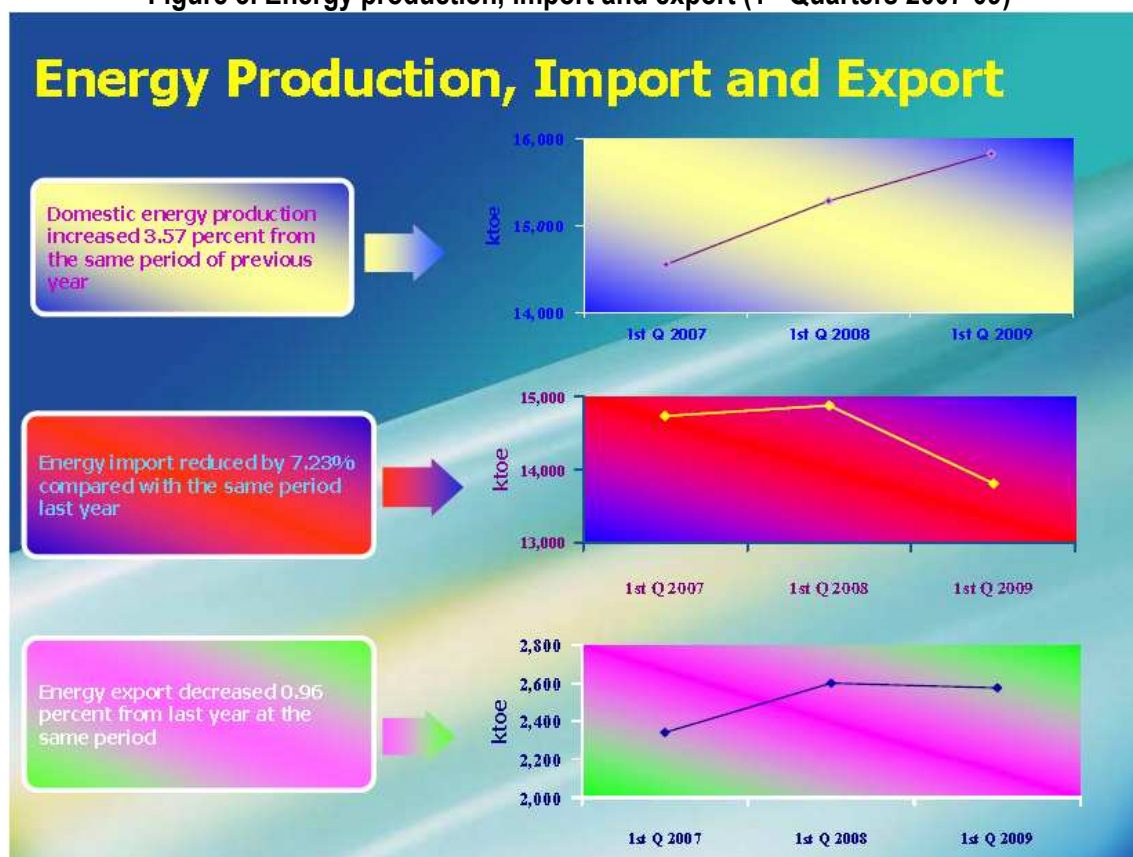
Figure 2. Energy consumption (1st Quarter 2009)



Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

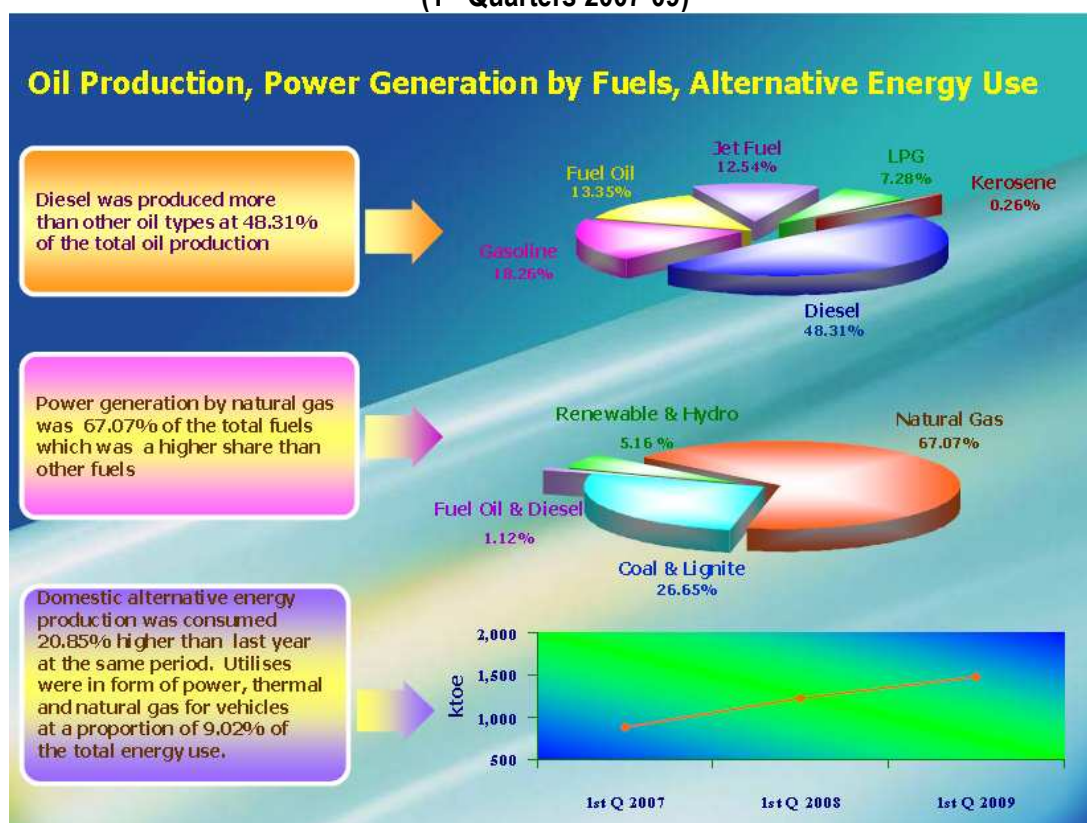
¹¹ Clean Technology Fund Investment Plan for Thailand
<http://www.nesdb.go.th/Portals/0/home/interest/09/CTF%20Investment%20Plan%20Thailand%20final.pdf>

Figure 3. Energy production, import and export (1st Quarters 2007-09)



Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Figure 4. Oil production, power generation by fuels, alternative energy use (1st Quarters 2007-09)



Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Table 4. Energy consumption by resources (1st Quarters 2007-09)

Energy consumption by resources	ktoe			Per cent change	
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 08 ^p	1 st Q 09 ^p
Total energy consumption	16,201	16,465	16,385	1.63	(0.49)
Commercial energy	13,283	13,417	13,277	1.01	(1.04)
- Coal/Lignite	1,812	2,003	2,461	10.54	22.87
- Natural gas	641	686	625	7.02	(8.89)
- Oil	8,027	7,847	7,649	(2.24)	(2.52)
- Electricity	2,803	2,881	2,542	2.78	(11.77)
Renewable energy*	2,918	3,048	3,108	4.46	1.97

* Refer to firewood, charcoal, paddy husk, bagasses, agricultural waste, MGW and biogas

p: preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Table 5. Energy consumption by economic sectors (1st Quarters 2007-09)

Energy consumption by economic sectors	ktoe			Per cent change	
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 08 ^p	1 st Q 09 ^p
1. Agricultural	850	854	844	0.47	(1.17)
2. Industrial*	5,950	6,080	6,053	2.18	(0.44)
3. Residential	2,401	2,496	2,470	3.96	(1.04)
4. Commercial	1,140	1,177	1,170	3.25	(0.59)
5. Transport	5,860	5,858	5,848	(0.03)	(0.17)
Total	16,201	16,465	16,385	1.63	(0.49)

* Industrial sector comprises manufacturing, mining and construction (5,995, 27 and 31 ktoe)

p: preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Table 6. Energy production (1st Quarters 2007-09)

Energy production	ktoe			Per cent change	
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 08 ^p	1 st Q 09 ^p
Total energy production	14,554	15,282	15,827	4.98	3.57
Commercial	9,870	10,262	10,454	3.93	1.87
- Crude oil	1,640	1,747	1,919	6.52	9.85
- Natural gas	5,592	5,957	5,762	6.53	(3.27)
- Condensate	1,019	954	950	(6.77)	(0.42)
- Lignite	1,179	1,205	1,314	2.21	9.05
- Hydropower and others*	440	399	509	(9.32)	27.57
Renewables**	4,684	5,020	5,373	7.17	7.03

* "Others" refers to geothermal, solar and wind energy

** Renewables comprise firewood, charcoal, bagasses, agricultural waste, MSW and biogas

p: preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Table 7. Energy import (1st Quarters 2007-09)

Energy import	ktoe			Per cent change	
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 08 ^p	1 st Q 09 ^p
Total energy import	14,735	14,878	13,802	0.97	(7.23)
Commercial	14,731	14,873	13,796	0.96	(7.24)
- Coal	2,238	2,562	2,149	14.48	(16.12)
- Crude oil	9,961	9,946	9,944	(0.15)	(0.02)
- Natural gas	2,232	2,168	1,521	(2.87)	(29.84)
- Oil	203	126	147	(37.93)	16.67
- Electricity	97	71	35	(26.80)	(50.70)
Renewables*	4	5	6	25.00	20.00

* Refers to firewood and charcoal

p: preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Table 8. Energy export (1st Quarters 2007-09)

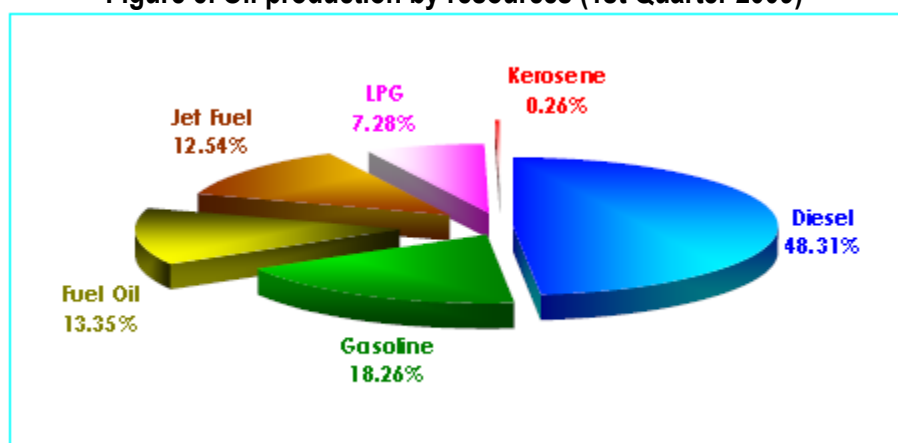
Energy export	ktoe			Per cent change	
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 08 ^p	1 st Q 09 ^p
Total energy export	2,340	2,600	2,575	11.11	(0.96)
Commercial	2,333	2,593	2,570	11.14	(0.89)
- Crude oil	650	603	558	(7.23)	(7.46)
- Natural gas	26	29	11	11.54	(62.07)
- Oil	1,637	1,944	1,974	18.75	1.54
- Electricity	20	17	27	(15.00)	58.82
Renewable (charcoal)	7	7	5	-	(28.57)

p: preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

There are seven oil refineries in Thailand with the overall capacity of 1,012,500 barrels in 2009. Besides that, there are five natural gas separation plants of 1,710 mscf/day and the PlangPetch gas separation plant which mainly produces the LPG at 120 mscf/day. Oil production by resources and power generation by fuel types in the first Quarter of 2009 are shown in Figures 5 and 6 below.¹²

Figure 5. Oil production by resources (1st Quarter 2009)^p

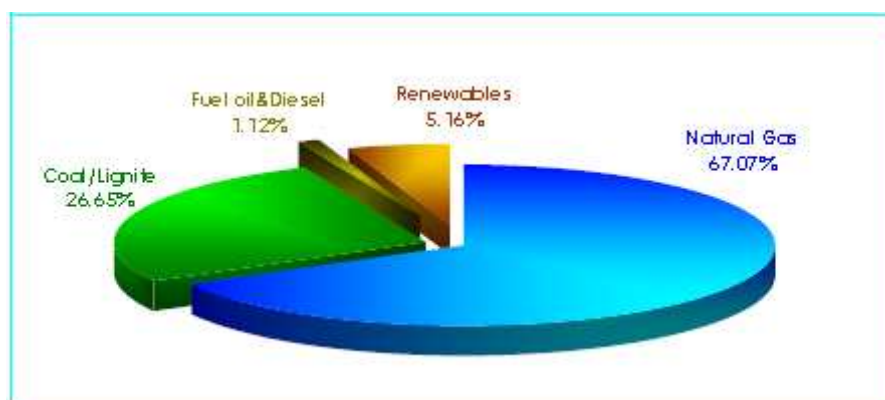


p = preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

¹² http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Figure 6. Power generation by fuel type (1st Quarter 2009) ^p



p = preliminary data

Source: http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Alternative energy situation: Crude oil prices had increased very rapidly, so Thailand needed to use alternative energy resources for oil substitution. The government set the policy to support sustainable use of more alternative energy, especially all renewable energy domestically produced as from solar, wind, hydropower, biogas, MSW/refuses, bio fuels (ethanol and biodiesel) and NGV. Thailand's alternative energy use in the 1st Quarter of 2009 is presented in the table below.¹³

Table 9. Alternative energy use (1st Quarters 2007-09)

Alternative energy use	ktoe			Per cent change
	1 st Q 07	1 st Q 08 ^p	1 st Q 09 ^p	1 st Q 09 ^p
1. Electricity	128	147	190	29.25
2. Thermal energy	655	756	811	7.28
3. Biofuels				
- Ethanol	33	63	91	44.44
- Biodiesel	11	89	106	19.10
4. Natural gas for vehicles (NGV)	52	168	280	66.67
Total	879	1,223	1,478	20.85

p: preliminary data

Source: DEDE, Ministry of Energy: Thailand Energy Situation – 1st Quarter 2009
http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

Thailand's emissions have been steadily increasing, placing Thailand among the top 25 GHG emitting countries.¹⁴ Between 1994 and 2003, Thailand's GHG emissions grew from 286.373 MtCO₂e to 344.2 MtCO₂e - an annual rate of about 2 to 3 per cent;

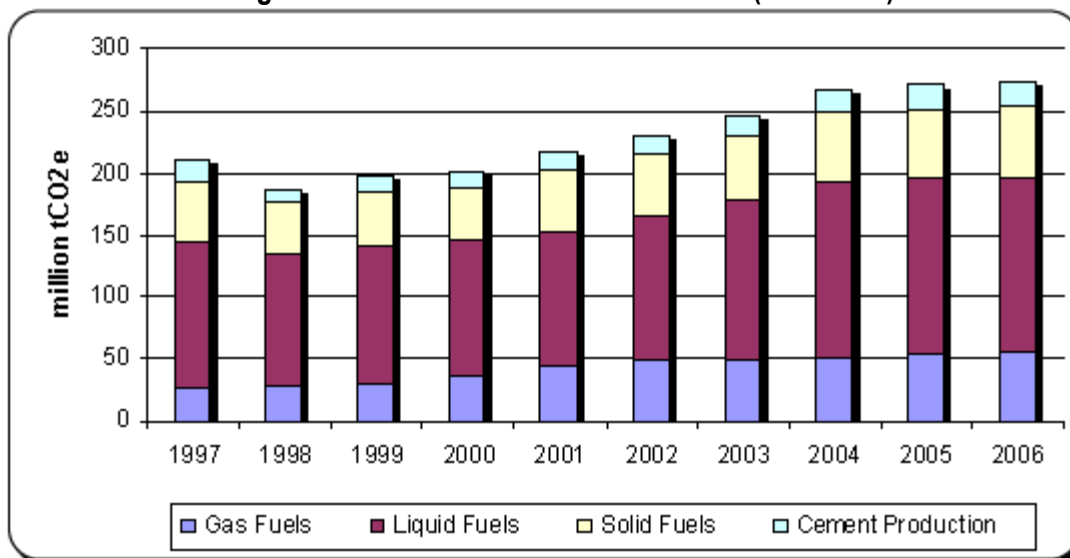
¹³ http://www.dede.go.th/dede/fileadmin/upload/pictures_eng/pdf/energy1-09_01.pdf

¹⁴

<http://www.nesdb.go.th/Portals/0/home/interest/09/CTF%20Investment%20Plan%20Thailand%20final.pdf>

more recently, with continued economic expansion, a growing population, and increased dependence on fuel imports, GHG emissions growth from fossil fuel use has been 3 per cent per annum, mostly in the form of petroleum products (see Figure 7). According to the latest data from the Energy Information Administration, US Department of Energy, energy-related GHG emissions of 245 MtCO₂e in 2006 placed Thailand as 24th among the World's largest GHG emitters.

Figure 7. CO₂ emissions from fossil fuels (1997-2006)



Source: Carbon Dioxide Information Analysis Center <http://cdiac.ornl.gov/ftp/trends/emissions/tha.dat>

The largest contributor to Thailand's GHG emission is the electricity generation sector. In 2006, more than a third (37.45 per cent) of GHG emissions stemmed from the energy sector. The second largest GHG emission contributor was the transport sector (26.32 per cent). The manufacturing sector accounted for almost another quarter (22.96 per cent) of emissions, followed by the residential and commercial sectors.

Table 10. GHG emissions by sector (2002-06)

Sector	2002		2006	
	1,000 tonnes of CO ₂ equivalent	Per cent	1,000 tonnes of CO ₂ equivalent	Per cent
Transport	48,110	29.29	48,388	26.32
Electricity	63,542	38.69	68,849	37.45
Manufacturing	37,198	22.65	42,207	22.96
Residential and commercial	5,514	3.36	14,254	7.75
Others	9,872	6.01	10,162	5.53
Total	164,236	100	183,859	100

Source: Calculations based on DEDE data

Note: GHG emissions shown here included CO₂ and CH₄. The conversion factors used are based on IPCC 1996 revised guidelines.

The emissions of other GHGs excluded in this figure are negligible compared to the total.

Appendix 2. Thailand's Constitution

The table below shows the relationship of the Constitution of the Kingdom of Thailand to current government policy as follows:

Table 11. Constitution of the Kingdom of Thailand in relation to current government policy

Section 85: The State shall act in compliance with the policy approach on land use, natural resources and the environment as follows:	
Constitution of the Kingdom of Thailand	Cabinet Policy
(1) Prescribe rules on land use applicable to the entire country with due regard to compatibility with environmental conditions, including land and water and the way of life of local communities, efficient measures for conservation of natural resources, sustainable standards for land use, with people in the affected area having a say in the decision-making. (2) Ensure equitable distribution of land rights to entitle farmers to land rights or ownership for agriculture by means of land reforms or through other means, and providing adequate and suitable water resources for farmers for agricultural usage. (3) Conduct town and city planning, and implementing those plans effectively and efficiently for sustainable conservation of natural resources. (4) Provide a systematic water and natural resources management plan for the public participation in the preservation, conservation and appropriate utilization of natural resources and biological diversity. (5) Promote the conservation and protection of environment quality based on sustainable development, and controlling and eliminating pollution affecting health, sanitation, welfare and the quality of life of the public by encouraging the public, the local communities and the local governments to participate in the formulation of policy measures.	5. Policy on Land, Natural Resources, and the Environment (5.1) 4. Policy on Economics 4.2 Economic Restructuring Policy (4.2.1) 5. Policy on Land, Natural Resources, and the Environment (5.1) 5. Policy on Land, Natural Resources, and the Environment (5.1, 5.6) 5. Policy on Land, Natural Resources, and the Environment (5.4)
Section 86: The State shall follow the policy approach on science, intellectual property and energy as follows:	
Constitution of the Kingdom of Thailand	Cabinet Policy
(1) Encourage the development of science, technology and innovation in all aspects by enacting specific laws, allocating educational budgets for study, and research, establishing research and development institutes, encouraging utilization of research outcomes, the effective transfer of technology and the development of research personnel and dissemination of knowledge on science and modern technology to the public, and utilization of research outcomes, the effective transfer of technology and the development of research personnel and dissemination of knowledge on science and modern technology to the public, and encouraging the public to apply scientific knowledge in real life. (2) Support invention or cogitation to create new knowledge, preserving and developing local and Thai wisdom, and protecting intellectual properties. (3) Promote and support research and development and utilization of alternative energy that benefits the environment in a continuous and systematic manner.	4. Policy on Economics 4.4 Energy Policy 6. Policy on Science, Technology, Research and Innovation (6.1-6.3) 6. Policy on Science, Technology, Research and Innovation (6.3) 4. Policy on Economics 4.4 Energy Policy 6. Policy on Science, Technology, Research and Innovation (6.3)

Sources: Policy Statement delivered by Prime Minister Abhisit Vejjajiva to the National Assembly 30 December B.E 2551(2008)

It is noticeable that Constitution Sections 85 and 86 focus on infrastructure and R&D which require a higher educational background than the skill development of people to work.

Appendix 3. Department of Alternative Energy and Efficiency (DEDE) Four-Year Action Plan (2008-2011)¹⁵

Vision

Be a Clean Energy Leader of Asian Region by 2011.

Missions

To develop, promote and support the clean energy production and consumption pertinent to each area situation with worthy and sustainability. Develop the commercial clean energy technology for domestic consumption and export. Create the co-operation network that will lead Thailand to the energy knowledge base society for our economic security and social sustainable happiness.

Policy	Servicing target	Strategy/Implementation as required in the National Bureaucratic Admin. Plan
1st Policy: Restoring the Country Reliance Policy Issue (detail) 1.15: Implement the measure on reducing the energy pricing impacts - Policy Target - Reduce the energy cost and reduce using an energy. - Indicator: Expanding rate of using the NGV, biodiesel and gasohol Policy Issue (detail) 1.19: Accelerate the projects and measures for mitigating the global warming impacts - Policy Target - The problem of global warming crisis is substantially and continuously resolved by such the measures / projects. - Indicator: the GHG reduction rate	- Ministerial Servicing Target: sustainable increasing of an alternative energy development. - Indicator: Push up an increasing use of biodiesel from 1.4 ml/d to 3 ml/day. - Organization Servicing Target: promote using of alternative energy - Indicator: Biofuel production of 52.000 l/day - Ministerial Servicing Target: Prevent and control the environment impacts causing from energy industry for the better life quality and sustainable development. - Indicator: Certified Emission Reduction (CER), from the Energy CDM Project, at not less than 1 mt of CO₂ equivalent per year. - Organization Servicing Target: Propose the energy project for CDM certification - Indicator: 17 projects proposed for CDM certification.	- Strategy: Promote using of alternative energy and disseminate the energy saving and energy efficiency measures - Strategy: Develop an alternative energy at the three southern border provinces. - Strategy: Campaign for proposing energy projects to the CDM project. - Strategy: Promote R&D for all alternative energy resources.

¹⁵ Source: www.dede.go.th/dede/fileadmin/.../DEDE_Projects2008-2011.doc

Policy	Servicing target	Strategy/Implementation as required in the National Bureaucratic Admin. Plan
3rd Policy: Economics policy Policy Issue (detail) 3.7: Energy Policy • Policy Target • Promote using the alternative energy. • Indicator: Increasing of sustainable alternative energy development. 2. Increase an efficient use of energy in Thailand • Indicator: Expansion rate of energy consumption reduced.	• Ministerial Servicing Target: Sustainable increasing of an alternative energy development. • Indicator: Increasing of alternative energy share from 6.14 per cent to 9.75 per cent by 2011. • Organization Servicing Target: To use the alternative energy resources. • Indicator: Consume alternative energy at 85.585 ktoe ¹⁶ • Ministerial Servicing Target: Using energy of the country at higher efficiency • Indicator: Energy intensity of industrial sector reduced by 20 per cent • Organization Servicing Target: To use energy efficiently. • Indicator: Reduce an energy consumption of 7,577.1 ktoe	• Strategy: Promote R&D for all alternative energy resources. Strategy: Provide, push up and promote using the alternative energy. Strategy: Increase the country energy efficiency. • Strategy: Promote, support and regulate the energy conservation.

¹⁶ Kilotonne of Oil Equivalent

DEDE Projects –Activities by 2008-2011 Budget, million baht

Source: Adapted from [http://www.docstoc.com/docs/18424434/The-Four-Year-DEDE-Action-Plan-\(2008-2011\)](http://www.docstoc.com/docs/18424434/The-Four-Year-DEDE-Action-Plan-(2008-2011))

Acronyms and abbreviations used in the following:

BBFD	Bureau of Biofuel Development	ESCO	Energy Conservation and Alternative Energy
BCA	Bureau of Central Administration	FFV	Flexible Fuel Vehicle
BED	Bureau of Energy Development	GHG	Greenhouse Gas
BEEP	Bureau of Energy Efficiency Promotion	IT	Information Technology
BER	Bureau of Energy Research	IT Centre	Alternative Energy and Efficiency IT Centre
BERC	Bureau of Energy Regulation and Conservation	ktoe	Thousand ton of oil equivalent
BETTD	Bureau of Energy Technology Transfer and Dissemination	MSW	Municipal Solid Waste
BHRD	Bureau of Human Resource Development	NGV	Natural Gas Vehicle
BMA	Bangkok Metropolitan Administration	PR	Public Relations
BSED	Bureau of Solar Energy Development	PRE	Personnel Responsible for Energy
CDM	Clean Development Mechanism	R&D	Research and Development
CHP	Coal-based hydrogen production	RDF	Refuse Derived Fuel
DEDE	Department of Alternative Energy and Efficiency	SEC	Specific Energy Consumption
ECP	Energy Conservation Promotion (ECP Act)	SMEs	Small and Medium Enterprises
		WPD	Work Plan Division

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
Output: Bioenergy Production						
Activity of Producing Biofuel						
1) Research and Testing Project on Using Biodiesel Blended over 20 per cent in the Fishing Boats	20				20	BBFD
2) Project to Study and Build the Machine Model for Community Biodiesel Produced from Crude Palm Oil and Palm Seeds.	1				1	BBFD
3) Project to Develop, Access and Recommend the Management of Energy Self Reliance Project by Local/ Community Biodiesel	20				20	BBFD
4) Feasibility Study of Biodiesel Produced from Seaweed /Algae and Candlenut Tree		5			5	BBFD
5) Promotion on MSW Energy Production (RDF of Municipal/Local Admin Organizations)	191				191	BER
6) Demon Project on Wind Energy Development for Power Generation in Pattani	25.5				25.5	BED
7) Demon Project on Power Generation from Large Wind Turbine in Pattani	125				125	BED
8) Project on Establishment of Solar Hot Water System for Health Station in the Three Southern Border Provinces	6	7.2			13.2	BETD
9) Feasibility Study Project: Environmental Impacts and Detail Designing for Klong AiBuTae Hydropower Project in Narathiwat	18				18	BED
10) Community Biodiesel in the Three Southern Border Provinces	14				14	BBFD

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
11) Crude Palm Oil Extraction for Integrated Biodiesel Production Project for Medium Community in Yala	17				17	BBFD
12) Project to Establish a Production System of Biodiesel derived from Palm at BaJoh Co-operatives, Amphoe Bajoh in Narathiwat	40				40	BBFD
13) Biogas Production Project Using Wastewater from Palm Oil Extraction Plant	20				20	BBFD
Output: CO₂ Reduction						
Activity of Studying the CDM Projects						
1) Hiring Cost to Study the Development Methods of Small Energy Project for CDM Project Implementation	3.072				3.072	BER
2) Study the Technology and Potential of Reducing GHG Released from Energy Production	6				6	BER
Output: Alternative Energy Produced						
Activity: Study and Develop the Alternative Energy						
1) Facilitating and Administrative Cost	25.3	33.647	31.74	31.74	122.427	
2) Hiring Cost to Study the Feasibility and Environmental Impacts of the Mini Hydropower Project: MaeNgao Project at Amphoe OmGoi in ChiangMai	9				9	BED
3) Hiring Cost to Study the Feasibility and Environmental Impacts on Mini Hydropower Project : HuaiMaePahPai Project at Amphoe Hawd in ChiangMai	9				9	BED
4) Hiring Cost to Design the Mini Hydropower Project Detail of HuaiOngPoe Project at ThongPahPoom, Kanchanaburi	9.025				9.025	BED
5) Design the Mini Hydropower Project Detail of HuaiClitee Project at Amphoe ThongPahPoom, Kanchanaburi	9.025				9.025	BED
6) Hiring Cost to Study the Prelim Environmental Impacts of Mini Hydropower Project: HuaiDanMeeh Project at Amphoe PaLein, Trang	4.798				4.798	BED
7) Hiring Cost to Study the Prelim Environmental Impacts of Mini Hydropower Project: KlongAeh Project at Amphoe Kirirathnikom, Suratthani	4.798				4.798	BED
8) Study the Feasibility and Environmental Impacts of Mini Hydropower Project: HuaiSlakPra Hydropower Project in Kanchanaburi		9.850	10.5	11	31.35	BED
9) Feasibility Study to Construct Mini Hydropower Plant at Floodgate Rear in the ChaoPraya Project		9.5			9.5	BED
10) Design Mini Hydropower Plant (1 plant)		9.45	10	10.5	29.95	BED
11) Design the Mini Hydropower Project Detail at Irrigation Dam Ridge (4 plants)		18.5	19	09.5	47	BED
12) Study the Feasibility and Environmental Impacts of Hydropower Project: Maekong Stepladder Weir, a PagKom Weir.		30	50		80	BED

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
13) Design the Hydropower Project Detail for MaeKong Stepladder Weir, a PagKom Weir				120	120	BED
14) Study the Feasibility and Prelim. Environmental Impacts of MaeOab Mini Hydropower Project	9.5				9.5	BED
15) Study and Establish the Master Plan of Hydropower Project Development (Village Level)	15				15	BED
16) Development and Promotion Project on Using Micro Hydropower (Household Level)	4				4	BED
17) Design the Mini Hydropower Project Detail: HuaiPahPu Project	9				9	BED
Ethanol						
18) Develop and Test Using Desohol in Passenger Car				10	10	BBFD
19) Develop and Demonstrate on Building up Value Added from Ethanol Production			10		10	BBFD
20) Feasibility Study on Producing Ethanol from Cellulose		8			8	BBFD
21) Develop and Demonstrate Machine Model for Ethanol Produced from Cellulose			20	30	50	BBFD
22) Research and Test Using Gasohol as Flex Fuel for Car (FFV, <i>Flexible Fuel Vehicle</i>)			30		30	BBFD
23) Research and Test Producing Yeast by Extracting from Ethanol Plant Waste		10			10	BBFD
Biodiesel						
24) A Testing Cost of Using Jatropha Oil in the Low Rotation Speed (rpm) Engine	5				5	BBFD
25) Hiring Cost to Analyse and Recommend the Biofuel Development		3	3	3	9	BBFD
26) Hiring Cost of Biofuel Public Relations	4.750	4	4	4	16.750	BBFD
27) Research and Test Producing Community Biodiesel with no Water Use by Replace Using Methanol by Ethanol		3			3	BBFD
28) Establish and Demonstrate the Mini Crude Palm Oil Extractor		15			15	BBFD
29) Demonstrate Biodiesel Production in the Educational Centre		2	2	2	6	BBFD
Solar Energy						
30) Hiring Cost to Develop Solar Drying System-Greenhouse Type in Large Industry		7.5	10	10	27.5	BSFD
31) Hiring Cost to Study the Potentials of Solar Cooling System Production and Consumption	7		15	25	47	BSFD
32) Hiring Cost to Develop the Solar Radiator Database			10		10	BSFD
33) Hiring Cost to Study and Develop the Power Generation System by Solar Thermal Energy			40	10	50	BSFD
34) Hiring Cost to Study and Develop the Prototype of Solar Cell Water Pump Set by Deploying Domestic Assembling Parts	3				3	BSFD

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
35) Project on Standard Testing Centre for Appliances of Solar Hot Water System	12	15	11		38	BSED
36) Thailand Solar Cells Development to the Best Project	40	40	40	40	160	BSED
37) The 3 rd Year Project on Solar Cells System Testing and Standard Development Centre	30				30	BSED
38) Promotion Project on Solar Hot Water Generation by Hybrid System	37.5	48.75	67.5	101.25	255	BSED
Biomass						
39) Hiring Cost to Study, Design and Promote Biomass Thermal Generation for Small Industry		3	10	15	28	BER
40) Hiring Cost to Develop and Promote Using the Brick Making Furnace and Biomass Furnace in Community Industry			3	9	12	BER
41) Study and Develop Biomass Gas System for Agro-Water Pumping		3.5	8	8	19.6	BER
42) Hiring Cost to Demonstrate Power Generation System by Biomass Gas	6				6	BER
43) Study and Establish the Plan of Planting the Fast Growth Tree for Energy Production and Study the Promotion on Using and Producing the Biomass to Charcoal Processing		4	3	3	10	BER
44) Public Relations and Support the Clean Coal and Biomass Energy Network		4	4	4	12	BER
45) Project on R&D, Promotion and Support the Biomass Energy Production System of Three Stage Gasifier	67	56	185	350	658	BER
46) Promote Using the High Efficient Biomass Stove and Cooking Stove		30	50	100	180	BER
47) Study, Research and Establish the Prototype and Promote the Bio-Oil Production from Biomass		20	50	70	140	BER
MSW/RDF						
48) Hiring Cost to Follow-up and Increase Efficiency in Using the Energy Production System from MSW	4	3.5	5	5	17.5	BER
49) Campaign to Educate the People on Energy Production from MSW/RDF			5	5	10	BER
50) Study the Development and Promotion on RDF-5 Production		5			5	BER
51) Promote Using the Biogas Fermented Tank in the BMA Schools	5				5	BER
52) Study the Prototype/Model of Biogas Production System from the BMA Market Waste/Garbage	10				10	BER
Coal						
53) Develop and Demonstrate the Clean Coal Technology in Industry		20	14	18	52	BER
54) Study the Promotion on CHP System from Coal Fuel		5			5	BER

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
55) Campaign to Educate the People on Clean Coal Technology	3	3	16	16	38	BER
56) Royal Decree on Coal as Regulated Energy and Draft Ministerial Regulation for Using Coal Efficiently and Environmental Friendly		5			5	BER
57) Hiring Cost to Develop the Hot Spring Sources for the Low Potential Group by Using the Efficiency Increasing Technology to Build up the Drying Chamber for Agricultural Crops	4				4	BER
58) Hiring Cost for Public Relations on Geothermal Energy Utilisations			1	1	2	BER
Biogas						
59) Hiring Cost to Study the Use of Biogas as Energy in the Compressed Granular Organic Fertiliser Making Machine	1.5				1.5	BER
60) Hiring Cost to Study the Biogas Production System Control by Simulation System and Consultancy of Expert System		11.5	8		19.5	BER
61) Establish the Draft Ministerial Regulation Re: Safety Requirements on Biogas Consumption and Production System		2			2	BER
62) Hiring Cost to Study on Performance Assessment and Efficiency Improvement for Biogas Production System		7.2	8	8	23.2	BER
63) Knowledge Dissemination on Adding Value by Wastewater from Biogas Production System and Compressed Granular Organic Fertiliser Making Machine		2	2	2	6	BER
64) Study on Adding Value to the Water processed from Treatment from Biogas Production System of Swine Farm to follow the Sufficiency Economy		3.5			3.5	BER
65) Promotion Project on Biogas Production System from Finished or Semi-finished Manures		25	25	25	75	BER
66) Support, Demonstrate and Promote Biogas Production System from Cassava Residues		15	15	15	45	BER
67) Study and Demonstrate Technology of Biogas Production System by Wastewater from Concentrated Latex Factory		25	25	25	75	BER
68) Study, RD&D and Promote Biogas Production from Biomass Residues		5	10	15	30	BER
69) Monitor and Assess the Biogas Production System from Finished or Semi-finished Manures		3	3.5	4	10.5	BER
Wind Energy						
70) Hiring Cost to Monitor and Assess the Implementation on Wind Energy Development and Promotion	2.5				2.5	BER
71) Hiring Cost to Study the Design, Potential and Assessment of Using the Bailer (traditional water turbine) by Wind Energy		3			3	BER
72) Hiring Cost to Investigate and Maintain the Wind Potential Measurement Station			1.8		1.8	BER

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
73) Hiring cost to Develop Network of the Wind Potential Measurement Station		31			31	BER
74) Hiring Cost to Establish a Wind Energy Potential Map of Thailand		18			18	BER
75) Hiring Cost to Study and Research for Efficiency Increasing of Wind Turbine Assembly			3.5		3.5	BER
76) Demonstrate and Promote Using Bailer (traditional water turbine) by Wind Energy			3	6	9	BER
77) Project on Supportive the Wind Turbine Power Generation for the Royal Initiative Projects			15	15	30	BER
78) Demonstrate and Promote Power Generation by Small, Low Speed Wind Turbine at Community level			30	30	60	BER
79) Demonstrate and Promote Power Generation by Large Wind Turbine in the Wind Zone at particular sources			125	250	375	BER
80) Demonstrate the Hybrid Power Generation by Wind Turbine and Other Power Generation System			30		30	BER
Hydrogen and Fuel Cells						
81) Hiring Cost to Develop Using Hydrogen in Natural Gas (NGV) Car as for Prototype	5				5	BER
82) Preparing the Infrastructure Readiness to Respond Using Hydrogen and Fuel Cells in Transport & Communication Sector	2				2	BER
83) Producing the Methanol from Biomass for Using as Fuel in Fuel Cells		6			6	BER
84) Study the Line and Plan for Using, Supporting and Promotion on Fuel Cells and Hydrogen Energy Industry			5		5	BER
85) Development on the Prototype of the Commercial Fuel Cells Tricycle (Tuk-Tuk)			8		8	BER
86) Hiring Cost to Develop the Safety Requirements on Production, Consumption, Storing and Transport the Fuel Cells and Hydrogen In Sectors of Transport and Power Generation			4		4	BER
87) Development and Demonstration on Hydrogen Production from Chemical Thermal Process: the 2nd Phase	6				6	BER
88) Establishment of the Appliance Standard for Using Hydrogen Technology	8				8	BER
89) Development on Hydrogen Production System at Community Level for Decentralisation			5	5	10	BER
90) Develop and Demonstrate the Fuel Cells for Power Generation Coupling with Other Alternative Energy Resources				4	4	BER
91) Hiring Cost to Study and Prepare the Knowledge Base to response with Development on Using Nuclear for CDM Energy Aspects			2	2	4	BER
92) Promotion Project on Implementing the CDM Energy Project		3	4	4	11	BER

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
Activity of Alternative Energy Production and Maintenance						
1) Facilitating and Administrative Cost	130.659	164.376	154.787	154.787	604.609	BED
2) Produce and Maintain the Hydropower Project	125.740	156.339	54.370	55.886	392.335	BED
3) Hiring Cost to Install the Dam Behaviour Measuring Instrument (5 Projects)		12.5			12.5	BED
4) Procurement Cost to Purchase Water Turbine plus the Installation and Testing Costs for Huai YaMoeh Hydropower Project (binding budget 2008-2009)	12	48			60	BED
5) Maintain the Solar Cells Power Generation System	7.624	8.130	10.192	10.210	36.156	BSSED
6) Improve the Standby Energy Source of the Solar Cells Power Generation System for 61 Plants in Operation not less than 5 Years		27.021	27	27	81.021	BSSED
7) Hiring Cost to Improve the Solar Water Pumping System for Annually 100 Plants			10	10	20	BSSED
8) Hiring Cost to Provide and Install the Wind Turbine for Power Generation by Small Wind Turbine in the Area of ChiangMai (2 Plants)		15.488	45.150	46.150	106.788	BED
9) Hiring Cost to Proceed the Wind Power Generation and Maintenance	0.4	1	1	2	4.4	BED
10) Hiring Cost to Establish the Solar Energy System Supporting the Utilisations in the Area of the Royal Initiative Project for 28 Sites	20.373	5.975	19.9	19.9	66.512	BSSED
11) Hiring Cost to install the Solar Cells Power Generation System for the 140 Community Learning Centres	16.210	16.877	25.5	59.5	188.087	BSSED
12) Hiring Cost to install the Solar Cells Power Generation System for the 80 Rural Schools	21.477	20.8	46	92	180.277	BSSED
13) Hiring Cost to install the Solar Cells Power Generation System for the National Reserved Forest and National Park for 110 Sites	14.485	15.689	48	96	174.174	BSSED
14) Hiring Cost to install the Solar Cells Power Generation System in Rural School for Generating Capacity Expansion in 65 Schools	14.485	14.33	32	40	100.815	BSSED
15) Hiring Cost to install the Solar Cells Power Generation System for Border Patrol Police and Military Bases for 60 Sites	4.338				4.338	BSSED
16) Hiring Cost to install the Solar Cells Power Generation System for the 23 Health Stations	19.423				19.423	BSSED
17) Hiring Cost to install the Solar Cells Power Generation System for the 143 Community Learning Centres			34	87.55	121.55	BSSED
18) Hiring Cost to install the Solar Cells Power Generation System for the 117 Rural Schools			69	200.1	269.1	BSSED
19) Hiring Cost to install the Solar Cells Power Generation System for the National Reserved Forest and National Park for 240 Sites			96	288	384	BSSED
20) Promotion Project for Solar Cells Power Generation for Border Patrol Police and Military	15.744				15.744	BSSED

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
Bases for 223 Sites						
21) Hiring Cost to Establish the Laboratory for Quality Testing and to Install the Wastewater Treatment System in the Biodiesel Production Plant (binding budget 2008-2009)	1.573				1.573	BBFD
Activity of Alternative Energy Promotion, Dissemination and Transfer						
1) Facilitating and Administrative Cost	20.523	31.531	27.068	27.068	106.19	
2) Cost for Alternative Energy Dissemination and Transfer to Support the Royal Initiative Project following the Sufficiency Economy	15	9.4	15	15	54.4	BETTD
3) Cost of Project on Result Expansion for Establishing the Community Energy Plan to Respond the Royal Initiative in Sufficiency Economy	24	48.6	24	24	120.6	BETTD
4) Cost to Disseminate and Demonstrate the Incinerator for Local Government Agency		5.1	5.1	6.8	17	BETTD
5) Cost to Establish the Energy Security Home Project	12	15	15	15	57	BETTD
6) Cost of Dissemination and Demonstration on Producing and Using the Economic Stove for Community	1.8				1.8	BETTD
7) Cost to Establish the Energy Village Project in Upcountry	18	18	36	36	108	BETTD
8) Cost to Promote the Furnace for Steam Pasteurisation the Sawdust Substrate Bag to Culture the Mushroom Spawn for the Community in Upcountry	6.4				6.4	BETTD
9) Project on Monitoring and Assessing the Project Implementation of Building up the Consciousness for Juveniles in Educational Institution	5.582				5.582	BETTD
10) Project: Building up the Consciousness in Energy Use for Juveniles in Educational Institution administrated by the Bangkok Metropolitan	17.4				17.4	BETTD
11) Monitor and Assess the Energy Security Housing Project	3.75				3.75	BETTD
12) Promote the Energy Production from the MSW	191	213.5	330.5	271.5	1.006.5	BETTD
13) the Solar Cells System Testing and Standard Development Centre Project: the 3 rd Year	30				30	BETTD
14) the Promotion Project on MSW Management for Community Energy		16	16	16	48	BETTD
15) School/ Learning Centre of the Samples of Alternative Energy Use and Production following the Sufficiency Economy		15	15		30	BETTD
16) Project on Transfer the Production and Consumption of High Efficiency Cooking Stove and Charcoal Making Furnace for the Skill Development Human Resource			15		15	BETTD
Activity: Alternative Energy Facilitation						
1. Facilitating and Administrative Cost	32.023	34.599	90.715	90.715	248.052	

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
2. Project on Campaign and Contest of Alternative Energy and Energy Conservation	55	110	240	150	555	BCA
3. Project on Analysing the Situation and Forwarding Public Relations		10	10	10	30	BCA
4. Project on Media Development of Knowledge in Alternative Energy and Energy Conservation		15	30	10	55	BCA
Hydropower Dam Construction Project at Klong ThoongPleng						
1. Activity of Constructing the Hydropower Dam Project at Klong ThoongPleng	71.544	31.773			103.317	BED
Hydropower Dam Construction Project at Upper Nan River Basin						
1. Activity of Constructing the Hydropower Dam Project at Upper Nan River Basin	340.860	547.114	191.83	302.95	1382.754	BED
Hydropower Dam Construction Project at Mae Kanai						
1. Activity of Constructing the Hydropower Dam Project at Mae Kanai	23.226	72.07	19.49		114.786	BED
Hydropower Dam Construction Project at Huai Clitee						
1. Activity of Constructing the Hydropower Dam Project at Huai Clitee		95	180	200	475	BED
Mini Hydropower Capacity Expansion Project						
1. Activity of Additional Construction of Hydropower Project	69	158.89	54.85		282.74	BED
Hydropower Dam Construction Project at Kwaie Noi						
1. Activity of Constructing the Hydropower Dam Project at Kwaie Noi	64.78	104.24	185.64	95.71	450.37	BED
Hydropower Dam Construction Project at Mae U-Su						
1. Activity of Constructing the Hydropower Dam Project at Mae U-Su			36.89	102.69	139.58	BED
Hydropower Dam Construction Project at Huai OngPawh						
1. Activity of Constructing the Hydropower Dam Project at Huai Ong Pawh				25.99	25.99	BED
Hydropower Dam Construction Project for Village Level						
1. Activity of Constructing the Hydropower Dam Project for Village Level (2 nd Phase)	24.503	19.61	14.76	20.37	79.243	BED
Community Hydropower Development Project	67	67	67		201	BED
On-Grid Hydropower Project for Village Level	56.5	48	45.5		150	BED

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
Hydropower Project for Village Level	15.25				15.25	BED
Output: Energy Conservation						
Activity: Regulate, Promote and Support Energy Conservation						
1) Facilitating and Administrative Cost	56.462	68.309	71.206	73.927	269.904	BEEP, BERC
2) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Food and Textile Sub-sectors	11.4				11.4	BERC
3) Hiring Cost to Monitor and Promote the Collaborative Energy Conservation	1.52	2	2	2	7.52	BEEP
4) Hiring Cost to Implement the Collaborative Energy Conservation by the Small and Medium Commercial Buildings and Factories in the Central Region	11.883	11.883	11.883	11.883	47.532	BEEP
5) Hiring Cost to Implement the Collaborative Energy Conservation by the Small and Medium Commercial Buildings and Factories in the Eastern Region	11.883	11.883	11.883	11.883	47.532	BEEP
6) Hiring Cost to Implement the Collaborative Energy Conservation by the Small and Medium Commercial Buildings and Factories in the North Eastern Region	11.883	11.883	11.883	11.883	47.532	BEEP
7) Hiring Cost to Implement the Collaborative Energy Conservation by the Small and Medium Commercial Buildings and Factories in the Northern Region	11.883	11.883	11.883	11.883	47.532	BEEP
8) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Food Sub-sector		15.642	78.209	78.209	172.06	BERC
9) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Textile Sub-sector		15.642	39.104	39.104	93.85	BERC
10) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Paper Sub-sector		15.642	19.552		35.194	BERC
11) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Chemical Sub-sector		15.642	78.209	78.209	172.06	BERC
12) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Non-metallic Sub-sector		15.642	19.552	19.552	54.746	BERC
13) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Basic Metal Sub-sector		15.642	19.552	19.552	54.746	BERC
14) Hiring Cost for Consultant to Conduct Energy Conservation in Production Process of the Designated Factory in Equipment and Machinery Metallic Product Sub-sector		15.642	78.209	97.761	191.612	BERC
15) Hiring Cost to Conduct the Efficiency Analysis and Implement the Measure in the Air Compressing		10	10	10	30	BERC

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
System for Designated Factory						
16) Hiring Cost to Conserve Energy in the Central Air-conditioning System in Designated Building		10.096	10.096	10.096	30.288	BERC
17) Tax Privilege Project for Energy Conservation, the 2 nd Phase (Supportive Money for Tax Refund)		100	100	100	300	BERC
18) Tax Privilege Project for Energy Conservation, the 3 rd and 4 th Phase		50	100	50	200	BERC
19) Revolving Fund Project for Energy Conservation by Financial Institutions in the 3 rd Phase (Additional)	2000	2000	2000	2000	8000	BERC
20) Supporting the Implementation to Pursue the ECP Act 1992 (B.E.2535)	95.976	150	120	110	475.976	BERC
21) Project on Promoting Investment in Energy Conservation and Alternative Energy (ESCO Fund)	525	1050	1050	1050	3675	BERC
22) Assessment on the Designated Building/Factory Implementation in Compliance with ECP Act 1992	27	27	27	27	108	BERC
23) the Collaborative Energy Conservation Project by the Small and Medium Commercial Buildings and Factories	100	100	100	100	400	BERC
24) the Collaborative Energy Conservation Project by Designated Commercial Buildings and Factories	58				58	BERC
25) Study and Build up Understanding in the Revised Act and Laws of Energy Conservation	15	10	10	10	45	BERC
26) Servicing Project of One Stop Service Unit	4	5	5	5	19	BERC
27) Energy Savings Consultancy Centre	6	9	9	9	33	BERC
28) Regulation, Monitoring to Administrate the Revolving Fund Project for Energy Conservation	6	6	6	6	24	BERC
29) Demonstration Project on Energy Conservation Detailed Technologies		100	100	100	300	BERC
30) ESCO Promotion Project and Establishing the Network for ESCO, Entrepreneurs/ Industry and Financial Institutions	8	8	10	10	36	BERC
31) Building Energy Conservation Promotion Project by Energy Labeling	12	12	12	12	48	BEEP
32) Project on Hiring the Consultant to Promote High Efficiency Machinery/Equipment and Material/Appliances for Energy Conservation (Energy Labeling Products)	13	30	40	50	133	BEEP
33) Energy Efficiency Laboratory Centre Network Project for Testing the Machines, Equipment, Appliances and Materials to Conserve Energy	4.5	4	1	1	10.5	BEEP
34) Energy Conservation Demonstration and Promotion Project for Agricultural Sector		11	12	15	38	BEEP
35) Project on Establishing the Method to Manage the Transport System for Easily Rotten Damage Agro-Products for Energy Conservation	9	10	10	10	39	BEEP
36) Industrial Boiler Quality Development Project	20		25	25	70	BEEP
37) Project to Develop the Energy Conservation Network and Knowledge Centre		5	5	5	15	BERC

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
38) Project to Disseminate the Energy Conservation Technology Documents		10	10	10	30	BERC
39) Project to Study the SEC (Specific Energy Consumption) in Industry and Commercial Buildings		20	20	20	60	BERC
40) Project to Monitor and Assess the Energy Auditing		5		5	10	BERC, BEEP
41) Hiring the Consultant to Administrate the Collaborative Energy Conservation Project (SMEs)	3.5	3.5	3.5	3.5	14	BEEP
42) Hiring Cost to Study and Develop the Secondary Law Enacted by the ECP Act and Laws	5				5	BERC
43) Hiring Cost to Study and Analyse the Method to Implement the ECP Act	5				5	BERC
44) Project to Study on Establishment of Ministerial Regulations for the 54 Products (incl. cars) and Establish the Draft on Minimum Energy Efficiency Performance Standards for 50 Products	20.545	42.23	47.23	47.23	157.235	BEEP
45) Project to Establish the Promotion Measures on Recovery the Building Wastewater to Re-use in Sanitary System for Energy Conservation Purpose		6	10	10	26	BEEP
46) Hiring the Consultant to Promote and Regulate the Designated Building of the Public Sector		110	110		220	BERC
47) Hiring the Consultant to Promote and Regulate the Energy Conservation in Building to be Constructed or Modified		20	10	10	40	BERC
48) Project to Hire the Consultant to Study the Method of Implementing the DEDE Mission to Fulfill an Achievement	3.2		4		7.2	WPD
49) Vocational and Technician Team Project for Energy Savings	30	30	30	30	120	BEEP
50) Project to Produce the Documentary for Energy Conservation and Alternative Energy for Dissemination and Public Relations through Television Media	30				30	BCA
51) Project to Contest for Distinguished Energy Conserving House	12	12	12	12	48	BEEP
52) Project to Study and Promote the House Plan for Comfortable living and Energy Saving that Compatible with the Country Climate and Geography.		15	10	10	35	BEEP
Activity : Training, Dissemination and Transfer of Energy Conservation Technologies						
1. Facilitating and Administrative Cost	25.512	31.237	31.91	31.91	120.569	BHRD, BETTD
2. Hiring Cost to Develop the Human Resources for Practical Work in Energy Conservation Technology of Air-conditioning System for 400 Personnel.	3.5	3.5	3.5	3.5	14	BHRD
3. Hiring Cost to Develop the Human Resources for Practical Work in Energy Conservation Technology of Lighting System for 400 Personnel.	3.5	3.5	3.5	3.5	14	BHRD

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
4. Hiring Cost to Develop the Human Resources for Practical Work in Energy Conservation Technology of the Steam Boiler and Air Compressing System for 400 Personnel	3.5	3.5	3.5	3.5	14	BHRD
5. Project to Sustainable Promote and Develop the Quality of PRE (Personnel Responsible for Energy) for Energy Conservation	23.25	23.25	23.25	23.25	93	BHRD
6. Project to Develop Energy Conservation Personnel by Industrial Sub-sectors (Food, Textile, Chemical, Metal, Paper, etc.)	20	20	20	20	80	BHRD
7. Result Expanding Project of the Vocational Energy Management Course	16				16	BHRD
8. Project to Promote and Disseminate the Energy Conservation Technology of the Display Centre and the Energy Savings Home	15	15	15	15	60	BHRD
9. Human Resources Development Project for Energy Conservation Technology in the General and Common Machine /Equipment Used in Factory and Commercial Building.	16	16	16	16	64	BHRD
10. Human Resources Development Project for Factory Energy Auditing	5	5	5	5	20	BHRD
11. Human Resources Development Project for the Efficient Machinery Operating and Maintenance			4	4	8	BHRD
12. PRE Seminar Project (overall 3,500 persons throughout the country)	7			7	14	BHRD
13. Human Resources Development Project for Energy Conservation from the Case Study of Achieved Industry	10	10	10	10	40	BHRD
14. Promotion and Dissemination Project for Energy Conservation Knowledge	5	5	5	5	20	BHRD
15. Project to Develop the Energy Management Auditor		4	4	4	12	BHRD
16. Human Resources Development Project for Energy Conservation Auditor in Government Building	24				24	BHRD
17. Human Resources Development Project for Energy Conservation Auditor in Commercial Building	5	5	5	5	20	BHRD
18. Hiring Cost to Develop the Energy Learning for the 5,000 Juveniles		9.5			9.5	BCA
19. Hiring Cost to Develop the 450 Energy Management Personnel	4.75	5	5	5	19.75	BCA
20. Project to Build up the Energy Consciousness for Juveniles in Educational Institutions	16	24	24	24	88	BCA
21. Cost to Promote Using Alternative Energy and Energy Conservation to Army Force in Military Base	10	20	20	20	70	BCA
22. Hiring Cost for Personnel Development and to Develop the Knowledge Management System	4.75	5	5	5	19.75	BCA
23. Project to Produce the Spot Ads for Projects/Activities on Energy Conservation and Alternative Energy to Disseminate and Public Relations via Radio Media	5				5	BCA

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
24. Project to Produce Articles for Projects/Activities on Energy Conservation and Alternative Energy to Disseminate and Public Relations via Newspaper and Journal Media	30				30	BCA
25. Project to Disseminate and Public Relations on Energy Conservation and Alternative Energy via Publication Media	15	25	25	25	90	BCA
26. Project to Establish the Achievements of Projects/Activities and Progressive News of the Energy Conservation and Alternative Energy Project via Posters and Cut-Out Media	10				10	BCA
27. Project to Strengthen the DEDE Image through PR Advertisement						
- Produce and Disseminate the Ads Film by Television Spot to Build up a DEDE Good Image			95	50	145	BCA
- Produce and Disseminate the Radio Spot to Build up a DEDE Good Image			3	3	6	BCA
- Produce and Disseminate the News and Information through Newspapers and Magazines			5	5	10	BCA
- Produce and Disseminate the Information through the Media in the Public Mass Transit Stations and in the Exposed Media			8	4	12	BCA
28. Project to Hire the Consultant for PR Administration and Management (as for the DEDE PR Strategy)	8	25	25	30	88	BCA
29. Energy Conservation Project for Temples /Monasteries.	16	16	16	16	64	BCA
Activity: Issuing the Permit for Generation and Generation Extension of Regulated Energy						
1. Facilitating and Administrative Cost	2.207	3.299	3.42	3.42	12.346	BERC
2. Hiring Cost to Inspect the Generation System of Regulated Energy and Making the Report to Issue the Permit	2.1	3	3	3.5	11.6	BERC
Activity: Energy Conservation Facilitation						
1. Facilitating and Administrative Cost	29.984	28.75	26.823	16.823	112.38	BCA, WPD
2. Alternative Energy and Energy Conservation Co-operation Project between Thailand and Neighbouring Countries	94.616	1.334	42.5	0.3	138.75	WPD
3. Cost to Hire the Consultant to Coordinate the International and Regional Co-operation for Alternative Energy and Energy Conservation.	2.841	3.29	3.45	3.8	13.381	WPD
4. Hiring Cost to Develop and Improve the Information Dissemination System (a DEDE Website)		2		2	4	IT Centre
5. Hiring Cost to Study the Energy Consumption Structure in Agricultural Sector	8				8	WPD
6. Cost to Hire the Consultant to Develop the Competency Measuring System, Reporting, Monitoring and Assessment for Administration aimed at Effective Achievement		6.5		6.5	13	WPD

Project-activity	2008	2009	2010	2011	Total	Responsible organizations
7. Hiring Cost to Monitor an Assessment and Promotion on Administrative Efficiency for Energy Conservation and Alternative Energy	4.75		5		9.75	WPD
8. Hiring Cost to Develop the IT Personnel		1	1	1	3	WPD
9. Hiring cost to Develop the DEDE Personnel Potentials on Communication and Public Relations		0.825			0.825	BCA
10. Hiring Cost to Administrate the Information and News Tasks for Public Relations (on Line News Clipping)	2	2	2	2	8	BCA
11. Hiring Cost to Public Relation for Alternative Energy and Energy conservation to Reduce the Global Warming in Compliance with the National Energy Strategy		5.5	5.5	5.5	16.5	BCA

Appendix 4. DEDE training¹⁷

TD (Training Division) Aim and Target

TD, as a government agency aimed at implementation on transferring the knowledge, expertise, and to disseminate the energy technology and efficient energy management to the concerned people both in the public and private sectors through the administration, management and using the training resources efficiently that leads to country human resource development and energy conservation promotion

Duties and Responsibilities of TD

The Royal Decree on Government Re-organisation of DEDE, under the Ministry of Energy, had assigned TD with duties and responsibilities as follows.

1. Study, analyse, establish and develop the training courses, handbooks and media for human resource development in energy for being consistent with energy conservation technology and energy provision.
2. Establish an Action Plan on Human Resource Development for energy conservation technology and energy provision.
3. Promote and support the educational institutes, the private and public sectors to participate in production of human resources in energy in consistent with an Action Plan.
4. Organise the human resource development and training for the private and public sectors and to grant the certificates for the legal energy personnel.
5. Determine the standard basis on granting and withdrawal the certificates of the training providers for energy personnel

TD is a sub-organisation of DEDE, the Department of Alternative Energy Development and Efficiency, under the Ministry of Energy. TD was originally the Electrician Training Centre Project established by the Sub-Committee on Electric Power of ECAF through an assistance of the French Government

In the year 1962, the cabinet had the resolution, dated 16 November 1965, for an establishment of " Electrician Training Centre " as a government agency for a media of national energy administration with its status equivalent to a department ever since.

1965: Established the "Electrician Training Centre" under the National Energy Administration in the Ministry of National Development. Its office was located within EGAT, the Electricity Generation Authority of Thailand, BangKreuy-TraiNoi Road, Amphoe BangKreuy, Nonthaburi.

1982: Changing the old name to be "Energy Training Centre" under the National Energy Administration

1994-2002: The status was raised to be "Training Division" under DEDP, the Department of Energy Development and Promotion, Ministry of Science Technology and Environment.

3 October 2002: DEDP had been changed to DEDE, and TD is under DEDE in compliance with the Government Restructuring Act 2002 (B.E. 2545), published in the Royal Gazette No 119, Part 99 A, dated 2 October 2002.

Vision

Strong intent on development the human resources at better quality through the service provision in any forms of training administration so as to develop and transfer the knowledge on energy technology and management in compliance with the Act for using energy at efficiency and savings.

Training Courses

TD had classified the training courses into 5 groups for the people in concern to capably choose for applying to their interested courses. The courses organized are as follows:

Note:

- TD Courses implemented in present provision
- ❖ TD Courses to be provided in the near future Training Division

1. Training Courses on Energy Management for Efficient Energy Conservation in Factory and Building, i.e.

- Electricity Management Course
- Thermal Energy Management Course
- PRE Course in Designated Building, 3 Sessions
- PRE Course in Designated Factory, 3 Sessions

¹⁷ Adapted from:

<http://www2.dede.go.th/bhrd/tdeng.htm>

http://www2.dede.go.th/bhrd/courseappthai_eng.html

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- Basic Course for Energy Operators/Staff in the 4th Year Designated Factory
 - Energy Conservation in Factory and Building
 - PRE Course: Ordinary
 - PRE Course: Senior
 - Energy Conservation by Practice (Mini Plant)
 - ❖ ESCO Project Administration in Thailand (ESCO: Energy Service Company)
 - ❖ Energy Manager Course
 - ❖ Monitoring and Assessment of Energy Consumption
 - ❖ Energy Audit and Establishment of Energy Conservation Plan and Target
 - ❖ Energy Seminar for Building and Factory Owners /Executives
2. Training Courses on Energy Technology for Energy Conserving Material, Equipment and Machinery, i.e.
- Air Conditioner Control
 - Energy Savings and Steam Boiler Maintenance in Factory
 - Energy Savings and Air Compressor Maintenance in Factory
 - Energy Audit in Large Air Conditioner for Energy Conservation
 - Supporting the Knowledge and Advice on Equipment Operation and Maintenance in Government Buildings
 - ❖ Heat Recovery
 - ❖ Refrigeration System
 - ❖ Lighting System
 - ❖ Motor
3. Training Courses on Energy End-Use System by Designated Factory Classifications, i.e.
- Energy Conservation in Food Industry
 - Energy Conservation in Textile Industry
 - Energy Conservation in Ice Making Plant
 - ❖ Energy Conservation in Metallic Industry
 - ❖ Energy Conservation in Glass Industry
 - ❖ Energy Conservation in Paper and Pulp Industry
 - ❖ Energy Conservation in Tile Industry
4. Training Courses on Energy End-Use System by Categories of Designated Building, i.e.
- Energy Conservation in Hotel
 - Energy Conservation in Hospital
 - Energy Conservation in Office Building and Department Store
5. Training at Educational Institutes
- Through developing the courses and organizing the training for teachers-lecturers who will be the ones to transfer the knowledge and skill on energy conservation to students whose future professionals are of energy managers, engineers, and technicians in factories and buildings.**
- Electricity Conservation Course for Vocational Instructors
 - Thermal Energy Conservation Course for Vocational Instructors
 - Training Project on Energy Conservation in Factory/Building for the Final Year Students in Bachelor Degree
 - Energy Management for Vocational Education

Training Division

Energy Conservation Technology Centre

Appendix 5. Energy Conservation Building in Honour of His Majesty the King¹⁸

Background

Energy Conservation Building in Honour of His Majesty the King is the celebration of the King on the Throne Project on the occasion of the fifty year anniversary of His Majesty the King's coronation. There was a ceremony on laying the foundation stone on 12th December 1995 at TechnoThanee, Klong 5 District, Amphoe KlongLuang in PathumThanee. This building design and construction adopted the advanced energy conservation technology using the natural system of Thailand 's climatic weather and cooling environment. The design of the building's internal system and material selection can capably block the external heat and moisture. Hence, these can minimise the building energy use and still maintain the value and image of architecture.

Building Construction Objectives

1. To be a Centre for national energy conservation activities, for industry, buildings, residences, communication and transport.
2. To be a building example capable of better energy conservation than the standard required for typical designated building and capable to display clearly the advantages gained from energy conservation. Hence setting the guidelines for other buildings in Thailand.
3. To be a display centre for energy conservation technology and information for pupils, students and other people.
4. To be the technology transfer organization and training centre for energy conservation.

The Practical Energy Management Training Center

The project on the Practical Energy Management Training Center, which is a part of training programme for energy conservation, started in 2002 and is to run for 3 years under bilateral cooperation between the Government of Japan and the Government of Thailand through the Japan International Cooperation Agency (JICA) and the Department of Alternative Energy Development and Efficiency (DEDE) respectively. The project is effective in strengthening knowledge and skills of PRE, and in disseminating energy conservation nationwide as well.

The Cooperation Project comprises the :

- Dispatch of long-term and short-term Japanese experts for technology transfer to Thai counterpart personnel.
- Provision of machinery and equipment necessary for practical training amounting to 200 million Yen or 70 Million Baht.
- Provision of training programme in Japan for Thai counterpart personnel.

Building for Energy Audit Training: a Mini Plant in increasing training efficiency, it is necessary to prepare for significant training equipment, i.e. measuring instrument and equipment for energy auditing of the Mini Plant.

1. Combustion Furnace

Special performance

- Fuelling by LPG and diesel oil
- Heating up highly at 200,000 kcal/hr

Objectives

- Use in calculating a heating value of industrial furnace
- Use as a training tool for burner

1. Application

- Use as a measuring instrument for energy savings
- Use in calculating the energy savings from results of insulation materials
- Use for training in heat management technology

2. Air-Compressor

Special performance

- Air compressing capacity of 3.7 cu.m/min at 0.7 mega Pascal

Objectives

- Use in training on finding the air infiltration points.
- To know a reduction method of energy loss from pressure drops in pipe.

3. Revolution machinery (Fan & Pump)

¹⁸ http://www2.dede.go.th/bhrd/ecb_eng.html

http://www2.dede.go.th/bhrd/jica_eng.html

Special performance

- Fan performance on air pressure 6,200 Pascal at speed of 30 cu.m/min.
- Water pump capacity of 0.37-0.4 cu.m/min.

Objectives

- Use for training on energy saving technology of the revolution machinery
- Use for training on the principle of a variable speed device and energy savings
- Use to know the reduction method of energy loss from pressure drop in line
- Use for training on measuring the electrical power
- Use for training on an automatic control system

4. Boiler and Stream trap training unit

Special performance

- Fuelling by diesel oil
- Steam generating capacity of 500 kg/hr
- A Steam pressure of 10 kg/sq.cm gauge

Objectives

- Use for supplying the steam to a demo-steam trap set
- Use in training for energy savings
- Use in training on operation of mechanism and instruction method of steam trap in various states
- Use for training in solving the problems of using the special measuring instruments.
- Use in inspection and training on hot water recovery

Energy Conservation Technology Centre (ECTC)

was established under supervision of the Training Division by DEDE.

Its roles and duties are to collect and provide data and information to internal and external agencies. ECTC was found as the centre to disseminate the data and information of research and development on: energy conservation, alternative energy, water and energy production sources, demon projects, training media, training courses, human resources for training, software programmes developed by DEDE. The dissemination will be implemented with the public and private sectors through direct advice, distribution of brochures, seminars and workshops and On-line Information on Training Activities by external agencies, which ECTC has participated in as part of public relations via the Training Calendar for dissemination to all interested.

1. Establish the database on personnel in concern with training, such as:
 - 1.1. Personnel getting trained in energy conservation by DEDE
 - 1.2. Consultants and agencies providing the energy conservation training
 - 1.3. Experts and resource persons in energy conservation
2. List of all training/seminar courses on energy conservation
3. Collect the information on training courses, both internal and external DEDE, and to process in form of Training Calendar on energy conservation
4. Collect the training lists on energy conservation both internal and external DEDE
5. Establish, produce, develop and service on training media and handbooks, such as: case studies, good practice guides, software programmes for training guidelines/handbook, VDO, Cassette Tape and Self-Learning Tool kit,
6. Coordinate working with the DEDE external agencies to find the co-providers in energy conservation training, including in supporting the energy conservation training resources.
7. Work in public relations and campaigns to promote the energy conservation activities, such as: a Commitment Campaign Project in Factory/Building Group
8. Issuing the Energy Conservation Newsletter for dissemination to the target groups
9. Follow up the information on energy conservation technology from both domestic and overseas for further applications and dissemination.
10. Develop and update the information in TD Homepages for energy conservation training
11. Training Information Service via telephone inquiry for the targeted groups