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APEC Peer Review on Low-Carbon Energy Policies (PRLCE) Phase 1

Renewable Energy Promotion Policies

FINAL REPORT

APEC Energy Working Group

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Table of Contents

Abbreviations and Units

ADB	Asian Development Bank
AEDP	Alternative Energy Development Plan
AGCI	Chilean International Cooperation Agency
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
AusAID	Australian Agency for International Development
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CASES	Cost Assessment for Sustainable Energy Systems
CBM	Coal Bed Methane
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CIDA	Canadian International Development Agency
CO_2	Carbon Dioxide
COP3	The 3rd Session of the Conference of the Parties
COP15	The 15th Session of the Conference of the Parties
COP18	The 18th Session of the Conference of the Parties
CTL	Coal to Liquids
CURES	Citizens United for Renewable Energy and Sustainability
DEDE	Department of Alternative Energy Development and Efficiency
DOE	Department of Energy, Philippines
EAV	Environmental Added Value
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEG	Renewable Energy Act
EPIRA	Electric Power Industry Reform Act
EPPO	Energy Policy and Planning Office, Thailand
ERC	Energy Regulatory Commission
EU	European Union
FIT	Feed-in Tariff
FT	Fuel Tariff

GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GW	Giga-watt
IAEA	International Atomic Energy Agency
ICDF	International Cooperation and Development Fund
IDRC	International Development Research Centre
IEA	International Energy Agency
IGA	Indonesia Geological Agency
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
ISEP	Institute for Sustainable Energy Policies
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
ktoe	Thousand ton oil equivalence
kWh	Kilowatt Hour
MBIPV	Malaysia Building Integrated Photovoltaic
MT	Magnetic Telluric
MSW	Municipal Solid Waste
MW	Megawatt
NEPC	National Energy Policy Council
NGO	Non-Government Organization
NGV	Natural Gas for Vehicles
NPC	National Power company
NREB	National Renewable Energy Board
NZAid	New Zealand Agency for International Development
OSW	Ocean, Solar and Wind
OECD	Organization for Economic Co-operation and Development
PEMC	Philippine Electricity Market Corporation
PIP	Pusat Investasi Pemerintah
PNOC	Philippine National Oil Company
PPA	Power Purchase Agreements

PRLCE	Peer Review on Low-Carbon Energy Policies
PURP	Public Utility Regulatory Policies Act
PV	Photovoltaic
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency of ECOWAS
RE	Renewable Energy
RECs	Renewable Energy Certificates
REDP	Renewable Energy Development Plan 2008-2022, Thailand
REEEP	Renewable Energy and Energy Efficiency Partnership
REN21	Renewable Energy Policy Network for the 21st Century
ROI	Return on Investment
RPS	Renewable Portfolio Standard
SEDA	Sustainable Energy Development Authority
SHS	Solar Home System
SPP	Small Power Producer
TICA	Thailand International Development Cooperation Agency
TRANSCO	National Transmission Corporation
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
U.S.	United States
US$	US Dollars
USAID	United States Agency for International Development
V	Volt
VAT	Value Add Tax
VSPP	Very Small Power Producer
WB	World Bank
WCRE	World Council for Renewable Energy
WGC	World Geothermal Congress
WKP	Geothermal Working Areas
WRI	World Resources Institute

List of Figures and Tables

Foreword

The APEC Energy Ministers in their June 2010 Fukui Declaration emphasized the message that

> "Cleaner energy supply also boosts both sustainable development and energy security. Low emission power sources - renewable, nuclear and fossil-fuelled with carbon capture and storage - can allow electricity generation to expand in a sustainable fashion without the risk of needing to be curtailed to cope with climate change. Their deployment should be promoted."

The APEC Ministers also instructed the APEC Energy Working Group (EWG) to

> "explore mechanisms to encourage APEC economies to set individual goals and action plans for introducing low-emission power sources with assistance from APERC and relevant technology expert groups, building upon the success of the APEC Peer Review on Energy Efficiency (PREE)."

Upon this instruction, we have started Peer Review on Low-Carbon Energy Policies (PRLCE) Project. This "Policy Template" is prepared by New and Renewable Energy Group of the Institute of Energy Economics, Japan (IEEJ) and is intended for the purpose of disseminating information and knowledge about development of renewable energy in the APEC region.

Takato Ojimi
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December 2012

Executive Summary

The purpose of this report is to direct the experience and knowledge obtained from the application of policies for promoting renewable energy in the world to address the developing economies in APEC. Depletion of fossil fuels, rising energy prices and global warming are major challenges in recent years. Therefore, it is necessary to shift to renewable and environmentally friendly energy sources that can supply energy continuously. The EU economies have been promoting the introduction of renewable energy as a policy for the prevention of global warming at a much earlier stage. Hence, the EU has accumulated a vast amount of knowledge and experience in this field. The EU's experience is able to provide a practical policy on renewable energy around the world, and has shown in more detail the potential of renewable energy.

Introduction of renewable energy in the Asia Pacific region was relatively slow compared to the EU. The member economies of APEC have vast differences in terms of economic development, political structure, patterns on energy consumption and societal preferences within a region rich in diversity. The progress in renewable energy promotion is totally different among member economies. There are many developing economies within APEC still dependent on rural energy sources such as firewood and agriculture residues call "traditional biomass". Further, the vast accumulated experience in the EU economies may not all be adaptable to all areas.

The current increase in energy consumption is due to the growth in consumption of the developing economies like China, Indonesia and Viet Nam. It is estimated that energy consumption in developing economies will exceed the current consumption of the developed economies by 20 to 30 years in the future. Therefore, the energy issue will not be solved without the participation of developing economies. The amount of potential renewable energy use is closely related to the structure and form of future energy supply and demand in developing economies. Promotion of renewable energy has become an important factor in considering a renewable energy policy, and can actually be a problem in international issues which involve developing economies.

Current Status of Renewable Energy promotion in APEC Member Economies

The developed economies in APEC like Japan, United States, Australia, New Zealand, Korea and Canada, are promoting the development of renewable energy policy from the viewpoint of preventing a global warming policy. On the other hand, many of the developing economies in APEC develop renewable energy to reduce the import of oil due to soaring oil prices. Renewable energy as a domestic energy policy can replace the import of oil in order to reduce the financial pressure. In other words, the promotion of renewable energy is from the viewpoint of security of energy supply. This phenomenon was more pronounced after the "Asian Financial Crisis" in August 1997. The local currency of Thailand, Indonesia, Malaysia and Philippines were devalued in the globe market.

The high price of crude oil was found to have a significant impact on the rate of exchange in each of these economies.

According to the IEA in 2010 statistics, the share of renewable energy is 9.0% of the primary energy supply of the APEC total. The share of renewable energy to the total primary energy supply in developed economies in the region in the year 2010 was: United States 5.6%, Australia 5.5%, Japan 3.3%, Russia 2.5%, and Korea 0.7%. These were low compared to New Zealand (39.1%) and Canada (16.9%). Energy consumption of the APEC economies can be said to be highly dependent on fossil fuels. The most characteristic is coal consumption in China which accounted for 65.9% and natural gas consumption in Russia which accounted for 56.8%. In the case of developing economies, Philippines accounted for 39.8% followed by Indonesia 34.5% and Viet Nam 29.0%. This indicates a limited proportion of renewable energy in developing economies. This is because most of the rural areas in developing economies in the region were still dependent on traditional biomass (firewood and agricultural residues) in their daily energy needs.

The major source of renewable energy that has been installed in the APEC region is geothermal energy. The amount of geothermal generation capacity that has been installed in APEC member economies accounted for 79.1% of the world total. In the same year, United States ranked first in the world with a capacity of 3,086 MW, Philippines was ranked second with 1,904 MW, Indonesia was ranked third with 1,197 MW, Mexico was fourth with 958MW, New Zealand was sixth with 628 MW and Japan was ranked eighth with 536 MW. In hydro power, China has become largest producer in the world with a capacity of 196.8 GW in 2010. Canada has become the world's second largest with a capacity of 88.9 GW, follow by the United States ranked 4 (79.5 GW) and Russia ranked 5 (45.0 GW). However, the rate of hydropower development in developing economies was low. Developments in this area are expected in the future.

In terms of solar PV, China and Japan have become leading exporters in the world by production volume. In terms of wind power, introductions in the United States and China are in progress. Many applied technologies for biomass usage have been widely deployed in the region. However, most of them were on a small scale and may not appear on the energy statistics. In terms of biomass technologies, the use of biofuel has been widely adopted in member economies including the United States. Economies such as China, Indonesia, Thailand, Philippines, and Chinese Taipei have installed the mandated schedule.

In addition, "Feed-in Tariffs (FIT)" is becoming an important policy tool for renewable energy promotion in the region. The FIT system is a valid means of renewable energy policy, which has been demonstrated in the EU. Canada, Indonesia, Malaysia, Japan, Philippines and Thailand have adopted the FIT, and some of the member economies are preparing for FIT regulation. Quota obligations also play an important role as a policy instrument on renewable energy promotion. The member economies like United States (state level), Philippines, Australia and Korea have adopted

the obligation system call "Renewable Portfolio Standard (RPS)". Thailand and Japan used to implement the RPS system in the past, but Thailand has moved to the FIT system in 2008 and Japan has moved to the FIT system in 2011. On the other hand, Korea was allowed to migrate to the RPS system from the FIT system in 2011.

These two policy instruments that have been implemented are important as they mandate the utilization of biofuels. Biofuels is one of the renewable energy industries with superiority for the APEC region from the viewpoint of abundance of resources. United States and China are the largest producers of corn, while Indonesia and Malaysia produce more than 90% of the palm oil in the world, Thailand, Indonesia and Philippines are major producers of sugarcane. These economies represent the major agricultural producers in the world that will also be the feedstock suppliers for the biofuel industry. They have also conducted the biofuel industry development policy in each of their economies. Another feature is un-electrified areas in most of the developing economies in the region. Many developing economies have however implemented a program of rural electrification using renewable energy.

The Role of Renewable Energy in Developing Economies

In APEC developing economies, geographical features, stage of development, and socio-economic status are diverse, and the social economy for renewable energy varies widely in each of the economies. Thailand, Viet Nam and Papua New Guinea are disadvantaged without fossil resources, and hence they have to focus on the development of biomass resources and hydropower resources. In the case of the Philippines, the promotion of renewable energy will increase the rate of energy self-sufficiency and strengthening the energy security in the energy supply chain. Geothermal power development has contributed greatly to the power supply in the Philippines. In Indonesia, the rapid economic development has increased the demand for energy and the national budget has been squeezed with heavy fuel subsidies. Promotion of renewable energy is expected to reduce fossil fuel subsidies. Malaysia is blessed with oil and natural gas resources; but promotes renewable energy as an industrial policy strategy. Malaysia is planning to become the hub for the solar equipment manufacturing industry in Southeast Asia and also as a major biodiesel producer. However, the significance of renewable energy in developing economies is variable, and in terms of energy security renewable energy is an important domestic resource. Further, the environmental awareness is rather thin compared to developed economies.

What are the Barriers to Renewable Energy Utilization?

The main barriers can be divided into physical barriers and social barriers. Physical barriers: (1) Barriers to ensure the land required for installation, (2) The distribution of resources may not necessarily be close to the demand area. On the other hand, social barriers: (1) Renewable energy is weak on market competitiveness, (2) The existing social system such as environmental regulations and technical regulations will become barriers. All these barriers can be resolved by implementing

appropriate policies. In general, the developing economies are often hindered by a lack of human resources, investment, funds and technology.

In general, the basis for introducing renewable energy is to correct the "market failure". The legitimacy of government intervention is indicated by a clear political objectives and effective policy design. APEC however does not have the mechanism as a community like EU. However, individual goal setting and action plans from each of the member economies should be encouraged.

Policy and Program Planning

The interest in "renewable energy" in developed economies became important as a policy measure after the first oil crisis in 1973. After the second oil crisis in the late 1970s, the subsidy was extended to actual capital investment, subsidies for research and development as well as the taxation policies began to appear in some developed economies to further renewable energy utilization. At the same time, the first preferential price system was also suggested by PURPA in the United States, where this policy measure become the Feed-In Tariff later. The global warming issue and the Gulf War in 1990s had made the full-fledged introduction of renewable energy in the EU. The new system of voluntary program and obligation system was introduced during this period, and the introduction of Feed-In Tariff in the EU was expanded. After the enforcement of the Kyoto Protocol in 1997, environmental taxes (carbon tax) and green certificate trading scheme were added on as a new policy.

Since the 1990s, many policies were introduced in the world to promote the utilization of renewable energy (example; RPS, FIT, Bidding Scheme, Tradable Certificate, Production Tax Credit, Tax Incentives, Net Metering, Green Pricing, Green Power, Green Power Certificates, Green Power Fund). Quota Obligation (formally call Renewable Portfolio Standard, RPS), Bidding Scheme and Feed-in tariff system (FIT) are the major instruments on renewable energy introduction. Currently the FIT system and RPS system have become major policy instruments to promote the introduction of renewable energy in the world.

Most of the policies that have been described so far are a policy instrument to expand the use of renewable energy. Simultaneously with the introduction of renewable energy, it is important to policies that foster renewable energy equipment manufacturing industry. The industrial development policy for biofuel and solar manufacturing is one of the characteristic renewable energy industries in APEC developing economies.

Realization of Promotion of Renewable Policies

GHG Mitigation and Sustainable Development

The cost-effective on introduction of renewable energy as a measure against global warming is not efficient. This has been pointed out because the inefficiency due to duplication of greenhouse gas reduction policy and renewable energy policy (Tinbergen's Rule). Market price of emission rights that are currently traded on the international market has changed between 15-20 Euro cents/ton CO_{2e}. However, this is not simply to debate the introduction of renewable energy to replace fossil fuels. Renewable energy has significance as a new economic policy from the feature does not burden the environment and sustainable development. As a new economic policy, it is important to develop a foundation for sustainable development to society by this innovation.

Energy Security

The value of energy security (supply diversification) is not necessarily has become clear in the existing research. As a means of measuring the energy security, it is a point how many "external effect (cost)" that can be improved in general. According to the results of the "Extern-E", coal has the highest "external costs" at 2~15 Euro cents/kWh, natural gas will cost nearly the same with biomass. The external costs for other renewable energy will be generated in the stage of manufacturing facilities but basically will not occur at power generation stage. Concept of "external costs" of EU as described can be applied in developing economies because something it is difficult to quantify in developing economies. Concept of energy security and significance in APEC developing economies is an important issue how to be taken. There is two points below we should thing about. By shifting the subsidies from retail price and expenditure to imports fossil fuels to subsidize the development of renewable energy can internalization the external risk and reduce the risk on energy supply to improve the security. Secondly, renewable energy of low technologies can be utilized in fact cheaper. In addition, renewable energy of low technologies can be said to have a supply in terms of sustainability and a kind of security of energy supply for developing economies.

Benefits to Economy

In addition to environmental effects, the promotion of renewable energy is the idea generally that will create a new employment (Green Job) and maintained the facilities (economic benefits) of renewable energy. The effect on economic and creation of employment can be obtained in the short term in some specific sectors, and this is a demand by policy purpose. In evaluation of the economic effect of promoting renewable energy, the economic effect is expected to grown with export industries have been conducted, but this economic effect is significant miscalculation. In the manufacturing sector of the upstream flow to developing economies, Green Job which is expected to be initially developed economies has become a situation such as being limited to employment in the services sector.

Prospects of Renewable Energy Policies in the APEC Region

Key Consideration in Policy Selecting or Evaluating

(1) Expansion Speed

In case of RPS, if quota set a high target value obligation, the installation of renewable energy will speed up; if target value is low the adoption does not proceed. Similarly we can control the speed of any system introduced by setting the level of tariff FIT. Of course, both of the system will increase the additional cost if the target set at high level.

(2) Reasonable Tariff or Reasonable Quota

The most important point on policy design of renewable energy is the setting of the auxiliary level. The increase or decrease of renewable energy in the amount is determined by the level setting of the amount of quota in RPS. In other words, the "reasonable" of tariff or quota will become the main point on policy design. Policies on the basis of renewable energy penetration "market failure", it is necessary to consider the extent to the "reasonable".

(3) External Cost

External costs are one of the important bases in the introduction of renewable energy policy. Especially famous is the study of the "Extern-E" project by the European Commission. And also a study of "social cost of power" conducted by Professor Anil Markandya in the Department of Economics, University of Bath in England. This project is called "CASES", has calculated the cost of a separate external power until 2030 for EU. Both of these two precisely analyze has become a basis to promote renewable energy policy in Europe. Such an objective basis even in the APEC region is required.

(4) Regional Trend

While in some economies there is a difference objective respectively, most of the member economies in Europe emphasis on the development of early expansion speed and industry spread where there have adopted a fixed price. On the other hand, in the economies of the Pacific region United States, Korea, Philippines and Australia has adopted a market-oriented allocation of costs and obligations.

(5) Potentially biased to a particular technology

Normally it is desirable to choose the best technology by market mechanism, there is a view point of the market is going to rely on the policy itself for immature, as a result the politics decision influence specific industry development that is dominated by the politics of the time. For example the biofuel technology has been promoted in Thailand, Malaysia, United State, Philippines, Indonesia and China because the possibility on feedstock supply. The promotion on geothermal power in Philippines, United State, Indonesia and Japan has been advantage because of geothermal resources.

(6) Intermittency and grid connection

As a natural energy, the output of renewable energy is depending to the nature conditions. The unstable of renewable energy output known as "Intermittency". For example, hydropower depends on the season, solar power depends on the sun movement and wind power depends on wind speed.

These changes will become a major problem for the transmission system. For this suppression and management is required additional costs and how to bear this cost has become a major policy issue.

Conclusions

This report has been described the trends of renewable energy introduction in the APEC region and the significance of the introduction of renewable energy policy. As the three mentioned at the beginning, large supply and energy conversion is a major policy issue today on renewable energy policy implemented. The third issue is reformation from the centralization supply system to micro-grid supply system where suitable for renewable energy.

Several major trends can be points out.

- Renewable energy policies has integrated with industrial policy and environmental policy and changing to more complexity.
- The practical use of research and development with a focus on the subsidy policy for dissemination, the emphasis is shifting to the application of market principles in particular.
- Generate a new policy issues related to renewable energy on technical problems such as "Intermittency" issue.
- There is no policy that works best for all situations.

Introduction of renewable energy in developing economies in APEC is a relatively slow after the 1997 financial crisis. However, it has remarkable achievements in the field of geothermal utilization, biofuels development, wind and solar equipment manufacturing industry, and biogas and small hydro. In the introduction and implementation of renewable energy policy, APEC developing economies have been promoted to reference while exploring the world of experience. What's missing in this area is a framework that can share information, technology and experience about renewable energy. Set of common goals by renewable energy promotion policies in APEC, it is possible to create a common market for renewable energy. The mean of common market is developing a rule in the region in promoting renewable energy standards (fuel, equipment, etc.), trade, technology diffusion and transfer. Experience with low technologies for renewable energy is a need to cooperate among developing economies in the region.

Table i. Renewable Energy Policies and Programs in APEC Region

	Australia	Brunei Darussalam	Canada[1]	Chile	China[2]	Hong Kong, China	Indonesia	Japan	Korea	Malaysia	Mexico	New Zealand	Papau New Guinea	Peru	Philippines	Russia	Singapore	Chinese Taipei	Thailand	United States[3]	Viet Nam
Renewable Energy Policies and planning																					
Renewable Energy Act	○				○			○		○					○			○			
Renewable Energy Policy					○		○	○	○	○	○	○		○	○	○	○	○	○	○	○
Implementation Program																					
Feed-in Tariff			○		○		○	○	▲	○					○		○		○	○	○
Renewable Portfolio Standard	○							▲	○						○				▲	○	
Biofuel Mandate	○				○		○	○							○				○	○	
Solar Program					○			○									○		○	○	
Rural Electrification Program				○	○		○			○				○	○				○		○
Biogas Program					○																
Incentives																					
Subsidies and Taxition					○		○	○		○					○				○	○	
Renewable Energy Industry Policies																					
Biofuel Industry Policy	○				○		○			○					○		○		○	○	
Solar Industry Policy					○			○		○									○	○	
Geothermal Industry Policy							○	○				○			○					○	

(Notes) ○ Implemented, ▲ Abolish

(1) Ontario State Policy, (2) People's Republic of China, (3) State Policy

Introduction

The Industrial Revolution which began in the 18th-century in England brought a new era on mass consumption of fossil fuel. The human society has built a modern civilization based on the dynamics obtained in the conversion of fossil resources to the energy. The human race has gained numerous new technologies down to the present. Mankind has been increasing the amount of its energy use from the underground energy resources starting from coal and followed by oil, natural gas and uranium. In recent years, particularly from the perspective of sustainable development, the warning has been sounded against the mass consumption of underground resources of fossil fuels such as coal, oil, and natural gas. The depletion of fossil fuels has been an issue of concern. In addition to this, the costs of global warming and energy prices have increased. Therefore, renewable energy has again come to the limelight as an environmentally friendly energy that can be supplied continuously.

However, we cannot go back to the days of the old traditional biomass energy with the current social structure. There are three main reasons.

1. The modern society is in an era that consumes a lot of energy compared with the past. To replace it, it is necessary to innovative new technologies that ensure more efficient and economical use of renewable energy.
2. The second reason is the close proximity to the structure of consumption of fossil fuels. Energy sources that support the social and economic activities of the modern era, such as gasoline and electricity are secondary energy converted from fossil fuels. This energy consumption structure is fused into our lifestyle.
3. The structure of existing energy infrastructure has central control. For example electricity, it is more efficient to concentrate the energy resources on a number of power plants and produce power on a large scale. In contrast, renewable energy is distributed throughout nature, and hence the distributed energy system may be more suitable.

In the introduction of renewable energy as a means to resolve problems faced by the current energy system, the cost and the infrastructure will become major issues. As a society, the cost of the renewable energy should be minimized in the short term. In the long term, the use of renewable energy would maximize benefits. That should be the approach for a renewable energy policy.

In addition to the three reasons above, there are other issues that should be noted. The current increase in energy consumption reflects the growth of developing economies like China, Indonesia and Viet Nam. It is estimated that energy consumption in developing economies will exceed the current consumption of the developed economies within 20 to 30 years in the future. Therefore, the energy issue will not be resolved without the participation of developing economies. The potential

renewable energy use is closely related to the structure and form of future energy supply and demand in developing economies.

Promotion of renewable energy has become an important factor in considering a renewable energy policy, and can actually be a problem in international issues which involve developing economies.

EU has been promoting the introduction of renewable energy for the prevention of global warming as a policy at a much earlier stage. As a pioneer in the introduction of renewable energy, EU has accumulated considerable knowledge and experience in this field. EU's experience has enabled the promotion of renewable energy around the world, and has demonstrated the potential of renewable energy more definitely.

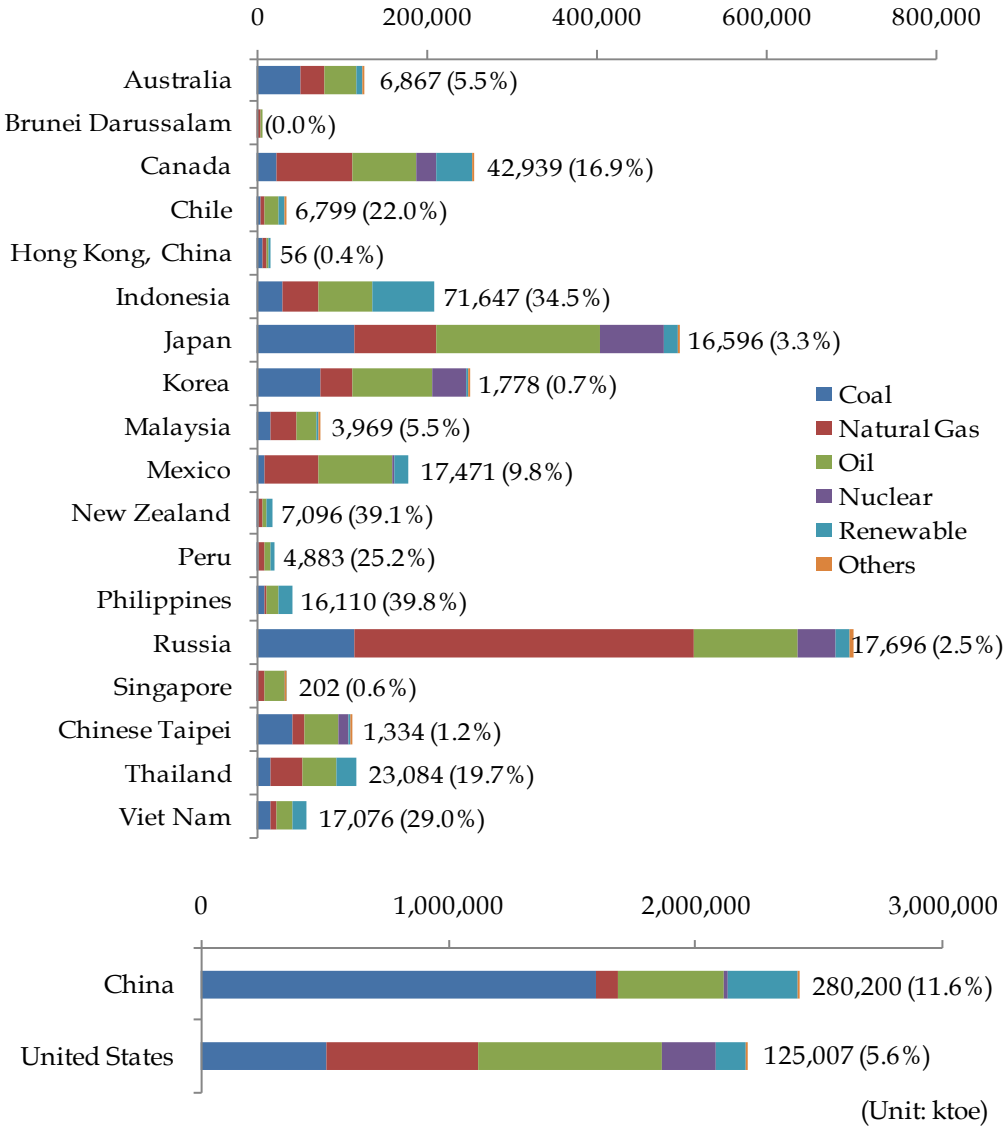
Introduction of renewable energy in the Asia Pacific region was relatively slow compared to the EU. The member economies of APEC have major differences in terms of economic development, political structure, pattern of energy consumption and as a society as they come from a region rich in diversity. The progress in renewable energy promotion is totally different among member economies. There are many developing economies included in APEC which are still dependent on rural energy such as firewood and agriculture residues called "traditional biomass". Further, the accumulated experience in EU economies may not necessarily be adaptable to all areas. The purpose of this report is to direct the experience and knowledge obtained from the application of the main policies in the world to address similar issues in the developing economies in APEC.

Current Status in Member Economies

The developed economies in APEC like Japan, United States, Australia, New Zealand, Korea and Canada, are promoting the development of renewable energy policy from the viewpoint of preventing global warming as a policy. On the other hand, many of the developing economies in APEC develop renewable energy to reduce the import of oil due to soaring oil prices. Renewable energy as a domestic energy can replace the import of oil and reduce the financial pressure. In other words, the promotion of renewable energy is from the viewpoint of security of energy supply. This phenomenon was more pronounced after the "Asian Financial Crisis"in August 1997. The national currency of Thailand, Indonesia, Malaysia and Philippines were devalued in the globe market. The high price of crude oil was found to have a significant impact on the rate of exchange in each of these economies. Hence, they began actively promoting the introduction of renewable energy policy especially after year 2000. Biomass is likely to expand in comparison when considering technologies and resources in these four economies.

Utilization of Renewable Energy in APEC

According to the IEA statistics in 2010, the share of renewable energy was 9.0% of primary energy supply of the APEC total. The Philippines accounted for 39.8% followed by New Zealand 39.1%, Indonesia 34.5% and Viet Nam 29.0%. This represents a high proportion of renewable energy especially in the developing economies. This is because most of the rural areas in developing economies in the region were still dependent on traditional biomass (firewood and agricultural residue) for their daily energy source. In New Zealand however the major share of renewable energy was provided by geothermal power.

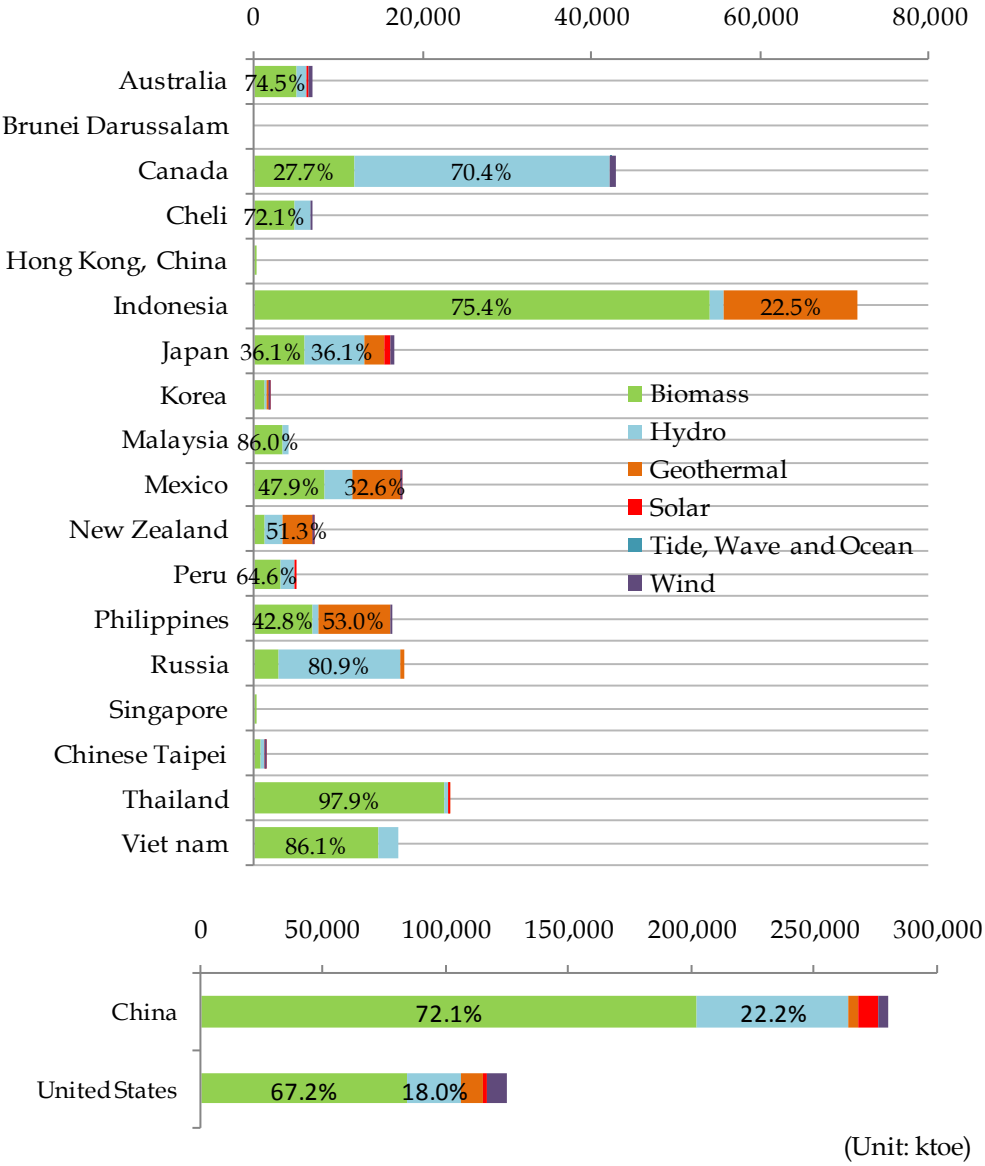


Source: IEA Energy Balance, edition 2012

Figure 1. Renewable Energy Consumption and Share in Total Primary Energy Supply in 2010

On the other hand, the share of renewable energy to the total primary energy supply in developed economies in the region in the year 2010 was low with the United States with 5.6%, Australia 5.5%,

Japan 3.3%, Russia 2.5% and Korea 0.7%. The exceptions were New Zealand (39.1%) and Canada (16.9%). Energy consumption of the APEC economies can be said to be highly dependent on fossil fuels. In particular the coal consumption in China accounted for 65.9% and natural gas consumption in Russia accounted for 56.8%. The consumption of fossil fuels in the United States, Japan, Australia, Canada, and Korea have been diversified and evenly promoted.



Source: IEA Energy Balance, edition 2012

Figure 2. Renewable Energy Utilization by Sources in 2010

In terms of source of renewable energy that has been widely adopted in the APEC region, biomass, hydro and geothermal was the highest. The utilization of biomass in developing economies is projected high. This is because most rural areas in these economies use the small scale traditional

biomass for direct combustion. The world's geothermal resources are also mainly distributed in the Asia Pacific region. Most APEC economies have the highest amount of geothermal resources and have installed capacity for geothermal generation. On the other hand, the developed economies had made good progress on the development of hydropower resources compared with developing economies where the utilization of hydro resources is relatively low. However, the development of hydropower resources can be expected in the future. The development of natural resources in the area of solar and wind power in the APEC region is limited. Only Japan, China and United States have a made significant progress on solar PV and wind power promotion.

In 2010, the United States led the world in geothermal electricity production with 3,086 MW of installed capacity from 77 power plants. The largest group of geothermal power plants in the world is located at The Geysers, a geothermal field in California. The Philippines is the second highest producer, with 1,904 MW of capacity online, followed by Indonesia 1,197 MW, Mexico 958 MW, New Zealand 628 MW and Japan 536 MW. The amount of geothermal generating capacity installed in APEC member economies accounted for 79.1% of the world total in 2010. However, compared to the amount of geothermal resources in this region, the rate of development is considered low. Although the amount of geothermal resources in Indonesia and Japan are ranked at first and third place in the world, the achieved utilization rate was only 4.3% and 2.6% of total resources.

Table 1. Installed Geothermal Electric Capacity in 2010

Rank in World	Economy	Capacity (MW)[1]	Resources (MW)[2]	Utilization Rate (%)
1	United States	3,086	23,000	13.4
2	Philippines	1,904	6,000	31.7
3	Indonesia	1,197	27,791	4.3
4	Mexico	958	6,000	16.0
6	New Zealand	628	3,650	17.2
8	Japan	536	20,540	2.6
14	Russia	82	3,000[3]	2.7
15	Papua New Guinea	56		
18	China	24		
23	Australia	1.1		
24	Thailand	0.3		

Sources:
(1) The International Geothermal Association
(2) WGC2005
(3) Resources for Russia are from REN21.

The share of hydropower to total amount of renewable energy was large for Canada, Russia, Japan, China and United States. These economies have widely distributed basins of rivers and are rich in hydropower resources. China is the largest producer of hydropower in the world. The Chinese government has announced that it would increase hydro capacity to 380 GW by 2020. The largest power project under construction is the Three Gorges Dam (partially in operation) along the Yangtze

River, which include 32 separate 700 MW generators with a total capacity of 22.5 GW. In the other developing economies in APEC however, the development of hydropower was low compared to the available resources. Hydropower has the potential to be developed as a major source of energy.

Table 2. Largest Hydroelectric Producers as at 2010

Rank in World	Economy	Capacity (GW)
1	China	196.790
2	Canada	88.974
4	United State	79.511
5	Russia	45.000
9	Japan	27.229

Sources: REN21

Renewable Energy Policy Implementation in APEC

All APEC economies have implemented policies promoting renewable energy, except Brunei Darussalam and Papua New Guinea. China, United States, Philippines, Thailand, Indonesia and Japan are promoting the policy separately for different renewable energy technologies, and some of them have implemented policies to promote only specific renewable energy technologies. This may be attributed to:

- Variable distribution of renewable energy resources in the economies
- Lack of financial support for solar and wind energy where the initial investment is relatively expensive
- Lack of progress in maintenance of renewable energy policy

In addition, "Feed-in Tariffs (FIT)" is becoming an important policy tool for renewable energy promotion in the region. The FIT system is a valid system of renewable energy policy which has been demonstrated in the EU. Canada, Indonesia, Malaysia, Japan, Philippines and Thailand have adopted the FIT, while some of the member economies are preparing for FIT regulation. Quota obligation also plays an important role as a policy instrument for renewable energy promotion. The United States (state level), Philippines, Australia and Korea have adopted the obligation system call "Renewable Portfolio Standard (RPS)". Thailand and Japan used to implement the RPS system in the past, but Thailand had moved to the FIT system in 2008, while Japan had moved to the FIT system in 2011. On the other hand, Korea was allowed to migrate back to the RPS system from the FIT system in 2011.

Other than these two policy instruments that have been implemented an important policy is the mandate for the utilization of biofuels. Biofuels is one of the renewable energy industries with superiority for the APEC region from the viewpoint of the perspective of abundance. United States

and China are the largest producers of corn, while Indonesia and Malaysia produce more than 90% of palm oil in the world, and Thailand, Indonesia and Philippines are major producers of sugarcane. These represent the major agricultural producers in the world and can also serve as the major feedstock suppliers for the biofuel industry. They have also introduced the biofuel industry development policy in each of the economies.

Another feature in many of the developing economies is the implementation of rural electrification programs using renewable energy. The small scale biogas technology, small hydropower, and the solar home system (SHS) have become the most effective policy instrument to electrify the rural areas in developing economies. Developing economies in the APEC region are rich in renewable resources especially traditional biomass resources. In recent years most developing economies are paying more attention to the conversion of natural resources to electricity as one of the renewable energy options to electrify the rural area for reducing costs and technology penetration. Nevertheless, the different characteristics reflect the diversity of the developing economies. Recently, China, Thailand, Philippines and Indonesia have become active in promoting renewable energy. These economies have made their own policies based on socio-economic needs on renewable energy.

From the social and economic aspects, China and Indonesia are both rich in renewable resources and have a large demand for renewable energy. It is obvious that the two economies need to develop and use their resources, and they are gradually gaining the ability to do it. In Indonesia, the implementation of the rural electrification program is led by the private sector or local government with central policy support on financing and technology. On the other hand, in China the rural electrification rate (the household electrification rate) has reached nearly 99%, and hence rural electrification is no longer an issue in China. However, China's energy demand growth is also tied to the global energy demand, and the utilization of renewable energy to improve energy self-sufficiency in China has been noticed. In fact, the Renewable Energy Law was promulgated in February 2005. The law requires that energy be basically purchased at preferential prices with wind and solar power, and protect the development and rapid growth of the renewable energy industry.

In the case of Viet Nam, Philippines and Indonesia, the main policy to promote the renewable energy is based on low-cost technology. In order to effectively utilize the biomass resources, Thailand has been focusing on research and development of biofuels. In Malaysia industrialization of biofuels and biomass power generation is progressing, while Philippines and Indonesia are inclined towards a domestic policy for effective use of resources such as geothermal and hydropower. However, the development in renewable energy market is still at the early stages, while there have been a lot of improvements on policies. Hence, the introduction of certificate trading as an advanced policy in developing economies is still difficult. Most governments prefer the older methods like subsidies for research and development, subsidies on price or fuel, taxation and investment grants, as renewable energy promotion tools. The high oil prices in recent years

have significant impact on national renewable energy policy in the developing economies. Many developing economies have begun to advance legislation on renewable energy. In many cases the experiences of renewable energy policy from developed economies that have been effective have been adapted to the current conditions in the economy.

Table 3. Current Status of Renewable Energy Policy Implementation in APEC

	Australia	Brunei Darussalam	Canada[1]	Chile	China[2]	Hong Kong, China	Indonesia	Japan	Korea	Malaysia	Mexico	New Zealand	Papau New Guinea	Peru	Philippines	Russia	Singapore	Chinese Taipei	Thailand	United States[3]	Viet Nam
Renewable Energy Policies and planning																					
Renewable Energy Act	○				○			○		○					○			○			
Renewable Energy Policy					○		○	○	○	○	○	○		○	○	○	○	○	○	○	○
Implementation Program																					
Feed-in Tariff			○		○		○	○	▲	○					○		○		○	○	○
Renewable Portfolio Standard	○							▲	○						○				▲	○	
Biofuel Mandate	○				○		○	○							○				○	○	
Solar Program					○			○									○		○	○	
Rural Electrification Program				○	○		○			○				○	○				○		○
Biogas Program					○																
Incentives																					
Subsidies and Taxition					○		○	○		○					○				○	○	
Renewable Energy Industry Policies																					
Biofuel Industry Policy	○				○		○			○					○		○		○	○	
Solar Industry Policy					○			○		○									○	○	
Geothermal Industry Policy							○	○				○			○					○	

Notes: ○ Implemented, ▲ Abolish
Sources: (1) Ontario State Policy , (2) People's Republic of China, (3) State Policy

The Roles and the Benefits to Renewable Energy Policy

Definitions of Renewable Energy

Renewable energy is sometimes referred to as "natural energy" in general, because of the origin from natural resources. This is particularly true for the environmental conservationist. As the energy resource has less impact on the environment, they prefer to call it "natural energy". On the other hand, the energy sector would call it “Renewable Energy” as the use of natural energy as energy is constantly updated and sustainable and there is no risk of depletion seen in the supply source. In Japan and Indonesia, the addition of new technology hydrogen, coal bed methane (CBM) and coal to

liquids (CTL) have been defined as "new and renewable energy". In this report the term "Renewable Energy" is viewed from the point of a renewable resource supply. Further, the electricity generated from renewable energy will be termed "Renewable Generation" in this report.

Renewable Energy is energy coming from natural resources such as solar, wind, hydro, ocean, biomass and geothermal sources which are renewable. It should be noted that, wastes such as garbage could not be considered as natural energy, because it originally came from natural sources. However, if the waste is used as fuel or fermented to collect the methane gas o be used as a fuel, it can be referred to as renewable energy from one of the biomass resources.

The energy in nature s comprised of global energy and energy derived from extraterrestrial origin. The former comprises of solar energy from sources such as wind, wave, rain or biological in nature. The energy from solar, solar thermal, hydro, wind and biomass is energy that originates from solar energy. The latter is the energy contained in the earth, such as tidal effects from the rotation of the earth and geothermal energy sources. There are differences in the amounts of energy available by geographic location and natural conditions.

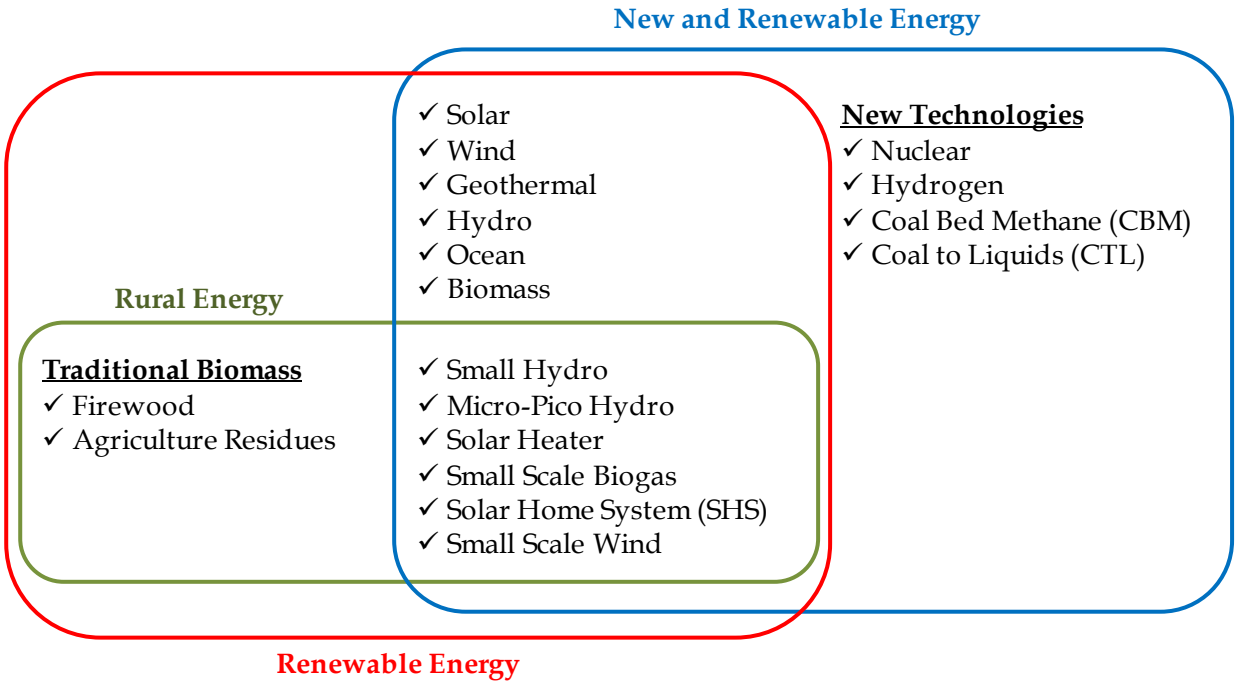


Figure 3. Definitions of Renewable Energy

This report is focused more on APEC developing economies. Many developing economies in this region have the characteristic of the energy supply being dependent on traditional biomass. In addition, many of these member economies have to electrify their rural areas using small renewable energy generation technologies. The use of traditional biomass (firewood and agriculture residues)

and small scale renewable energy technologies in rural area is generally called "Rural Energy". Many of the rural energy projects have been promoted on a non-commercial basis, and most of the projects have been promoted with the support of NGOs and international organizations until now.

Rural areas in developing economies may obtain the power and fuel using renewable energy for agriculture and small industry activities or meet the demand for household use. The independent regionally distributed energy system such as the small hydro, solar home system (SHS) is selected as suitable to install in rural areas. In China and Viet Nam significant achievements have been made in promoting the digester biogas plant for households to provide methane gas for cooking, heating and lighting. In Indonesia the installation of small scale hydropower generation has spread nationwide. However, not all cases have been successful. Many of the developing economies have an abundance of renewable energy resources, but they still develop their economies with heavy reliance on fossil fuel. There is an urgent need for the development of renewable energy in rural self-sustaining resources in developing economies. Rural energy development policy has important implications in the development and stability of the economy's political, economic and social wellbeing.

However, it is difficult to introduce renewable energy in rural areas on a commercial basis, because renewable energy has been promoted as small scale rural energy projects and most of them are off-grid. This report will not cover analysis of rural energy policy. This report will consider a renewable energy policy that can be deployed on a commercial basis, and can also be applied to developing economies based on experience.

Renewable energy in this report has the following characteristics [1].

1. Inexhaustible (harmony and circulation)
The feature of renewable energy is that there is no worry of depletion. Renewable energy is energy that is not depleted and updated daily. The use of fossil fuel since the Industrial Revolution have been diversified into coal, oil, natural gas and uranium (nuclear power), all of which are finite and will be depleted in the future.

2. Locality (localization)
Renewable energy sources and usage patterns are determined by the local climate and terrain in principle. In other words, the distribution of renewable energy resources is fixed to a particular region. The utilization of renewable energy will increase energy self-sufficiency rate and promote it as domestic energy. In addition, the development of renewable energy can avoid the centralization process by entry of new competition into the economy and a new management structure of localization can be expected.

[1] Hermann Scheer, 'Solare Weltwirtschaft', Verlag Antje Kunstmann, 1999, Munchen

3. Brief Supply Chain

The economic evaluation of renewable energy focuses on the structure of the supply chain and the impact on the environment along with the efficiency of energy conversion. The renewable energy sources based on solar energy is relatively short chain on energy conversion compared to fossil fuels. Therefore, the supply costs can be suppressed or reduced. The supply chain for fossil fuel like coal, oil, natural gas and uranium are comparatively long. Before the energy reaches the consumer, the supply chain should go through the long chain process like "mining – transportation – purification or refinery – conversion – transportation – consumption". In the case of uranium, there is the need for a process of interim storage and further enrichment process, and the final disposal costs and risks remain significant. Most importantly, the environmental impact is of a greater range of activities. In the case of renewable energy other than biomass, the energy can be supplied to consumers only by installing the energy conversion device. In particular the internal processing step of solar energy is dependent on conversion technology. The conversion to direct current electricity and internal conversion from direct current to alternating current electricity are the only two chains required for photovoltaic activity.

4. Cost Avoidance

Expenditures are avoided as part of the production cost required in the conventional system is saved by an alternative method. The recurring operating costs, such as fuel and labor are completely avoided in solar and wind power generation. In renewable energy, costing and long-term cash flow analysis is the most appropriate. Advantage of cost avoidance is also a self-sustaining economic theory to an energy self-sufficient economy that does not depend on the power grid.

5. Less Environmental Impact

Utilization of renewable energy resources has less impact on the environment compared to fossil fuels. In the case of fossil fuels, environmental destruction is likely to occur in the process of extraction from nature. In addition, it is necessary to use large-scale processing equipment, and there is a long transport distance from the mine to the consumer before fossil fuels can be taken out and used. In the case of renewable energy, there is no need for a mining process, and hence renewable energy has less environmental impact. The utilization of renewable energy without generating waste during use, and CO_2 emissions of pollutants into the atmosphere can be avoided as well. Use of biomass and geothermal sources may give rise to some contaminants, but these can be controlled by appropriate processing without having to discharge into the atmosphere.

6. Distributed

Most of the renewable energy facilities are distributed and are essentially small-scale. In the case of wind and solar, the distribution of resources exists widely and thinly, and it is difficult to centralize the facilities. The final consumers of the energy and the resources are present in the same area,

independent of the structure of conventional energy use, and form a distributed energy supply system.

Fossil fuels have two major issues with increased consumption.

1. The first issue is convenience and geographical ubiquity. Especially oil, referred to as "strategic goods", the cost of which will determine the prosperity of an economy. This is an issue of energy security. The first oil shock, second oil shock and Gulf War became global problems. The goal of energy security is in the security of supply and price stability. To achieve this target, there is domestic procurement and diversification of import sources. The renewable energy is positioned as a pure domestic resource. It is also valid for further diversification of energy sources. The supply and price fluctuation for oil and natural gas is dependent on external factors, while renewable energy is a domestic product and less dependent on external factors. In general, it can be controlled and can play an important role as part of the diversification for the stable supply of energy.

2. The second issue is the destruction of the environment. Acid rain and soot arise due to the use of coal, but these may be dismissed as a local problem. However, the release of carbon dioxide from the burning of fossil fuels including oil and natural gas as well as coal has been suspected as the cause of global warming from the 1970s and 1980s. The issue of abnormal weather had become a matter of concern among experts in this period. In the late 1980s, this phenomenon was even on the agenda of the International Energy Agency. At the Earth Summit in 1992, this phenomenon led to the United Nations Framework Convention on Climate Change as an important global environmental issue. Hence, the Kyoto Protocol was proposed in an international effort to reduce carbon dioxide in 1997 and came into force in February 2005.

In relation to the background described above, the following is expected of renewable energy:

1. Renewable energy is expected to contribute to energy supply security as it is domestic energy, and without any worry about depletion. Renewable energy will play a major role especially in economies that are currently dependent on the supply of energy from overseas. Although EU has implemented renewable energy as a policy to prevent global warming, the strengthening of the energy supply security is emphasized in addition to the renewable energy policy.

2. As an energy supply system in harmony with nature, renewable energy is the basis of an environmental conservation-oriented society. Human society is faced with the problem of global warming that has never been experienced before. A major cause of this problem is the emission of CO_2 from the burning of fossil fuels. CO_2 is not generated with use of renewable energy, and therefore these constraints are met.

The Role of Renewable Energy in Developing Economies

Most developing economies are less aggressive in promoting renewable energy because of the high cost. There is also no reason to convert to renewable energy lifestyles when relying on traditional biomass. Generally, this is a different trend when compared with developing and developed economies. APEC is particularly diverse, with the existence of economic and social circumstances in individual economies, and the meaning of renewable energy is also different.

In general, the rural electrification program has become a common issue to developing economies because the traditional biomass is a major energy source in rural areas. On the other hand, it can be said the rural areas are best place for the introduction of renewable energy supply. In fact, small-scale renewable energy projects will reduce the burden of government rural electrification of villages, and many such private units are already widely found in developing economies in the region.

In APEC developing economies, geographical features, stage of development and socio-economic status is diverse, while the social economy of renewable energy is widely different in each of the economies. Thailand and Viet Nam are importing hydropower electricity from Laos; while Laos is a major exporter of renewable energy and earning foreign currency. Thailand is not blessed with natural resources, does not have fossil resources, and hence imports fuel from the international market. However, the government of Thailand aims towards the effective use of biomass (especially biofuels and biomass generation) and is focused on renewable energy-related biotechnologies.

Philippines and Indonesia are island nations rich in geothermal resources. Both are a marine nation surrounded by sea. Indonesia is well endowed with fossil fuel resources, but the Philippines is not blessed with this. In the case of the Philippines, renewable energy plays an importance role to increase the rate of energy self-sufficiency for energy security. In fact, the current usage of geothermal resources in the Philippines is the second in the world after the United States.

In Viet Nam, Indonesia, Philippines and Papua New Guinea, the eradication of poverty through rural electrification is a major policy issue. A renewable energy source such as firewood is the major original energy supply, and the rural people could not afford to install expensive solar and wind power systems. Significance of renewable energy in developing economies is related to energy security in the sense that it is a domestic resource. The awareness of the environment is thin compared to developed economies.

What are the Barriers to Renewable Energy Utilization?

The promotion of renewable energy has many advantages, but there is also the failure to spread because of its constraints. Diffusion limitations are those contrasting the benefits of renewable

energy mentioned above, and it can divide into physical barriers and social barriers. However, these barriers can be resolved by implementing appropriate policies.

Distribution of renewable energy sources by natural conditions is the greatest limitation or barrier to utilization and promotion on the use of renewable energy. The physical barriers are outlined in the following two points.

1. Characteristics of renewable energy sources are as described with respect to locality. For example, solar energy is affected by the length of daylight hours, and depends on land securing required for installation. In the case of geothermal energy, the utilization is only available in areas which have geothermal resources. Furthermore, if the resources are distributed in national parks and protected forest areas, it is difficult to develop from the aspect of environmental protection. For wind energy, the conditions of installation location will be the main issues for development. Essentially, all these barriers will not be changed, but the development of the energy supply system can be along the barriers and optimally distributed in the region.

2. The barriers are uneven distribution of renewable energy resources. This uneven distribution barrier, particularly for hydro, wind and geothermal systems, are not close or simultaneously in demand. The case of offshore wind is available on a large scale, but they are far from the land or the demand market. The geothermal and hydropower resource systems need to take steps to send it to the consumer or distribute the resources because they are located far up in the mountains. To resolve this imbalance of supply and demand by region, it is necessary to take measures to develop and strengthen the distribution system.

The main social barriers are existing regulations and market competitiveness.

1. Renewable energy market competitiveness is weak at the present stage. This is the biggest obstacle in the promotion of renewable energy. Compared to existing fossil fuel, renewable energy has a high cost per unit of performance and large-scale commercial use does not offer a competitive market. Indeed, if the price of fossil fuels continues to rise or the innovation in the technology progresses, this issue may be resolved. However, in strengthening environmental improvement and energy security, there is a need to expand the renewable energy market share in a relatively short period. Thus, policy intervention is required to improve the competitiveness of renewable energy.

2. There are numerous regulations and systems that have been currently implemented which hamper the promotion of renewable energy under these regulations and systems. For example, geothermal resource development in national parks and protected forest areas are not allowed under the current regulations. The environmental assessment has been strict with installation of renewable energy such as hydropower and wind power. Also, the barrier on interconnection to

the existing power grid is a major factor preventing the promotion of renewable energy. In order to promote renewable energy these regulations need to be reviewed and it is necessary to develop a variety of regulatory systems in order to expand the installations for renewable energy.

Key Government Stakeholders in Renewable Energy Policy making

In general, the basis for introducing renewable energy is to correct the "market failure". The free market activities are refers to both buy and sell between the individuals player can performed freely. However, if this function is failure means the status interests of one of individual would harm. It is defined as "market failure." As well as public policy in all, it is necessary as a basis for a "market failure" for the introduction of renewable energy policy. Prerequisite is a "government intervention" in order to correct the "market failure".

Introduction of renewable energy policy is complicated by extensive energy policy, environmental policy, industrial policy, and agricultural policy. "Government intervention" is very different depending on whether the policy design works in any aspect and depends on the purpose or final goal. May in some cases, the policy design will bring about the "government failure." Renewable energy is known that the energy source is generally expensive. Government intervention has a crucial role in the promotion of renewable energy. In developing economies, except the three purposes of job creation of new industries, energy security, and prevention of global warming has been listed, renewable energy policy as a policy measure to development the rural energy in particular. For developing economies' policy maker, rural energy development policy that uses renewable energy is effective as a means of politics. The legitimacy of government intervention is indicated by a clear political objectives and effective policy design.

The importance of individual goal setting and action plans for PRLCE

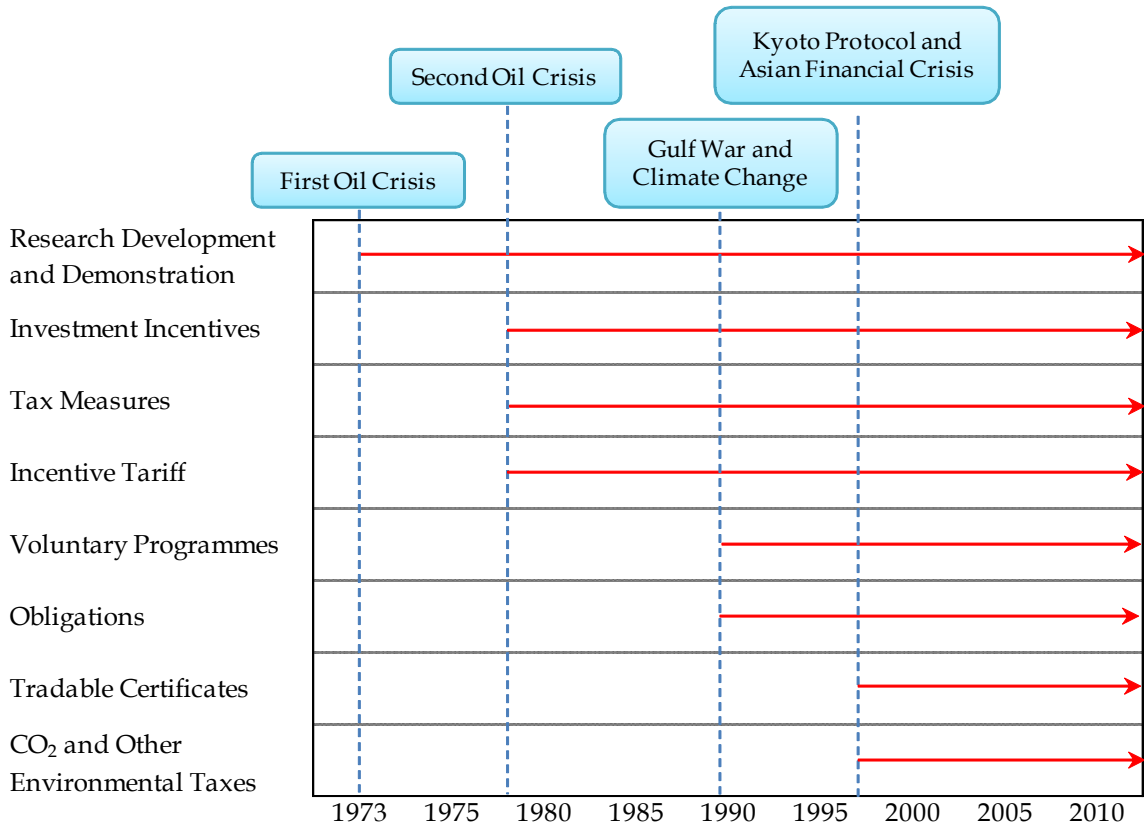
EU was able to set a common policy objective in promoting the utilization of renewable energy by EU directive. Under the EU directive, the member economies are urged to implement the action plan to achieve the target. APEC however does not have the mechanism as a community like EU. However, individual goal setting and action plans from each of the member economies should be encouraged. It is advantageous to set up targets and action plans as suggested below;

- Indicate the market size of renewable energy in the region to encourage investments in this sector.
- Urge for relevant legislation on renewable energy in each of the member economies.
- Increase information exchange on technology, human resources and financing.
- Enhance interaction for renewable energy cooperation.
- Encourage technology transfer between member economies.

1. Policy and Program Planning

Type and Role for Renewable Energy Policies

Interest in the concept of "renewable energy" in developed economies has become an important policy measure after the first oil crisis in 1973. Renewable Energy has been recognized as an alternative energy to replace the oil consumption. Unfortunately, research and development on new technology to convert solar, wind and biomass to electricity did not show any progress during that period. Only hydropower, as an old technology, was promoted in all developed economies.



Sources: Modify by "IEA, Renewable Energy Market & Policy Trends in IEA economies 2004, Figure 4-2"

Figure 4. The Introduction of Renewable Energy Policies

After the second oil crisis of the late 1970s, policy makers began to amplifying the crisis for the future of oil, and diverse policy measures become major issues. Subsidy was extended to actual capital investment, and subsidies for research and development as well as new taxation policies began to appear in some developed economies to further the utilization of renewable energy. At the same time, the first preferential price system was also suggested by PURPA in United States, where

this policy measure become the Feed-In Tariff later. In the 1990s, the oil crisis related to the Gulf War created tension in the oil supply chain, and the Obligation and voluntary programs for renewable energy promotion began to appear during this period. It was around this time that the cause of global warming gradually drew increasing criticism on the carbon dioxide generated from consumption of coal and oil generated energy.

The change in policy on the introduction of renewable energy was characterized as an alternative energy to replace oil until very recently (Figure 4). The impact of the oil crisis on the promotion of renewable energy policies was significant. There was a change in the trend, from the year 1992, that global warming was due to the consumption of fossil fuels from the end of the 1980s to the early 1990s. This issue was taken up internationally as an environmental issue framework for international environmental policy initiative called Earth Summit which was held in Kyoto. The Kyoto Mechanisms broken friendship with the Kyoto Protocol in 1997 was proposed. This principle and its obligations and allocation of certificate trading in renewable energy policy were similar. Mandatory assignment with a trade certificate and at the same time the amount of duty individually set targets for renewable energy. The implementation of "Clean Development Mechanism" (CDM), ensures an increase in the amount of renewable energy that can be supplied at low cost, while at the same time achieve more efficiently the application of market principles to the target value as a society.

Although various policies have been added as an option each year, in most of the cases the different policies were carried out simultaneously. In other words, policies that have been tried in the past as well as new policies will be used at the same time. The current policy means that it functions as a combination of various policies, which is a feature of the renewable energy policy in recent years.

The allocation of the burden of the cost of policies and policy type may be illustrated as follows. When we consider the promotion of renewable energy policy, we are considering to increase the generation or to increase the capacity. Furthermore, there is a requirement to respond to the demand side and supply side from the scope of regulation and support. The typical means for renewable energy policy are illustrated in the Table. Renewable energy policy is intended to define who is to bear much of the costs associated with the introduction. As the high cost of renewable energy becomes a major bottleneck, it is found that most of the policies will focus on support towards the supply side. In general, the policy instruments such as subsidies and tax is used for the supply side in order to increase the number of installed capacity in the initial stage. After the technology has been established, the diffusion policy will move to expand the market.

Costs and risks by policy is the ideal and it is reasonable to share among those who benefited by it. If we look at the cost burden in terms of policy, most have the means to support the supply side by placing the burden on the consumer. The policy for the supply side has less risk and the competition can spread quickly on promotion, but the problem has been with economic efficiency.

The appearance of the obligation system is expected to leave the choice to the market system, and it can be achieved by coincidence with a tradable certificate system. Conversely, there may be a problem of increased risk from the perspective of the supply side of renewable energy. Feed-in tariffs and quota obligation system are two major trends at present for promotion and utilization of renewable energy globally. There are pros and cons to each of these systems. The operation that matches the state of the respective economy is an important point for policy selection.

Table 4. Type of Renewable Energy Instruments

	Supply	**Demand**
Generation	Bidding Systems **Feed-in Tariff *** Obligation (RPS) Tradable Certificates Production Tax Credits	**Voluntary Programs *** **Net Metering *** **Green Pricing *** Government Purchases Excise Tax Exemption
Capacity	Investment Tax Credits Property Tax Exemptions Capital Grants Government Purchases	**Consumer Grants/rebates *** **Sales Tax Rebates ***

Notes: * Additional cost to end user.
Sources: Modify by "IEA, Renewable Energy Market & Policy Trends in IEA economies, page 85".

Policy Measures to Promote Renewable Power Supplies

This section describes an overview of policy measures that have been carried out in the world. Since the oil shock in 1973, the attention to renewable energy in developed economies has increased as described above. During that time, a lot of investments for research and development had been carried out. But most of these efforts did not lead to the introduction of renewable energy. Actually the promotion of renewable energy was initiated in the early 1990s, after the enforcement of the Convention for the Prevention of Global Warming. Since the 1990s, many policies were introduced in the world to promote the utilization of renewable energy (example; RPS, FIT, Bidding Scheme, Tradable Certificate, Production Tax Credit, Tax Incentives, Net Metering, Green Pricing, Green Power, Green Power Certificates, Green Power Fund). Quota Obligation (formally call Renewable Portfolio Standard, RPS), Bidding Scheme and Feed-In Tariff system (FIT) were the major instruments on renewable energy introduction. Currently the FIT system and RPS system have become major policy instruments to promote the introduction of renewable energy in the world.

(1) Quota Obligation: Renewable Portfolio Standard (RPS)

Briefly the quota Obligation system is a regulated "quantity". The specific content may vary depending on the economy or region to be introduced. Basically a target amount of renewable

energy minimum is defined by the regulatory authorities. Introduction of the target amount is determined and the electricity power distributor is obliged to provide a certain percentage of energy from renewable energy sources if the performance obligation does not comply with the target, in most cases a certain amount of penalty will be imposed. This policy is intended to give priority to economic efficiency, as a condition that players choose (potentially) from a variety of conditions that already exists in the market. It is a mechanism that tries to maximize benefits of the market. In addition, it is often carried out at the same time with a "Tradable Certificate". In case, the electricity power distributors do not want to own the renewable energy power generation, they are permitted to purchase the amount of renewable energy certificate to fulfill the obligations by trading.

(a) Advantage

- Encourage competition among renewable energy industries, and within the same industry; and can achieve the goals most efficiently on the market price.
  - Compared to feed-in tariff, the burden on the government and consumers are relatively low.
  - The policy can specify the subject on renewable energy technology, has target, and easy to control the competitiveness between the industries.
- By combining green certificate trading, further cost reduction is obtained. Additionally, this policy does not compete with emissions trading.

(b) Disadvantages

- The market provides the variety options (potentially) and players already existing. If the market is monopolized by one company or there is no potential of renewable energy resources physically, the obligation system does not work.
  - Shallow history as a policy instrument. The market for renewable energy has begun to grow up by various entrants such as wind, solar and biomass in the last few years. This policy assignment is also has just come to be tried in various economies since 2000. (United Kingdom has tried the "Non Fossil Fuel Obligation" without certificate trading since the 1990s)

(2) Bidding Scheme

As an obligation system, the bidding scheme is determined by the government's target by controlling the "quantity". Bidding Scheme is the same as the obligation system, and the amount of renewable energy power target is also allocated. The difference between the obligation system and the bidding scheme is that it is determined by competitive bidding on "price" of the renewable energy power. Renewable power generation companies participate to present the volume and price that can be supplied to the competitive bidding. The successful bidders determined by the biding will secure the bid for a certain period and price.

(3) Feed-in Tariff (FIT)

Feed-in Tariff is to set the purchase "price" of different renewable energy sources. The government sets a purchase price of renewable generation, and the Distribution Company is obliged to buy at this price. The aim of this system is to reduce the risk of businesses to invest in renewable energy by fixing the tariff for a certain period. This system is intended to give priority to technological development and early spread of a particular industry. Also, FIT is used as a policy instrument to promote the formation of renewable energy markets in the case when there is no market or the market is immature. There are advantages and disadvantages of this policy instrument.

(a) Advantages

- Fixing the tariff for a certain period ensures reduced risk for investors with specific rules. The end user ultimately bears the burden or by taxing the additional cost through the power company. It may be borne by local governments on a voluntary basis.
  - ✓ Can be targeted to a specific renewable energy associated technology.
  - ✓ Can be expanded to spread rapidly and expected to increase in employment.
- FIT already has a proven track record through 1980s based on the "Public Utility Regulatory Policies Act (PURPA)" in the United States and 1990s based on the "Electricity Feed-in Law" in Germany.
- Has the effect of encouraging new entrants.

(b) Disadvantages

- Is a kind of subsidy, although there are cost savings and the associated expansion of the market, but will prevent competition between different industries.
  - ✓ A policy instruments using market mechanisms to promote competition, the green certificate trading and emissions trading are hard to accept.
  - ✓ The rise and fall of industrial interest are dependent on the policy rather than in the market.
  - ✓ The electricity tariff soaring prone because of intentional tariff setting.
  - ✓ It is difficult to determine the target.

(4) Others

In addition to supporting the above three measures, many renewable energy policies are currently being conducted. These can divide into two main types: by policy intervention and voluntary programs.

by Government Intervention

Subsidy Scheme: It is a subsidy given to a power producer depending on the amount of electricity generated by renewable energy. Although many subsidy schemes provide for fixed capital equipment renewable energy generation, this system is a grant corresponding to the production of electricity. In addition, this system is a policy for effective increase in the amount of power generated.

Tax Incentive: There are many types of tax reductions that are offered for the purpose of disseminating renewable energy. For example, the value-added tax, tax exemption for capital investment, equipment import tax, export tax and tax refund are forms of tax incentives. These tax incentives have the effect of increasing the relative competitiveness of renewable energy and also increase investments.

by Voluntary Programs

There are a variety of systems for voluntary programs. The following table shows a summary of voluntary programs that have been implemented in the world.

Table 5. Voluntary Programs for Renewable Energy

Policy Name	Contents
Net Metering	It is a system where power companies purchase the surplus electricity from solar power that has been installed on the roofs of house. This system has been implemented in many economies including Japan.
Green Charge	It is a plan to sell a certain amount of power generated with the premier renewable energy for consumers with willingness to pay.
Green Certificate / Renewable Energy Certificates (RECs)	Green certificate is an "Environmental Added Value (EAV)" by replace fossil fuel with renewable energy generation. The EAV will be perform by using certificates and tradable in the market. Many economies have implemented this system including Japan.
Green Power Fund	Based on donations from individuals or corporations, funds are raised to support or invest the installation of renewable energy generation facilities such as wind and solar power generation. The case of Japan, the consumers may wish to donate a fixed amount (500 yen/month) extra at the time of collection of monthly electricity bill by the power company as a renewable promotion fund. Another mechanism involves individuals or corporations who jointly invest in the renewable energy generation facilities and receive the gains or losses in accordance to the shares held.

Voluntary programs are dependent on the awareness of people on the importance of renewable energy. Otherwise, if the people are not willing to pay the additional cost of renewable energy promotion, the introduction of renewable energy on a large scale will become difficult. The effect of the implementation of voluntary programs can to a certain degree be observed in developed economies, but the effect in developing economies is not expected. Some developing economies have been successful in the introduction of small-scale renewable energy equipment based on voluntary programs in rural electrification projects. For example, in Indonesia the famers raised certain amount of money among themselves to install small hydropower facilities. Also there are

many cases in China and Viet Nam where the famers installed digester biogas projects by joint venture and utilized methane gas as a fuel for cooking and lighting.

Financing Programs and Project

In addition to the policy instruments described above, there is also a measure of financing programs and international cooperation projects.

(1) Special Fund

Renewable energy fund has existed in many forms. As described above, "Green Power Fund" is one of the funds that are used in voluntary programs. Renewable Energy Fund is diversified to many types including those of private companies, financial institutions and government-led organizations. The following are two examples that have been introduced in APEC developing economies.

Revolving Fund in Thailand

This fund is one of the renewable energy promotion policies being pursued by the Thailand government. In parallel with the feed-in tariffs (Adder), the Thai government has implemented several measures of economic aid. Revolving Fund that targets the renewable energy sector is one of them. This policy is intended to promote private investments concerning the promotion of energy efficiency and renewable energy improvements by cooperation between the government and the financial sector. DEDE[2] was designed to allocate budget funds to domestic financial institutions to support private projects with low-interest loans. Fund size in the field of renewable energy in execution is now around 27.5 million US Dollars.

Geothermal Fund in Indonesia

The Indonesian government has established a fund for geothermal projects with an initial 145 million US dollars to encourage the promotion of development projects upstream. This was established by the government investment central unit called "Pusat Investasi Pemerintah, PIP". The initial intent of Geothermal Fund was to fund the initial exploration work before "Geothermal Working Areas (WKP)" tender process. This is to complement the data produced by Indonesia's Geological Agency (IGA), thereby assisting the potential investor in evaluating the geothermal prospects being offered. The preliminary surveys by IGA are funded by the State Budget and were designed to make the inventory of Indonesia's geothermal resources.

IGA has also prepared a long-term plan to conduct preliminary surveys through the year 2025. Accordingly, the Geothermal Fund should be used to:

[2] Department of Alternative Energy, Development and Efficiency, DEDE

1) Enhance data and information obtained during the preliminary surveys conducted by IGA, including Magnetic Telluric (MT) survey and other geological and geophysical surveys to better locate the site of first deep well(s).
2) Drill the first deep well(s). Depending on the size of the area, the number of wells will vary, subject to the size and complexity of the area. The purpose was to better define geological information, including but not limited to pressure and temperature gradient, fluid chemistry, steam quality, reservoir permeability, and proven exploratory reserves.

(2) International Cooperation

So far, developed economies and international organizations are the main supporters to the international cooperation in renewable energy development in developing economies. However, in recent years the case of multilateral and bilateral framework for renewable energy international cooperation has been increasing.

Support by International Cooperation
Projects supported by international organizations have played an important role in the development of renewable energy in developing economies until now. The current international cooperation can be divided to multilateral framework, national framework and non-government organization (NGO).

1) Multilateral or International Agencies
The most representative of the international cooperation framework are for example, the United Nations Development Programme (UNDP), World Bank (WB), Asian Development Bank (ADB), and the European Bank for Reconstruction and Development (EBRD) which have been working on renewable energy for rural electrification or rural development in developing economies. Renewable energy projects such as small hydro projects, solar home system (SHS) and biomass utilization that have been carried out with the support of international organizations was intended to eliminate the poverty issue in developing economies.

Currently, the "International Renewable Energy Agency (IRENA)" came to play an important role in the multilateral cooperation to promote renewable energy in the world. IRENA is an international organization, founded in January 2009 for the purpose of promoting renewable energy through multilateral cooperation, with the headquarters in Abu Dhabi UAE. Organizations such as IEA, IAEA, and IRENA have become positioned as the most important energy related international organizations in the world. The main activities of IRENA include the following.

- Facilitate access to useful information on the use of renewable energy
- The sharing of best practices and experience useful in terms of policy
- Capacity building
- Investment promotion (Financing)

REEEP on the other hand is a non-profit legal entity registered in Austria. REEEP's 'constitution' is based on statutes and additional documents approved at the "First Meeting of Partners" on 1 June 2004 in Bonn, and is revised from time to time through decisions of the Governing Board. The key activities are as follows.

- Funding clean energy project interventions
- Providing web-based information resources
- Supporting effective champions

2) National Organizations

The promotion of renewable energy activities of international organizations led by individual governments have contributed significantly. Many international cooperation agencies have been established among APEC member economies. The International cooperation agencies mainly led by these economies were often working on local bilateral cooperation. The support by these national agencies in the renewable energy sector was mainly on capacity building, human resource development and policy formulation. There is also support for financing and technology transfer related to renewable energy. Currently they are working to deepen cooperation between each other and cooperation with international organizations. The cooperation with key organizations like IRENA has been enhanced in recent years to promote activities that maximize the support system.

Table 6. International Cooperation Agency in APEC

Economies	**International Cooperation Agency**
Australia	Australian Agency for International Development (AusAID)
Canada	Canadian International Development Agency (CIDA) International Development Research Centre (IDRC)
Chile	Chilean International Cooperation Agency (AGCI)
Japan	Japan International Cooperation Agency (JICA) Japan Bank for International Cooperation (JBIC)
Korea	Korea International Cooperation Agency (KOICA)
New Zealand	New Zealand Agency for International Development (NZAid)
Chinese Taipei	International Cooperation and Development Fund (ICDF)
Thailand	Thailand International Development Cooperation Agency (TICA)
United State	United States Agency for International Development (USAID)

3) Non-Government Organizations

On the other hand, non-governmental organizations such as "Renewable Energy Policy Network for the 21st Century (REN21)" have contributed significantly on the aspect of information sharing. NGO activities normally play a role in complementing the network of major international organizations. There contribute significantly to information sharing by siphoning information within each region. In addition, it is also important in promoting renewable energy that the

activities of the NGO make adjustments for differences in the region. The following are major renewable energy NGOs which are active in the world.

- Institute for Sustainable Energy Policies (ISEP)
- World Council for Renewable Energy (WCRE)
- World Resources Institute (WRI)
- Citizens United for Renewable Energy and Sustainability (CURES)
- Regional Centre for Renewable Energy and Energy Efficiency of ECOWAS (RCREEE)

Clean Development Mechanism, CDM

This is one of the flexible measures to utilize market mechanisms that have been defined by the Third Conference of the Parties which adopted the United Nations Framework Convention on Climate Change (COP3) under the "Kyoto Protocol." When comparing with the case in the Non-Annex I countries (developing economies) where the project of global warming was not carried out, there was an additional emission reduction that will be certified by a CER. The CER obtained can be used to achieve the emission reduction targets of Annex I countries (developed economies) during the implementation of the project. With reduced (or absorption) of greenhouse gases, the implementation of CDM projects aims to promote the transfer of technology and energy-saving technologies, such as advanced environmental measures of developed economies, to developing economies.

Table 7. CDM project in APEC Region

Host Economy	Number of Project Registered at October 2012
China	2,462
Viet Nam	155
Mexico	145
Malaysia	112
Indonesia	85
Thailand	76
Korea	71
Chile	58
Philippines	58
Peru	34
Papua New Guinea	6
Singapore	2

Sources: UNFCCC homepage, cdm.unfccc.int

Many renewable energy projects have been introduced in APEC developing economies on the basis of this system. In APEC developing economies, the largest number of CDM projects was in China.

There are a lot of projects related to renewable energy such as wind, solar, hydro, biomass, and geothermal, and CDM projects are playing a role in the spread of renewable energy. CDM is making significant contributions from the aspect of technology transfer. The negotiations on a new international framework to prevent global warming will be led by UNFCCC (COP18) in Qatar from the 26th of November 2012 to 7th December 2012. A new framework is desirable for continued support of promoting renewable energy.

Industry Strategy (Manufacturing and Export)

Most of the policies that have been described so far are policy instruments to expand the use of renewable energy. Simultaneously with the introduction of renewable energy, it is important for policies that foster renewable energy equipment manufacturing industry. We must ensure the supply of equipment accordingly at the same time as the renewable energy market is expanding. The promotion of an industrial development policy can expand large-scale manufacture, and at the same time advanced research and development will continue to bring down the cost per unit of production. A typical industrial policy offers subsidies for research and development, tax incentives and subsidies for human resource development. A typical policy is the "Green New Deal" in the United States. This policy combines the environmental and energy policy and job creation. The contents of this policy include a goal to create 5 million green jobs and a 150 billion US$ (10 years) investment in the renewable energy industry.

The industrial development policy for biofuels was one of the characteristic renewable energy industries in the APEC region. Development of industry policy for bioethanol in the United Stated has been well-known. The APEC developing economies like China, Thailand, Indonesia, Malaysia, Philippines and Singapore have implemented its own biofuel industry policy. In Singapore, Malaysia and Indonesia, the development of the biodiesel industry has been promoted as an export industry. The Singapore government has been planning to make effective use of the infrastructure of the oil refining industry, and trying to create a trading market for biofuels, and also develop a market benchmark price for biofuels.

Table 8. The Top 5 Photovoltaic Module Producers in 2011

World Rank	Name	Capacity (MW)	Production (MW)
1	JA Solar (China)	3,000	1,600
2	Suntec (China)	2,400	2,000
3	First Solar (US)	2,271	1,500
4	LDK Solar (China)	2,000	1,500
5	Trina Solar (China)	1,900	1,400

Sources: European Photovoltaic Industry Association

Another characteristic was the policy to develop the solar PV related equipment manufacturing industry. China has been particularly successful in solar manufacturing industry development. Production volume of solar panels by several companies has made China to become the world's largest exporter. Chinese companies accounted for four of the top five ranked companies in world production in 2011. China entered the solar industry in the early 2000s. The departure of China is relatively slow compared with other solar panel producers, but the growth of solar industry is remarkable.

The central government's policy support plays a major role in pushing up the industry. The entry of foreign companies into high-tech industries require for clearance of various provisions in policy. These include the following.

- Foreign companies must joint venture with local companies according to a certain percentage. This is to ensure effective transfer of management and technology from foreign companies to the local participants.
- Siphoning of technology through mergers and acquisitions by the foreign companies.
- Financing scheme for the high technology industry.
- Development of infrastructure, legislation and tax incentives for export.
- Subsidies for research and development.

Malaysia for example, was able to become a hub for the development of the solar industry in Southeast Asia by attracting investments from the world leading solar manufacturers. The current production capacity for export has been increasing gradually. Many of the developing economies of APEC are preparing to capture the trends in the world's renewable energy and are promoting favorable industrial policies.

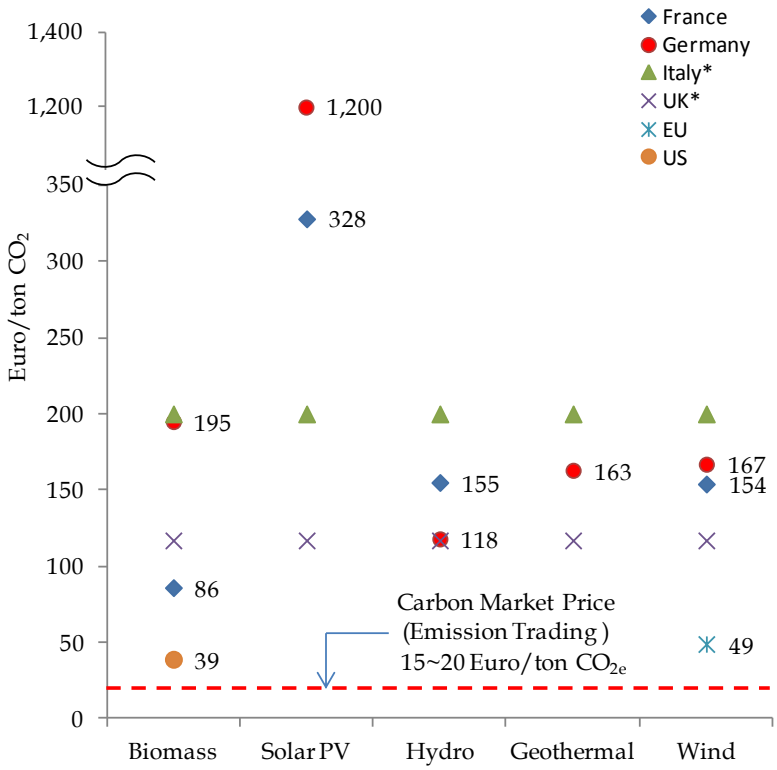
2. Realization of Promotion of Renewable Policies

GHG Mitigation and Sustainable Development

The introduction of renewable energy as a measure against global warming is not cost-effective or efficient. This has been pointed out because of the inefficiency due to duplication of greenhouse gas reduction policy and renewable energy policy. According to "Tinbergen's Rule"[3] on public policy, "For each and every policy target there must be at least one policy tool. If there are fewer tools than targets, then some policy goals will not be achieved". Market price of emission rights currently traded on the international market has changed between 15-20 Euro cents/ton CO_{2e}. As the figure

[3] (Tinbergen, 1952)

below indicates, although still debatable, renewable energy is unlikely to result in effective reduction of greenhouse gases.



Note: * CO_2 reduction cost of renewable energy is calculated by dividing the total cost of the total emission reductions.
Sources: Strand (2007)

Figure 5. CO_2 Reduction Cost by Renewable Energy in Developed Economies

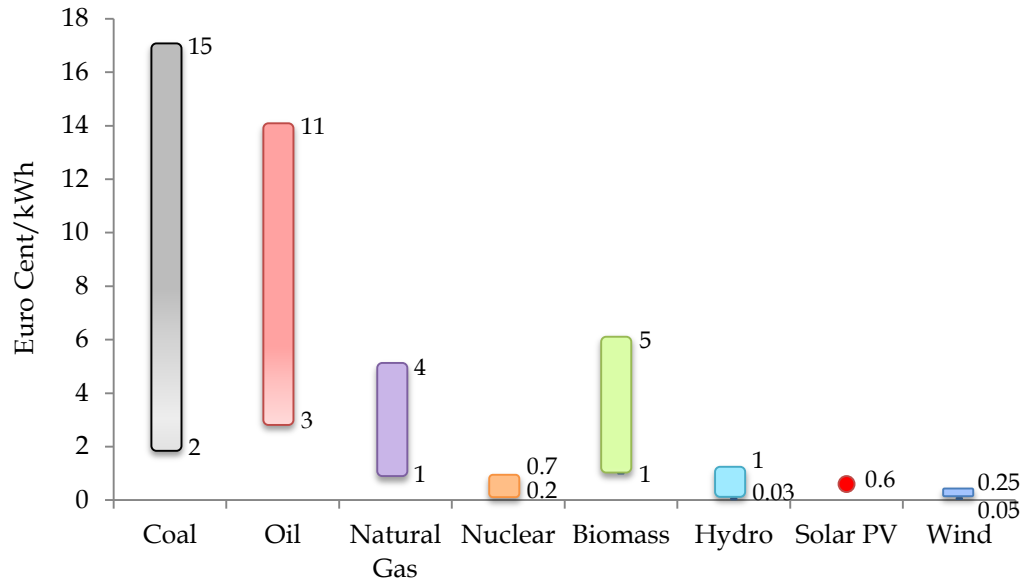
However, there are aspects that cannot be captured within the narrow framework of greenhouse gas reduction policies with the traditional renewable energy policy. First, we need to re-think on the characteristics of renewable energy. It is not simply a debate on the introduction of renewable energy to replace fossil fuels. Renewable energy has significance as a new economic policy which does not burden the environment and offers sustainable development. As a new economic policy, this innovation is important to develop a foundation for sustainable development. While there will be a real increase in future energy demand from developing populous economies like China, Indonesia, Philippines and Viet Nam, the social infrastructure for a sustainable new energy supply is needed rather than rely on the demand for fossil fuels.

Energy Security

Definition of energy security implies that a continuous supply can be obtained at stable low prices. However, except for hydro power and biomass, other forms of renewable energy are essentially

more expensive. In addition, the output of renewable energy is rather unstable and the amounts generated are relatively small. For solar PV and wind power there is also the need for a back-up power supply to stabilize the grid and this would incur additional costs.

Measuring the value of energy security (with supply diversification) is often not clear as there are many "external effects (costs)" that could be improved in general. External costs like global warming, health hazards, occupational health, material damage and noise can be quantified. The European Commission (EC) completed a study named "Extern-E Project" from 1991 to 2001 on external costs for different methods of electricity generation. The results of the study are summarized in Figure 6. According to the results of the "Extern-E", coal has the highest "external costs" at 2~15 Euro cents/kWh, while natural gas will cost nearly the same as biomass. The external costs for other renewable energy will be generated at the manufacturing facilities but basically will not occur at power the generation stage.



Sources: Extern-E (1991-2001), European Commission (2003), page 13

Figure 6. External Cost for Power Generation by Energy Resources

The concept of "external costs" as described above can be applied in developing economies; but some are difficult to quantify in developing economies. The concept of energy security and significance in APEC developing economies is an important issue that needs to be considered. There following two important points should be considered.

1) Review of subsidies

China, Indonesia, Viet Nam, and Malaysia subsidize their fossil fuel in the domestic market. For example, the subsidy expenditure to the energy sector for Indonesia accounts for approximately 20% of the total national budget. This state of affairs has been continued since the financial crisis of 1997

and the level of subsidy has been high until now. By shifting the subsidies from the retail price and expenditure to imports of fossil fuels to subsidize the development of renewable energy can internalize the external risk and reduce the risk on energy supply and thus improve energy security.

2) Evaluate low-technologies for renewable energy
Renewable energy technology has been considered to be expensive. Such a misunderstanding occurs because it is based on targeted promotion policies of developed economies. In developed economies the amount of energy consumption is very large, and to substitute the huge demand with the most advanced renewable energy technologies on a large scale will push up costs.

Cheaper renewable energy with lower technologies can be utilized. For example, small hydropower, small digester biogas, small-scale biomass power generation and solar heat have been successfully installed in a number of developing economies. These low technologies are absolutely incapable of substituting the large number of fossil fuel energy supply systems. However, utilization of renewable energy with low technologies can be constructed in community-based power supply systems and it is possible to relieve the upward pressure on the demand for fossil fuels. In addition, renewable energy with low technologies can be sustainable and offer security of energy supply for developing economies.

Benefits to Economy (GDP, Employment)

In addition to environmental effects, the promotion of renewable energy will generally create new employment (Green Job) opportunities and maintain the facilities (economic benefits) of renewable energy. The economic effects and the creation of employment can be realized in the short term in some specific sectors, and this may be determined by policy objectives. According to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) of Germany, the employment created by introducing renewable energy had reached 382,000 people by the end of 2011[4]. BMU has estimated that the number of employees will reach 500,000 by 2030 if the promotion of renewable energy is continued. However, it is necessary to take into account the impact on other industries as well. In the case of feed-in tariffs, it will be the long-term economic burden of electricity prices that consumers will have to pay.

The economic effect of promoting renewable energy was expected to grow with export industries, but this economic effect was a miscalculation. In the wind industry and photovoltaic industry in Europe and United States, unexpected developments occurred. In the manufacturing sector there was a upstream flow to developing economies, and Green Job which were expected to occur in developed economies were limited to the services sector. Since 2005, the amount of solar power

[4] "Renewable energies already provide more than 380,000 jobs in Germany", No.036/12, Berlin, 26.03.2012, http://www.erneuerbare-energien.de/english/current_press_releases/pm/48517.php

generation equipment production has been increasing in China, Chinese Taipei and Malaysia and they were the main suppliers of cheap solar power generation equipment for export all over the world. Many of the solar power manufacturing facilities in Europe and the United States were forced into bankruptcy. In other words, the economic benefits were exported to developing economies, while it was a burden to developed economies. In other words, there are significant economic benefits as a manufacturer and supplier of equipment in the developing economies for the expanding renewable energy markets in developed economies.

3. Experiences among APEC Developing Economies

Case Study (1): Renewable Energy in Philippines

Background

The Philippine government, showed a positive attitude towards introduction of policies on renewable energy as the axis to improve the environment, including global warming and reducing dependence on imported fossil fuels such as coal and crude oil. A series of laws and regulations went into effect after the year 2000. In 2000, the OSW law was amended to allow for the entry of the private sector to commercialize the solar, wind, ocean energy. In 2001, the "Electric Power Industry Reform Act" became effective. The Philippines ratified the Kyoto Protocol in 2003, and came up with the "Biofuels Act" in 2006 and the "Renewable Energy Act" in 2008.

The rules and regulations were created for enforcement of the "Electric Power Industry Reform Act (EPIRA)" in the year 2001. The restructuring of the power industry included the separation of the generation and distribution sectors by the National Power Company. At the same time, the "Electric Power Industry Reform Act" also specifies preferential treatment of renewable energy projects. In view of the intermittent nature of the supply of renewable energy generation, the provider is required to submit the power generation forecast table based on "Wholesale Electricity Spot Market" planning program. Consequently, the power demand is for each time zone, and the amount predicted is counted as the amount of required power.

In October 2003, when the Philippines ratified the Kyoto Protocol, there was great interest on renewable energy in terms of investments in technology (developed economies) abroad by the Clean Development Mechanism, and the acquisition of carbon credits.

The "Biofuels Act" came into force in January 2007. Within two years of the enforcement of this Act, the mixing ratios of 2% biodiesel and 5% for gasoline were mandated. From the year 2011, the rate of bioethanol mixture was raised from 5% to 10%. At the same time, the manufacture of biofuel projects were used to obtain carbon credits as "Clean Development Mechanism" projects and

cogeneration of the production process was further subjected to feed-in tariffs. However, in considering the energy consumption needed for sugarcane cultivation and the production process, a detailed analysis is required to ascertain which bioethanol can contribute to the best reduction in greenhouse gases. In terms of energy supply security, we need to evaluate the energy balance while considering a raise in the proportion of domestically produced energy.

The "Renewable Energy Act" which came into force on the 16th of December 2008 provided for market development, technology development, commercialization and expansion of consumption on renewable energy sources like biomass, solar, wind, geothermal, ocean and hydropower. In addition, the "National Renewable Energy Board (NREB)" was established based on the act. The board is composed of members elected from "Department of Energy", "Department of Finance", "Department of Natural Resources and Environment", "Department of Trade and Industry", "National Power company (NPC)", "Philippine National Oil Company (PNOC)", "National Transmission Corporation (TRANSCO)", "Philippine Electricity Market Corporation (PEMC)", renewable energy developers, distribution companies, power generation companies, government finance organizations and the private sector. The functions of the NREB are as follows;

- Recommend the proportion of renewable energy for power generated by RPS
- Recommend tariff level for FIT
- Recommend the minimum capacity for the off-grid area
- Recommend and implement the "National Renewable Energy Program"
- Enforce and supervise the "Renewable Energy Trust Fund"
  (For application in research and development of renewable energy)

Policy Structure (Policy design)

Based on the proposal by the "National Renewable Energy Program", the NREB had developed a strategy and policy target for sustainable development and improve energy security and self-sufficiency ratio of domestic energy in collaboration with the "Department of Energy". The introductory target for 2030 was 15,304 MW, which is about three times the 2010 target of 5,439 MW. The targets set for each of the technologies were as follows:

- Increase of 75% from geothermal energy sources
- Increase of 160% from hydropower
- Increase of 277 MW from biomass
- Increase of 2,345 MW from wind energy
- Increase of 284 MW from solar energy
- Develop the first ocean energy facility by 2018

The detailed targets for each 5 year period are presented in Table 9.

Table 9. Renewable Energy Targets for the Philippines (by 2030)

	Actual (MW)	New increase Capacity (MW)				Total Additional Capacity (MW)
	2010	2015	2020	2025	2030	2011-2030
Geothermal	1,966.0	220.0	1,100.0	95.0	80.0	1,495.0
Hydro	3,400.0	341.3	3,161.0	1,891.8	0.0	5,394.1
Wind	33.0	1,048.0	855.0	442.0	0.0	2,345.0
Solar	1.0	269.0	5.0	5.0	5.0	284.0
Biomass	39.0	276.7	0.0	0.0	0.0	276.7
Ocean	0.0	0.0	35.5	35.0	0.0	70.5
Total	5,439.0	2,155.0	5,156.5	2,468.8	85.0	9,865.3

Sources: Jose M.Layug,JR (2012), "National Renewable Energy Program", Department of Energy, Philippines

A policy instrument schedule was introduced to achieve the above goals with the implementation of the Renewable Energy Act of 2008 (RA 9513).

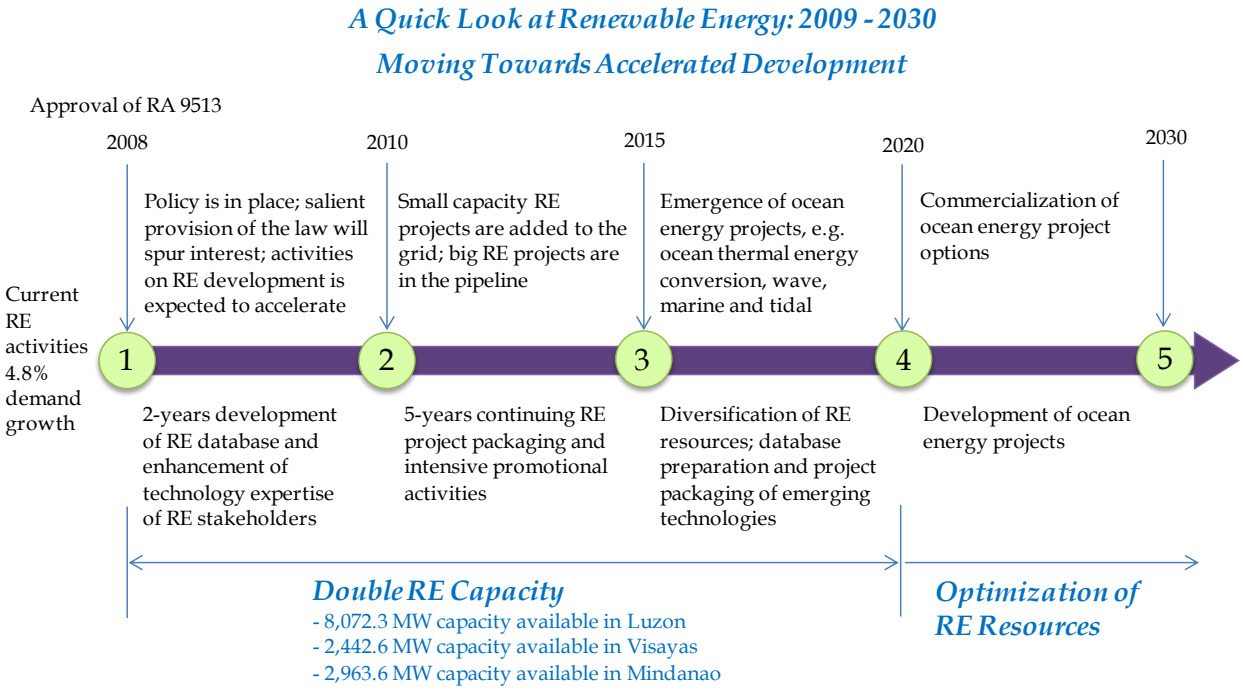


Figure 7. Renewable Energy Policy and Targets for the Philippines

Implementation

The Department of Energy has set two policy strategies: (1) design the market base incentive to encourage private investments, (2) design the market mechanism to facilitate the installation of renewable energy industry. The market base incentive to investors is intended to induce investments and encourage new entrants into the business. The design of market mechanisms for promotion of renewable energy is provided by RPS and feed-in tariffs.

1) Renewable Portfolio Standard (RPS)
According to the draft of RPS Rules (2011)[5] announced by NREB, DOE will determine the ratio of the annual percentage for renewable energy generation based on the proposal by the NREB. The amount of power demand is adapted to increase by 1% over a 10 year period. By the RPS Rules (2011), the power generating companies must produce the electricity via renewable energy sources according to the stipulated amount. One of the following methods may be chosen.

- The renewable power to be generated by an independent power producer.
- Sign agreement with other renewable power producers.
- Purchase renewable energy certificate (REC) from the renewable energy market.
- Get the assignment from National Transmission Company (TRANSCO) in accordance with feed-in tariff.

Renewable energy that are subjected to RPS include biomass, waste, wind, solar, hydro, run-of-river hydropower, geothermal, ocean, or a hybrid system as determined by the "Renewable Energy Act" and authorized by NREB. In addition, the power distributor or power producer must be approved by the domestic electricity market, and the local power producer or direct sale power producer must be approved by the NREB and subjected to RPS.

According to the draft of RPS Rules (2011), in case the supply is more than the amount of electricity assigned by the RPS, the producer can sell the surplus to the market by REC. The producer can also choose to save the credits for use in future. However, the period permitted for saving credits is only for one year. Recently, the price of REC trading in the international renewable energy market had soared due to imbalance in the demand and supply, where the demand was higher than supply. This was due to the fact that some companies held large amounts of REC and were approaching a monopolistic renewable energy market. This can result in distorted efficiency in the supply of renewable power. It is recommended that RPS be reviewed every two years or as required.

[5] RPS Rules (2011), "Rules Governing the Establishment of Renewable Portfolio Standard", National Renewable Energy Board (NREB) of Philippines, 8th March 2011

If the RPS is not in compliance, the penalty charges such as cancellation of authorization can be imposed. Noncompliance may include:

- Lack of capacity for power transmission.
- Generation cost is 300% higher than feed-in tariff rate
- Difficulty in supplying power due to natural disasters like typhoon, flood and drought.

2) Feed-in Tariffs (FIT)

The feed-in tariff scheme was set by the Renewable Energy Act (2008), but a formally enacted tariff was only set up in July 2012. The tariffs were proposed by the NREB and finally determined by the Energy Regulatory Commission (ERC).

The tariffs proposed by the NREB were follows:

- Run-of-the-river hydropower: 6.15 peso/kWh
- Biomass: 7.00 peso/kWh
- Wind: 10.37 peso/kWh
- Solar: 17.95 peso/kWh

Since the power generation cost was low, the Energy Regulatory Commission had set a lower tariff than the tariff proposed by NREB. The final recommended tariff was as follows[6]:

- Run-of-the-river hydropower : 5.9 peso/kWh
- Biomass: 6.63 peso/kWh
- Wind: 8.53 peso/kWh
- Solar: 9.68 peso/kWh
- Ocean: Undecided

In this process, the tariff for ocean energy was not determined. Also, the hydropower reservoir and geothermal supplies were not subjected to the FIT due to market competitiveness. However, the Energy Regulatory Commission did not provide any explanation about this. The duration of the tariff is 20 years.

The NREB will investigate the state of development in renewable energy and the impact of FIT, and report to the ERC. The ERC will review the tariffs based on the report by the NREB. The review will consider as to whether:

- The target has been achieved by introducing within the set period
- The target cannot be achieved within the set period

[6] "Resolution Approving the Feed-in Tariff Rates", Resolution No.10, Series of 2012, Energy Regulatory Commission, Republic of the Philippines, 27th July 2012

- There were significant changes in the cost or more accurate cost information was revealed

The tariffs may be adjusted by the ERC as a consequence of variations in inflation and exchange rates. The tariffs determined will vary depending on the technology of renewable energy; or there may be no difference due to scale power generation and other factors. The tariffs will be approximately 10% lower than the amount of actual tariffs proposed by the NREB and with sunlight as the source it will be about half. At the same time, it is an important issue to consider whether it will be used in combination or even as RPS.

3) Other Incentives

The contents in economic incentives are slightly different according to the renewable Energy Developer, Supplier and Manufacturer.

Renewable Energy Developer

- 7 years exemption of corporation tax
- Corporation tax of 10% after the annual year 8 (previously 35%)
- Import tax exemption for renewable energy related equipment and materials for 10 years
- Machine and equipment receive a special tax (1.5%)
- Domestic investments on equipment and services are free from tax
- Value Add Tax (VAT) exemption
- Profit from carbon credit exemption

Renewable Energy Supplier and Manufacturer

- 7 years exemption of corporation tax
- Import tax for renewable energy related equipment and material are exemption for 10 years
- Supply and manufacture VAT exemption
- Domestic equipment and material exemption

Case Study (2): FIT in Thailand

Background

Thailand has a high dependence on imports of energy. For example, Thailand is dependent on oil imports for 90% of total energy consumption. Against the backdrop of rising oil prices in recent years, there is a growing sense of a crisis for energy security. The government has come up with a policy with emphasis on expanding the introduction of alternative energy such as securing the supply of energy and the rationalization of energy use. Since agriculture is one of the major industries, Thailand has been conducting biofuel development projects since the early 1980s with a focus on the use of renewable energy such as agricultural waste.

Against this background, the Thailand government established the "Energy Strategy and Energy Policy in Thailand", and positioned it as a strategic pillar among the five listed below.

1) Energy security
2) Alternative energy
3) Energy price and safety management
4) Energy saving and efficiency
5) Environment protection

Policy Structure (Policy design)

As described above Thailand's energy policy shows that the main strategy is the focus on promotion, production and utilization of alternative energy. Especially biomass and biofuels would enable energy security to improve, reduce pollution and bring profits to the agricultural sector. It is important to apply appropriate incentives to promote the production and utilization at the community level. Also, the research and development of renewable energy have to be extensively targeted.

(1) Renewable Energy Development Plan 2008-2022, REDP[7]

The government has developed a plan indicating the specific renewable energy needs over the next 15 years, called "Renewable Energy Development Plan 2008-2022 (REDP)", based on the above energy policy. The "Department of Alternative Energy Development and Efficiency (DEDE)" announced a draft policy in 2008 which was submitted to the "National Energy Policy Council (NEPC)" on January 16, 2009, and was approved by the Cabinet on January 28, 2009.

REDP has set a goal for alternative energy at 20% of total energy consumption by 2022. Achievement of the set target will substitute an energy equivalent of 19,800 ktoe, a savings in the energy import bill of 4,610 million baht and expected reduction of 42 million tons of greenhouse gas emissions. The objectives of the plan are as follows:

1) Promote alternative energy as a main energy resource for the economy.
2) Strengthen security of energy supply.
3) Energy use focused on a green integrated community
4) Develop auxiliary industries in alternative energy production technology.
5) Promote research and development of alternative highly efficient energy technology

The target energy sources involve the following four areas:

1) Natural energy (solar, wind, hydro)
2) Bio-energy (biomass, biogas, municipal solid waste (MSW))

[7] Dr.Twarath Sutabutr (2010), "Thailand's Renewable Energy Development Plan (REDP)", Department of Alternative Energy Development and Efficiency (DEDE) Thailand's Ministry of Energy, 12 October 2010

3) Biofuels (ethanol, biodiesel)
4) Natural gas for transportation (natural gas for vehicles, NGV)

The targets for alternative energy is separated to short-term (2008-2011), medium term (2012-2016), and long-term (2017-2022) targets. More specifically, plans were developed to achieve the targets at 15.6% in 2011, 19.1% in 2016, and 20.3% in 2022.

Alternative Energy Development Plan (AEDP)

However, the new Prime Minister Yingluck Shinawatra who took office in August 5, 2011, announced the new energy policy. The main contents of the policy are as follows.

- Enhancing energy-related industries & business to be next generation
- Securing economy's energy supply
- Pricing energy right
- Up-scaling renewable energy mix to25% in 10 years.
- Targeting Energy Intensity Reduction by 25% (based on 2010 level) within 20 years.

Table 10. AEDP Master Plan, 2012-2021 (Target)

Technology	Unit	Actual 2011	Target (Old) 2022	Target (New) 2021
Generation				
Solar	MW	78.7	500	2,000
Wind	MW	7.3	700	1,200
Small Hydro	MW	95.7	324	1,608
Biomass	MW	1,790.2	3,700	3,630
Biogas	MW	159.2	120	600
MSW	MW	25.5	160	160
Geothermal	MW	0.3	-	1
Ocean	MW	-	-	2
Total Generation	MW	2,156.9	5,504.0	9,201
Biofuel				
Bioethanol	million liters/day	1.22	9.00	9.00
Biodiesel	million liters/day	2.10	4.50	5.97
Second Generation Biofuel	million liters/day	-	-	2.50
Total Biofuel	million liters/day	3.32	13.50	17.5

Sources:
1. "Update on Thailand's Key Energy-related Policies", August 2011, DEDE
2. "Thailand Alternative Energy Situation 2011", Department of Alternative Energy Development and Efficiency
3. Renewable Energy Development Plan 2008-2022, REDP

Prime Minister Yingluck Shinawatra has promised a policy promoting the development of low-carbon society using renewable energy and announced the "Alternative Energy Development Plan (AEDP)" (AEDP Master Plan 2012-2021), which proposes to increase the target from 20.3% to 25% of total final energy consumption by 2021. The details are presented in the following table.

Implementation

Thailand had introduced a system of RPS in 2003. The target of the RPS was set up at 4% of total power generation capacity with renewable energy including solar, wind, and biomass. However, the RPS system no longer functions as a major policy instrument with the introduction of feed-in tariffs (FIT) in April 2007. Currently, the feed-in tariffs are the main drivers for promoting renewable energy in Thailand. The following section focuses on the FIT system in Thailand.

(1)Feed-in Tariff (Adder)

Thailand introduced the feed-in tariff in April 2007 for renewable energy generation. The feed-in tariff system in Thailand is called "Adder". Thailand was the first economy in ASEAN to introduce this system. Investments in renewable energy projects were activated, and some of the projects involved foreign capital.

Table 11. Revised Feed-in Tariffs as at March 2009 (Adder)

	Capacity	Duration (Years)	Before Price Revision 2007-2008 (Bath/kWh)	After Price Revision March 2009 (Bath/kWh)	Add Premium (Diesel Alternative) (Bath/kWh)	Add Premium (Identified 3 regions in southern) (Bath/kWh)
Solar		10	8.0	8.0	1.5	1.5
Wind	＞50kW	10	3.5	4.5	1.5	1.5
	＜50kW	10	3.5	3.5	1.5	1.5
Biomass	＞1MW	7	0.3	0.5	1.0	1.0
	＜1MW	7	0.3	0.3	1.0	1.0
Biogas	＞1MW	7	0.3	0.5	1.0	1.0
	＜1MW	7	0.3	0.3	1.0	1.0
Small Hydro	＞50kW＜200kW	7	2.5	2.5	1.0	1.0
	＜50kW	7	2.5	3.5	1.0	1.0
Municipal Solid Waste	Landfill	7	0.4	0.8	1.0	1.0
	Heat	7	1.5	1.5	1.0	1.0

Sources: Thailand's Renewable Energy Development Plan and PV Development in Thailand, DEDE, March 3, 2010

The Feed-in tariff (hereinafter, Adder) system in Thailand stretches from the "Small Power Producer (SPP)[8]" (1994) to the "Very Small Power Producer (VSPP)[9]" (2002) program. "Adder" is a system that adds a fixed premium price from the normal purchase price (2.0~2.5 Baht/kWh) of SPP and VSPP. Those for solar (photovoltaic and solar thermal power generation) was the most expensive with the tariff of 8 baht per kWh of the premium. The duration for "Adder" was 7~10 years, and three regions in the southern part and remote area of the economy will pay an add premium called "Special Adder". Revision of the system was carried out in March 2009. This price review was to further accelerate the adoption of renewable energy technologies other than solar.

The producer of renewable energy who wishes to sell electricity to the distributer is required to file an application for through examination and inspection at the regulation office to get the final approval as an "Adder" project. The renewable energy power producer has to sign the power purchase agreements (PPA) and sell the electricity to the grid at a price based on the "Adder" tariff.

Sources: Solar Bangkok Power Company Limited

Figure 8. Chachoengsao Solar Farm (1.495 MW, 5th Oct 2007 Start Operation)

The Government of Thailand had conducted two rounds to review and accept the applied projects as "Adder". The first round was in February 2007 and the second round was in August 2009. So far, 1,198 projects have been submitted, and among the total number of projects 576 projects (total

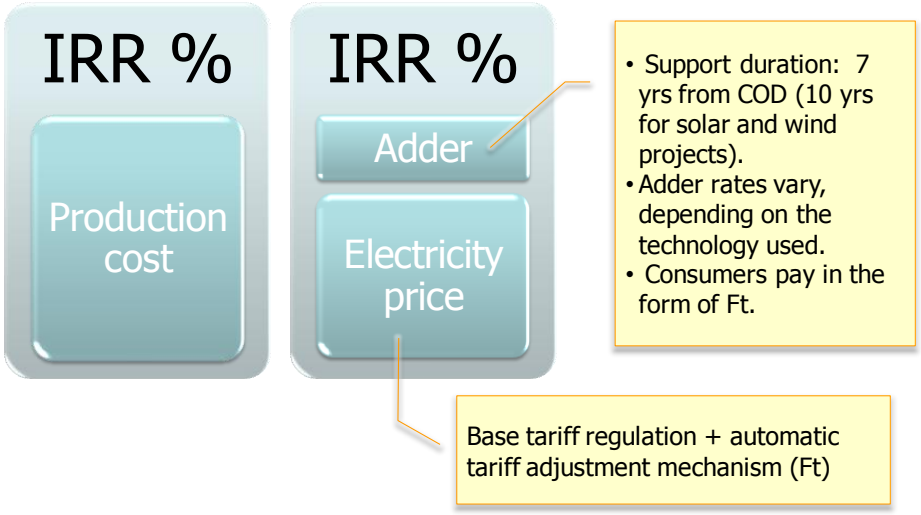
[8] Small Power Producer (SPP) is a power purchase program from small scale power generation project due to the revision of the law was introduced in 1994 EGAT (Electricity Generating Authority of Thailand) law. SPP has to refer to the capacity from 10 MW to 90 MW. This program was introduced with the aim of reducing the financial burden of the government in power generation and transmission. At the same time the promotion of private sector participation in power generation projects, and promote the use of renewable energy by byproduct of local industry.

[9] Very Small Power Producer (VSPP) is a power purchase program from renewable energy power producer where the capacity lower than 10 MW. This policy was established in May 2002.

capacity around 2,677.6 MW) were for solar power. Initially the Government had considered biomass power generation as the main renewable power source. However, solar power projects became significantly more prominent than other renewable energy technologies. From the total amount, 195 projects (total capacity around 500 MW) were for VSPP solar power. A total of 51 projects (7.6 MW) were completed and connected to the grid. For the SPP scheme, 5 projects (355 MW) were approved and most of them were mega solar projects on a large scale. By the end of the year 2011, the installed generation capacity for renewable energy achieved was 2,156.6 MW and renewable energy for heat achieved was 4,528.7 ktoe.

Process to determine the tariff and structure of the formula

Process to Determine the Tariff



Sources: "Thailand's Renewable Energy Policy: Status, Barriers, and Future Direction", Sept 2010, Asia Biomass Seminar Follow-Up Workshop in Hanoi, EPPO

Figure 9. Structure for "Adder" Tariff Determination

Thailand's tariff structure of Adder is basically composed of electricity charges (fee depending on usage) + fuel surcharge (Fuel Tariff, FT) and the Adder (Surcharge). The method to calculate the cost per unit of power generated for renewable energy sources (production cost) involves a constant "Internal Rate of Return (IRR)" for power generation projects. The same level of production costs will be divided into electricity price (Base tariff regulation + automatic tariff adjustment mechanism (Fuel Tariff, FT)) determined by the regulatory authority and an added premium called "Adder". The added premium involves a fuel adjustment cost to the electricity consumer. Of course, the production cost will vary depending on the differences between renewable energy techniques, and while the electricity charges remain constant, the "Adder" tariff for each type of resource will be different. "Adder" tariff levels vary greatly depending on the setting of the level of IRR. If IRR

setting was too high, the burden on the consumers in terms of the surcharge will increase. On the other hand, if the IRR setting is too low, the investors may not show any interest and this will make it difficult to achieve the target. In other words, the rate of a reasonable IRR level is a key driver to control the installation of renewable energy capacity. The burden of additional costs to consumers will fluctuate depending on the IRR. The following table indicates the levels of IRR that were used to calculate the tariff for solar and wind energy. IRR levels applied to the different renewable energy source were also divided into with and without income from reduced emissions of greenhouse gases in CDM projects.

Table 12. IRR Levels Used for Calculating "Adder" in 2010

Technology	**IRR in 2010**	
	Without CDM Income	**With CDM Income**
Solar Thermal (10 MW)	16.8%	17.8%
Solar PV (50 MW)	13.9%	15.1%
Wind (60MW)	9.5%	10.9%

Sources: "Thailand's Renewable Energy Policy: Status, Barriers, and Future Direction", September 2010, Asia Biomass Seminar Follow-Up Workshop in Hanoi, EPPO

When the Thai government considers the tariff, the prerequisites listed in the table are subjected to review. Thailand, conducted a review of the tariffs over a certain period of time for effective control of the level of the tariff for the introduction of renewable energy. This review was also aimed to adjust the distribution of benefits and burdens between the stakeholders.

Table 13. Assumptions revisited during policy reviews

Plant-specific Assumptions			**Financial Assumptions**	
Capacity	MW		Interest rate	%
Useful life	Years		Exchange rate	%
Project cost ~Machine & equipment ~Construction	$		Debt leverage	%
			Loan payback	Years
			Tax privilege	Details
Construction period	Years		CDM income	$/year
Operating hours ~Peak period ~Off peak period	% of total			
Capacity factor	%			
O&M cost ~Operating cost per year ~Part replacement	$/year $			
Other technology-specific assumptions (e.g., degrade factor for solar; cost of fuel supply per year for biomass, etc.)				

Sources: "Thailand's Renewable Energy Policy: Status, Barriers, and Future Direction", Sept 2010, Asia Biomass Seminar Follow-Up Workshop in Hanoi, EPPO

Additional Cost

The additional costs of "Adder" are transferred to consumers of electricity through the electric bill. According to government officials, the introduction of "Adder" did not have a great impact on electricity prices. The Thai government had already implemented a policy that provides consumers with free power to a maximum of 50kWh per month in order to protect the poor. Additional cost for "Adder" will be borne by consumers who have reached a certain level of income. According to an estimate by the DEDE, even as the government was going to realize the renewable energy power introduction target of 9,201 MW by 2022, the impact of the cost burden would not be significant.

However, since the introduction of renewable energy has been growing faster than previously assumed, there are opinions that the target value should be reviewed. While maintaining high tariffs attempts to expand deployment, it can increase consumer costs. In addition, domestic manufacturers have not been prepared to produce solar panels on a large scale; and the import of majority of solar cells and equipment will have some economic effects on the economy. The continuation of incentives can be a cost burden to the people, while it is difficult to obtain a general consensus of the nation.

Issues and Challenges

(1) Policy Aspect

Thailand had introduced its own feed-in tariff called "Adder" way in advance of other APEC developing economies. There is a system of electric utilities purchasing power from small power producers (VSPP and SPP) of renewable energy sources. There was also a foundation to promote private investments and this foundation became the background for the introduction of "Adder". In addition, the power market had a framework of price transfer to the consumer for fuel surcharge adjustment.

Implementation of "Adder" is an important factor that reduced cost of renewable energy power systems. This matter had made the private sector more aware of renewable power generation projects, and the use of "Adder" was increased above expected levels by the government. On the other hand, there were also the following problems.

Quantitative Uncertainty

The total power of solar PV projects in the year 2011 was 145 MW. This amount was higher than the target of 55 MW indicated in the REDP. However, it is unlikely that all the "Adder" projects have been included as some applicants have been "speculative" as indicated by previous examination. The actual amount of implementation and how many projects have successfully connected to the grid has become difficult to forecast and manage. Under the current rules, the upper limit of the applied "Adder" has not been established. The government has to manage the system by taking

into account the balance between the two objectives, while providing sufficient incentives and suppressing the impact on electricity prices due to proliferation of applied projects. It is also possible to apply based on past trends, and revise the target value upwards. However, the quantitative uncertainty for the future will affect the power development planning and it is also conceivable that it would contribute to bleak prospects for future operators.

Stability of the system

Thailand government will continue to apply the current tariffs for a certain period to maintain consistency in policy. However, reduction of tariff rates, the subsequent timing of the reduction and the schedule are yet to be determined. The reduction of the tariffs or most important issue in the management system of the future has been left to "political judgment". Thailand has had the experience to shift the feed-in tariffs from the previous RPS system. However, there is a necessity to scrutinize for consistency and integrity of the policy, and clearly show the intention of the government to further enhance the reliability of the system.

(2) Economic Aspect

Funding

One of the factors that affect the feasibility of application of "Adder" is the possibility of financing by businesses. Operators generally prepare to get a loan from a financial institution while at the same time applying for "Adder". However, in most of the financial institutions in the market, there has been poor investment performance of similar projects. For this reason, the returns and risk of the project loans have been examined are there has been a tendency to apply relatively more strict criteria. While the review by these financial institutions showed poor profitability of such projects, , there is a possibility that they may have missed a good opportunity.

Foreign investment

The Foreign Business Act (Revised in 1999) was enacted in March 2000. This regulation prevents the entry of foreign capital investment of not more than 50%. Local registered companies will hold a 51% minimum stake in a joint venture corporation with foreign company. However, the following incentives will be provided to foreign manufacturers on alternative energy and energy conservation related investments.

1) Corporate income tax exemption for 8 years and 50% taxation for the following five years.
2) Transportation cost and electricity charge are admissible for twice the appropriation; and deductible from net income up to a maximum of 25% of the amount invested for the installation of such equipment or construction costs.

The Government has a clear position on renewable energy as one of the most important investment promotions. A growing interest from foreign companies is expected with the promotion of the above measures including "Adder".

(3) Technical Aspect

Distribution system

Although there were many "Adder" application projects, the realized supply grid is about 732 MW in total (solar power 7.7 MW). According to official sources, the lack of capacity of the system at the moment is not a matter of urgency. Some of the projects cannot be connected to the high-pressure transmission lines because of an upper limit for connection under the electricity regulations. Normally, for a high pressure of 22,000 V the limit is 8 MW; while for transmission lines of 33,000 V the limit is 10 MW. In the long term, increasing the size and speed of transmission lines to achieve the project grid application and developing system stabilization measures will be one of the most important issues for the government. There are further discussions with regulatory agencies to increase the power generation facilities and also to secure backup power supply for this purpose.

Post-Installation issues

Many people involved in the renewable energy industry have pointed out that there is a problem in the maintenance of installations. The domestic market is lacking in sufficient technical know-how for equipment maintenance after installation. It takes time and involves considerable cost to respond in case of failure, especially with equipment imported from overseas manufacturers. Hence, the institutional development of standards to ensure equipment performance has become an important consideration especially for imported equipment.

(4) Administrative procedures

A review of "Adder" is usually carried out on the basis of possible land use changes, technology expertise, funding and environmental impact. According to investors, the review on the application of "Adder" takes a minimum of about six months. In comparison with other economies that have introduced feed-in tariffs the process in Thailand is relatively longer. One of the factors is that there is a speculative rush, which makes the administrative load become heavy. As a countermeasure to avoid speculation, it was decided that the 200,000 baht/MW application fee (as deposit) will not be refunded if the project activity does not take place within two years from the approval date.

Case Study (3): FIT in Malaysia

Background

According to the 9th Malaysia Plan (2006 ~ 2010), Malaysia's energy policy was formulated based on sustainable development by stockpiling planned preservation of petroleum resources, efficient use of natural gas and coal, and expand the utilization of renewable energy. The plan has set a target for installed capacity of renewable energy generation at 350 MW by 2010. This percentage of renewable energy generation accounted for all of 2010 was to reach 1.8%. However, only 53 MW was introduced by the end of December 2009.

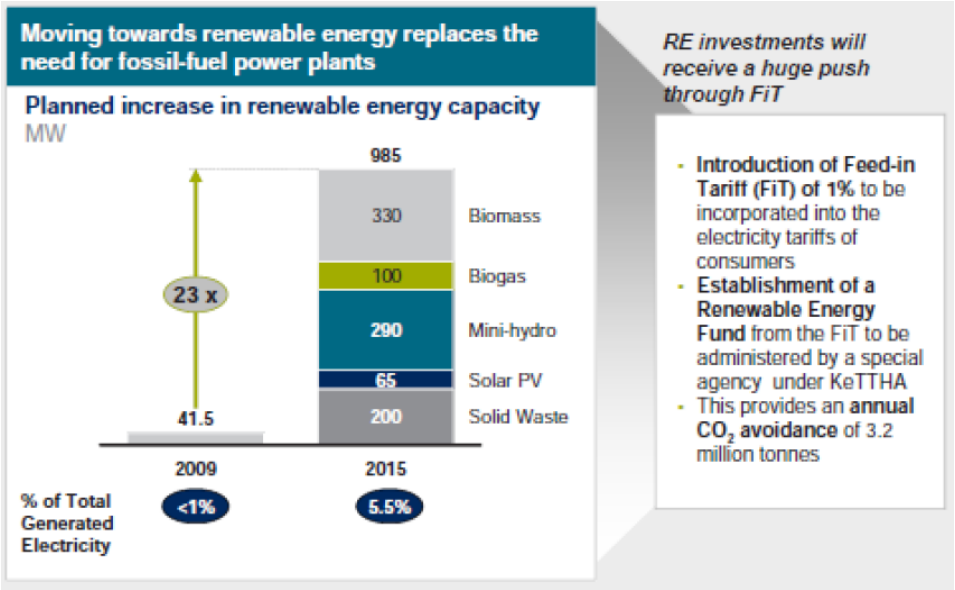
The above policy was inherited by the "10th Malaysia plan (2011 ~ 2015)", and the energy policies outlined are as follows;

- Streamline energy prices depending on the economic situation and shift the energy price to market price following the market mechanism.
- Promote the use of renewable energy and diversification of energy supplies. The energy policy shall also consider nuclear power as an alternative energy.
- Accelerate initiative for implementation of effective use of energy by each industrial sector
- Oversee the transition process to market prices and reduce the impact on the lower income group by providing an effective aid policy
- Ensure an integrated approach to achieve security in the supply of energy

Table 14. Renewable Energy Target by 2030

Year	Total Capacity (MW)	RE Share in Power Mix (Peak Load) (%)	CO_2 Reduction (Million ton)
2010	73	1	0
2015	985	6	11
2020	2,080	11	42
2030	4,000	17	145

Note:
(1) The amount of renewable energy installed capacity achieving is depends on the size of the renewable energy fund.
(2) Prerequisites: 1) Implementation of feed-in tariff system. 2) Renewable energy generation capacity continues to grow at an annual rate of 15.6% by the year 2011 ~ 2030.
Sources: Ministry of Energy, Green Technology and Water



Sources: Ministry of Energy, Green Technology and Water

Figure 10. Renewable Energy Target by 2015

Renewable energy is expected to increase from <1% in 2009 to 5.5% of Malaysia's total electricity generation by 2015.

Policy Structure (Policy design)

Malaysia's energy policy, called "National Petroleum policy (1975)", was enforced for the first time in 1975 after the first oil crisis. After the second oil crisis, fossil fuel and electricity have been the subject of subsequent energy policies in Malaysia, published in sequence as the "National Energy Policy (1979)", "National Depletion Policy (1980) and "Four Fuel Diversification Policy (1981)". Renewable energy became the central theme of the government's policy with the launching of the "Five Fuel Diversification Strategy" in 2001. The initial activities of renewable energy promotion were focused on CDM projects and the "Malaysia Building Integrated Photovoltaic (MBIPV)" project was conducted with the support of the UNDP / GEF.

Since the 2000, Malaysia began to incorporate renewable energy seriously. The first renewable energy promotion program called "Small Renewable Energy Power Program (2001)" was introduced to encourage grid connected small scale power generation. Another important policy was the "National Biofuel Policy (2006)" which was promoted under the leadership of the economy. The implementation of the MBIPV project had greatly affected the development of renewable energy policy in Malaysia.

Table 15. Development of Energy Policies in Malaysia

Energy Policy	Year	Objectives
National Petroleum Policy	1975	Introduced to ensure optimal use of petroleum resources; regulation of ownership and management of the industry; and economic, social and environmental safeguards in the exploitation of this resource.
National Energy Policy	1979	Formulated to achieve a range of supply, utilization and environmental objectives.
National Depletion Policy	1980	Introduced to guard against over-exploitation of national oil and gas reserves.
Four Fuel Diversification Policy	1981	Emphasis given to fuel diversification. Designed to reduce dependence on oil and to place increased emphasis on gas, hydro-electricity and coal as energy sources
Five Fuel Diversification Strategy	2001	Adds renewable energy to the Four Fuel Diversification policy. Introduced in recognition of the potential of biomass, biogas and other renewable energy resources.

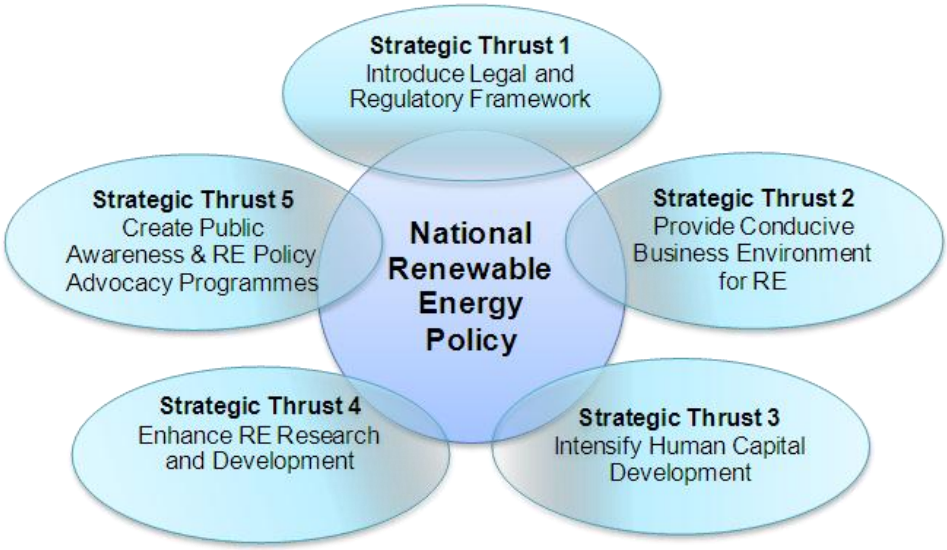
Sources: Badriyah Abdul Malek, Ministry of Energy, Green Technology and Water, UNDP Malaysia (2007)

National Renewable Energy Policy and Action Plan (2010)

The action plan was to clearly propose in detail the necessary legislation introduced policies, objectives and target. Policy statement of the action plan was to enhance the utilization of indigenous renewable energy resources to contribute towards national electricity supply security and sustainable socio-economic development. According to the action plan, the objectives for the National Renewable Energy Policy were as follows.

- To increase renewable energy contribution in the national power generation mix;
- To facilitate growth of the renewable energy industry;
- To ensure reasonable renewable energy generation costs;
- To conserve the environment for future generations; and
- To enhance awareness on the role and importance of renewable energy.

In addition, five strategic thrusts were set to capture the introduction of renewable energy. Base on Strategic Thrust 1, the "Renewable Energy Act" (Feed-in Tariff) was approved and came into effect in June 2011.



Sources: National Renewable Energy Policy and Action Plan (2011), Ministry of Energy, Green Technology and Water

Figure 11. Strategic Thrusts of National Renewable Energy Policy

Implementation

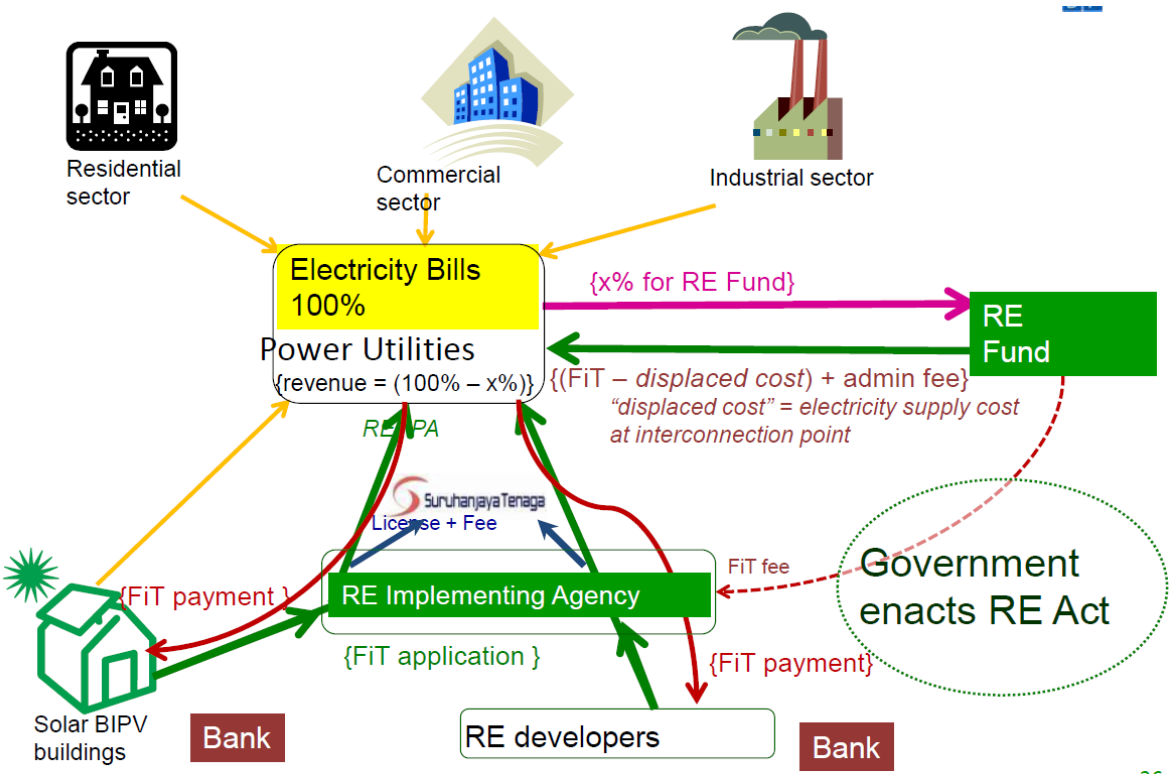
Renewable Energy Act, (2011) - Feed-in Tariff

Parliament of Malaysia approved the "Renewable Energy Act" in April 2010. This was the first renewable energy legislation in Malaysia. The "Feed-in tariff (FIT)" system was incorporated in the

law to obligate the National power company to purchase the electricity generated by renewable energy at a fixed price. The details of the FIT system and FIT implementing agency were addressed by the parliament in October 2010, and were approved in June 2011.

The FIT mechanism allows electricity that is produced from indigenous renewable energy resources to be sold to power utilities at a fixed premium price and for a specific duration. The FIT also provides a conducive and secured investment environment enabling financial institutions to be comfortable in providing loans for long periods of more than 15 years. FIT will provide a fixed revenue stream for installed systems and with a suitable degression rate, manufacturers and installers will be encouraged to reduce price while enhancing quality.

Basically the FIT system in Malaysia was created based on the German FIT system. In other words, the gradual decrease in the rate constant was adapted for the period in which the tariff was decided. This mechanism was based on the assumption that the future cost of renewable energy technology will decrease due to technological development and market expansion effects.



Sources: Gladys Mak, Senior Officer-Policy Analysis, MBIPV Project

Figure 12. Structure of FIT in Malaysia

However, Malaysia's FIT system has features that distinguish it from traditional FIT. The government will set the upper limit or the "RE Quota" for the amount of power generation equipment introduced every six months. A tender scheme will be used to select the operator of the

"RE Quota". The reason for this measure was to secure the additional cost required for the year and control the additional increase in costs. Basically, the additional cost will be transferred to the end user via the electricity bill. The additional difference of a plus 1% of the total will be charged only to customers whose monthly electric bill was more than 77 Ringgit Malaysia. Thus, the additional cost will not burden the poor. The "Sustainable Energy Development Authority (SEDA)" will manage and supervise the implementation of the bidding for the RE Quota and enforce and operate the FIT renewable energy fund collected via electricity bills. However, the current electricity tariff being sold at a price specified with government subsidies have continued to fuel natural gas. In fact the situation has become somewhat complex. A simplified diagram of the FIT system is shown in Figure 12.

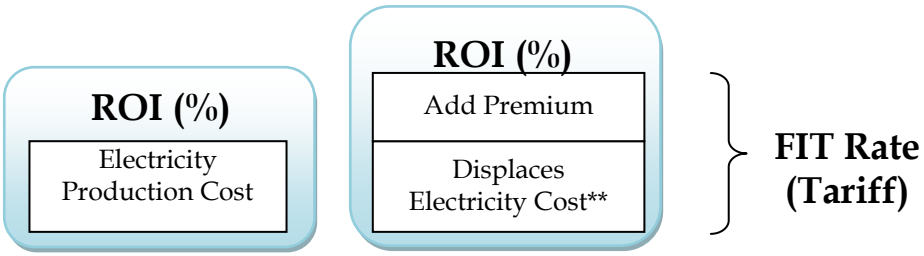
Critical Factors for Effective FIT Mechanism

There are some critical factors that must be guaranteed via the "Renewable Energy Act", whereby the effectiveness of the FIT mechanism can be assured.

- Access to the grid must be guaranteed – utility companies are legally obliged to accept all electricity generated by private renewable energy producers.
- Local approval procedures must be stream lined and clear.
- FIT rates must be high enough to produce a "Return on Investment, ROI" plus reasonable profit (not excessive) to act as an incentive.
- FIT rates will be fixed for a specific period to ensure certainty and provide businesses with a clear investment environment.
- Provide adequate "degression" for the FIT rates to promote cost reduction to achieve "grid parity"
- Ensure adequate fund is created to pay for the FIT rates (incremental cost) and guarantee the payment for the whole FIT contract period.
- Ensure implementation by a competent agency in a professional manner that includes constant monitoring, progress reporting and transparency.

Process to determine the tariff

The level of tariff for Malaysian FIT is calculated based on the rate of "Return on Investment, ROI" and electricity production cost. Basically the FIT rate (tariff) is determined by setting a constant ROI to guarantee the interest of investors. The premium added to the electricity production cost is an additional cost to keep the ROI constant (Figure 13).



Notes: ** Subject to tariff increment

Figure 13. Process to determine the tariff

The tariff for each renewable energy source is calculated as above. Detailed estimates are provided in Table 16. The tariff for photovoltaic has been set at the highest level compared to the other resources. Photovoltaic tariff is set at between 0.85 ~ 1.23 RM/kWh depending on capacity size and for a duration of 21 years. A degression rate of 8.0% per year was applied against the tariff to reflect the cost reduction on power generation due to declining equipment prices and technological progress. This degression rate has been excluded for small hydro, but biomass and biogas are set at a declining rate of 0.5% per year.

Table 16. Tariffs for the FIT System in Malaysia

Technologies	Capacity (X) (Adaptation Conditions)	Tariff (RM/kWh)	Duration (Years)	Annual Degression (%)
Biogas*	X ≦ 4 MW	0.32	16	0.5
	4 MW < X ≦ 10 MW	0.30	16	0.5
	10 MW < X ≦ 30 MW	0.28	16	0.5
Biomass*	X ≦ 10 MW	0.31	16	0.5
	10 MW < X ≦ 20 MW	0.29	16	0.5
	20 MW < X ≦ 30 MW	0.27	16	0.5
Small Hydro	X ≦ 10 MW	0.24	21	0.0
	10 MW < X ≦ 30 MW	0.23	21	0.0
Solar*	X ≦ 4 kW	1.23	21	8.0
	4 kW < X ≦ 24 kW	1.20	21	8.0
	24 kW < X ≦ 72 kW	1.18	21	8.0
	72 kW < X ≦ 1 MW	1.14	21	8.0
	1 MW < X ≦ 10 MW	0.95	21	8.0
	10 MW < X ≦ 30 MW	0.85	21	8.0

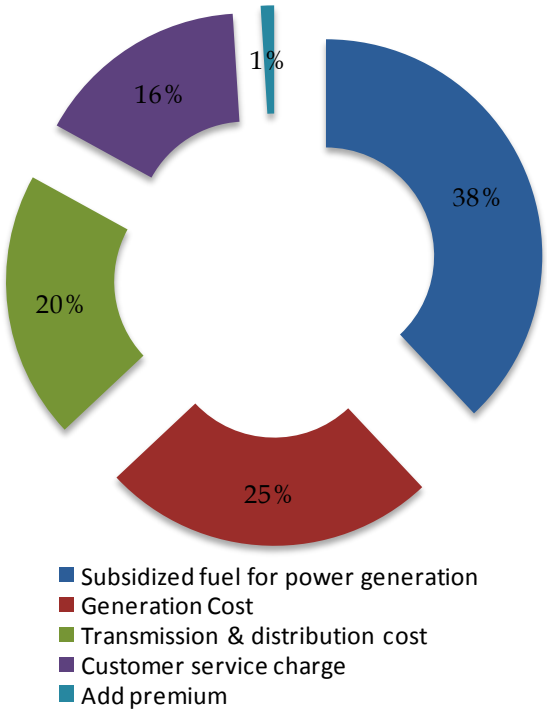
Note: Based on additional conditions, tariff plus the bonus is for the standard tariff.
Sources: Renewable Energy Act 2011 (Act 725), 2nd June 2011

Cost Allocation

Basically, the burden of additional costs for the introduction of renewable energy is transferred to end users or the consumers of electricity. However, in many developing economies adjustment between additional costs and subsidies has become an important issue because of the benefits or

subsidies to fuel price for electricity generation. In the case of Malaysia, the additional cost of introducing renewable energy will be transferred to consumers, but low-income consumers will be excluded. The limit set to protect the low-income consumer is the total monthly electricity billing of 77 RM (Ringgit Malaysia) (below 200 kWh / month). Consumers who use less than this limit will not be charged with the additional cost. For monthly electricity consumption above this limit, a 1% surcharge will be imposed on the sum of the monthly payment. The "Sustainable Energy Development Authority, SEDA" will collect the 1% surcharge as renewable energy fund to cover the additional cost and operating costs of the FIT system.

The renewable energy fund is managed by a professional fund manager according to procedures determined by the government and the disbursement from the fund shall be efficiently and expeditiously managed. SEDA as the renewable energy implementing agency to manage the fund shall take on the additional duty of implementing, managing and reviewing the renewable energy feed-in tariff mechanism.



Note: Currently reviewing possible contribution from power generators

Figure 14. Cost Breakdown for Average Domestic Electricity Tariff

Issues and Challenges

The success of the National Renewable Energy Policy is assured and the goals can be achieved when the following factors are put in place:

- The process of determining a reasonable tariff is most important for successful FIT management.

- Renewable energy fund must cover the cost of the FIT mechanism without the need for a Government budget (apart from the start-up budget)
- Source of renewable energy fund must be derived from electricity consumers at a nominal percentage
- Establishment of a dedicated implementation agency

4. Specific Experiences among Developed Economies

Case Study (4): Renewable Energy Policy in Korea

Background

New & Renewable Energy (NRE) Policy of Korea was based on "The 2nd Basic Plan for New & Renewable Energy Technology Development & Dissemination (2003-2012)" which was established in 2003 by the Ministry of Commerce, Industry and Energy. Three objectives were targeted in this basic plan.

- Ensuring sustainable economic growth and economic strength.
- Contributing to environmental improvement and energy security
- NRE as the next generation of industrial development

As a driver to promote the installation of NRE, the government has introduced measures such as investment subsidies, preferential treatment in terms of financing and a feed-in tariff system to support the promotion activities. Korea's energy supply relies almost entirely on import. In 2002, the proportion of NRE to total primary energy supply was 1.4 percent; Korea has since embarked on the development of a NRE policy in order to reduce the gap.

According to the "2nd Basic Plan", the target for NRE to total primary energy consumption was set at 3% for 2006 and 5% for 2011. At the same time, the target for NRE generation to total power generation was set at 2.4% for 2006 and 7% for 2011. These targets were set with consideration of the supply capacity in Korea and matched with the 4.9% of OECD forecasted average for 2010. In 2011, the annual electricity capacity from NRE was 1,000 MW. The policies promoted were focused on three major energy sources, i.e. hydrogen and fuel cells, wind and solar PV, as the technology gap between developed economies was small and the competition in market potential was large. The government will provide centralized project-based technology development and technology development in a top-down approach in these three areas.

As mentioned above, the Korean government had decided to select an effective FIT policy to expand the amount of NRE to catch up with the OECD economies. To achieve the target and develop

market creation, the government had raised a budget of around 9.1 trillion Korean Won for the period from 2004 to 2011. The budget was used to support intensive auxiliary equipment and technology development by financing systems to construct the market. Although the government had taken as first choice the FIT system, the policy makers had suggested that by 2011 the promotion driver will shift to the RPS system. According to the plan, Korea had introduced a duty ratio of power allocation.

Policy Structure (Policy design)

Korea has started to promote the utilization of NRE from the early 1980s. The Trend of the NRE policies introduction in Korea is summarized as follows.

Table 17. The Trend of NRE Programs and Policy Direction for Korea

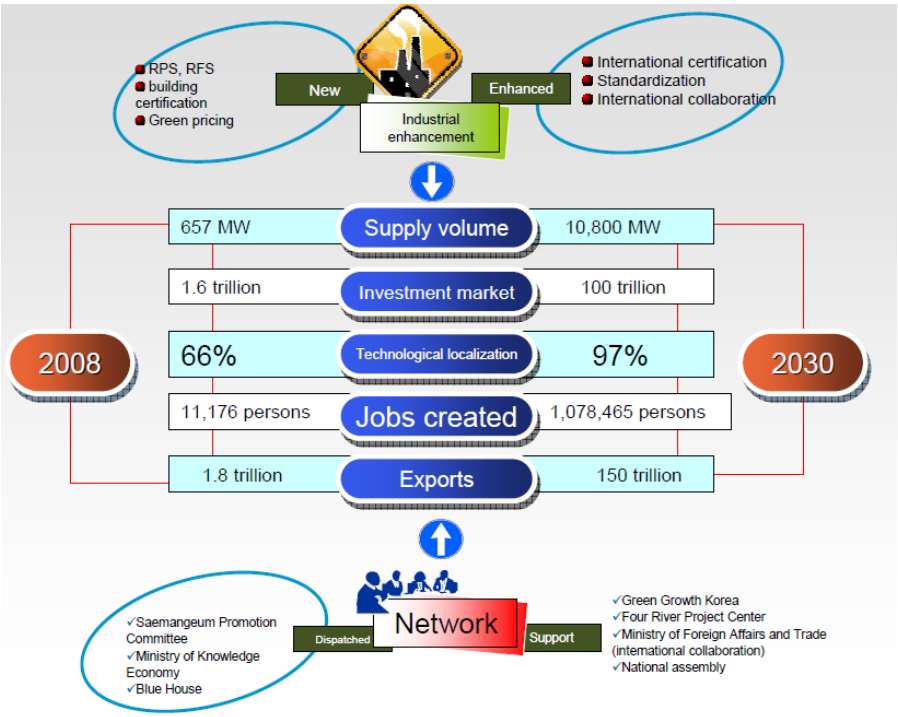
Year	Policy Name	Contents
1980~	Loan & Tax Deduction	➢ Low interest Loan is available with a 5 years of grace &10 years of allotment payment ➢ Tax deduction for 20% of total investment and tariff (customs duties) cut by 50% in 7 areas (Solar thermal, PV, Wind, Hydrogen fuel cells, Bio, Marine) for 81 products
1994~	General Subsidy Programs	➢ Government subsidizes part of the installation costs of the NRE facilities to enhance NRE deployment and to relieve the end user's cost burden (factories, individual Buildings) -Subsidy ratio: Electricity Production Facilities : 50%, Heat production facilities: 50%
1996~	Local New & Renewable Energy Deployment Program	➢ Local governments carry out local-fit eco-friendly NRE deployment program for public buildings and social service facilities, Remote Area's residents etc Central(60%) + Local(20%) + Individual(20%)
2011	Mandatory Use for Public Buildings	➢ The new construction, expansion and remodeling for public buildings having floor area which exceeds 3,000 square meters or larger, more than 5% of their total construction expenses to be invested in installation of NRE systems - '04~'08, 208 Million US Dollars has been invested (Geo thermal: 49%, PV: 36%, Solar thermal: 4%)
2005~ 2011	Feed-in Tariff	➢ In case of power generated from NRE, the government set standard price for each renewable energy source and supports difference between the standard price and system marginal price to help secure NRE's economic feasibility ➢ Standard price will be adjusted annually reflecting the change of the NRE market and economic feasibility of NRE
2006~ 2011	RPA (Renewable Portfolio Agreement)	➢ Large Public Utilities agreed with the Korean government to invest $737 M in NRE between '06~'08, and plan to transform to RPS in 2012 after 2nd

		agreement period('09-'11)
2009~	1 Million Green Homes Program	➢ In order to help build investment favorable environment in residential area, Government has been expanding existing 100,000 solar roof program to diversify and optimize RE use in residential area. This aims to disseminate 1 million green homes by 2020
2010~	Green Building Certification	➢ Grants and other incentives for NRE facilities in buildings of a certain size or larger
2011~	Revision of Obligation Program for Public Buildings	➢ Mandatory Use and Design with NRE of more than 5% of total energy load for new, renovated and expanded public buildings larger than 1,000 square meters
2012~	RPS (Renewable Portfolio Standards)	➢ Introduce RPS in 2012 that is to obligate utility companies to produce electricity from renewable energy to certain rate in their total power production -Review to expand NRE by 2% of total power production in 2012 and 10% by 2022
2012~	RFS (Renewable Fuel Standards)	➢ Obligate mix ratio of Bio-diesel to transportation fuels from 3% by 2012 and 7% by 2020 (Under` consideration to identify its concrete action plan) - Mix ratio of Bio ethanol will be determined after feasibility study and supply projections

Implementation

In the "3rd Basic Plan for New & Renewable Energy Technology Development & Dissemination" outlined in January 2009, the NRE installation target was revised to 4.3% by 2015, 6.1% by 2020 and 11.0% by 2030. According to the schedule as planned under the "2nd Basic Plan", Korea shifted the policy system from FIT to RPS in 2012. Previously the NRE policy in Korea was promoted with an expansion on the use of NRE by the FIT system. Now, the government has turned to the RPS system as the driver of qualitative growth in expansion.

The detail introduction target value by 2030 is shown in the figure 15.



Sources: Sanghoon Lee "New and Renewable Energy Policy in Republic of Korea", SejongUniversity, Korea, 26th April 2010

Figure 15. Long-term Target for NRE Policy in Korea

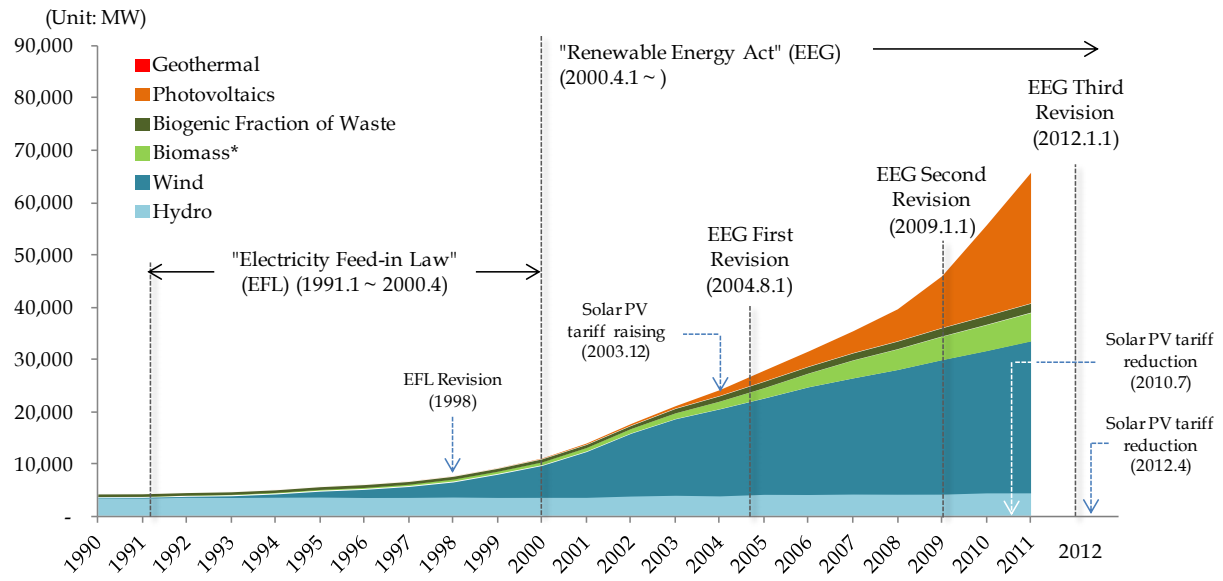
The target for "3rd Basic Plan" is to establish NRE-base sustainable energy system by two goals.

- Achieve NRE energy deployment of 11% by 2030
- Industrialize NRE as a green growth engine

Case Study (5): Current Status in Germany

The German government has been promoting the expansion of renewable energy by introduced the feed-in tariff system for renewable energy generation with the establishment of the "Renewable Energy Act (EEG[10])". However, in recent years the government has taken measures to reduce the auxiliary because of increased additional costs. This trend is reflected in particular for the solar power generation sector.

[10] Erneuerbare-Energien-Gesetz (EEG)



Sources: Development of renewable energy sources in Germany 2011 (AGEE) and EEG 2011 Report, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Figure 16. Renewable Energy Capacity Trend in Germany

According to data from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU [11]), the capacity of renewable energy generation at the end of 2011 was 67,000 MW, which was introduced by wind power (around 29,000 MW) and solar power (25,000 MW). In particular solar power generation has been rapidly expanding since the tariff (57.4 Euro cents / kWh at maximum) was reviewed in 2004.

On the other hand, the system cost had increased prominently. In 2010, the annual expense required for additional cost of tariff was more than 12.3 billion Euros. The additional cost charged to the electric bill in 2011 increased to 3.53 Euro cents / kWh from 0.41 Euro cents / kWh in 2003. The amount of monthly household burden (Standard 3,500 kWh annual consumption) had increased to 10.5 Euros from 1.2 Euros in the same period. Currently, the proportion of levy of promoting renewable energy accounted for a rise in household electricity prices to 14%. Approximately 40% of the additional cost was due to solar power generation, but only about 3% of the total amount of electricity generated was provided by solar power generation. Therefore, the low cost-effectiveness has been criticized.

Hence, measures for suppressing investments in solar power generation have been introduced in recent years. The government had revised the EEG in January 1, 2012 (EEG 2012), and a further revision was performed on June 28. As a result, the tariff for solar power generation was reduced from 18.33 ~ 24.43 cents / kWh to 13.5 ~ 19.5 cents / kWh. Other terms were revised as follows.

[11] Bundesministerium fűr Umwelt, Matursh utz und Reaktorsicherheit (BMU)

- The tariff was reduced by 1% per month from May 2012
- According to the annual introduction (2.5GW ~ 3.5GW), the degression rate was set at 2.8% ~ -0.5% in November 2012.
- Large scale generation capacity of more than 10 MW was excluded
- From 2014, the amount of purchase from 10 kW ~ 1,000 kW capacities is limited to 90% of the amount of electricity generated.
- The target for the introduction of solar power generation was set at 52,000 MW, and the FIT for solar power generation was to be abolished at the time of achieving the target.

Until now, no measures to review the rapid renewable energy other than solar power had been announced. EEG 2012 was carried out to define the market and introduce a premium for the purpose of promoting direct selling in the market by renewable energy producers. While utilizing these measures, gradual adaptation to the renewable energy market principles will become future policy issues.

Case Study (6): Current Status in Spain

With the liberalization of electricity in 1998 by the "Electricity Power Act 1997", the "Special Regime" had introduced promotion of renewable power generation with capacities of fewer than 50 MW (further revised in 2007, to under 100 MW). This system became the feed-in tariff system by decree of the King in 1998. Active promotion for the expansion of renewable energy through the "Special Regime" had resulted in a 29.9% share of renewable energy in the overall total electricity generated in Spain in 2011.

However, with the increased additional costs, the government had announced that it would stop accepting new applicants as of 27th January 2012. According to government announcement, the reason for a temporary moratorium on the system to promote renewable energy was because of macro conditions that have become unsuitable in view of the decline in demand and the current economic crisis. The government has shown a policy of promoting more efficient allocation of financial resources and the need to reform the electric power industry system. The government had also announced the "Draft Bill on Fiscal Measures for Energy Sustainability" adopted by the Cabinet on 14th September 2012 and submitted to the Parliament for approval. According to the bill, all power producers (including renewable energy producers) have to pay 6% of their income from generating activities. The bill is expected to be passed in Parliament and expected to come into force in January next year.

These measures will reduce the revenue to investors in renewable energy project activities as was expected at the time of investment. Hospitality policy for renewable energy is becoming transformed. The government did not necessarily indicate a failure of policy on views of a temporary freeze on the feed-in tariff. The introduction so far shows the view will not impair the

efforts of Spain to achieve the target. The provision of the EU renewable energy target was 20% to total energy consumption by 2020. To achieve the EU target, Spain's National Plan had set a target of 40% of the total amount of electricity generated by renewable energy power by 2020. According to this plan, the installation of 38,000 MW by wind power and 8,367 MW by solar powers is needed to achieve the target. At present, the installed capacity is 21,674 MW for wind power and 4,400 MW for solar power, where the achievement rate for wind power is 57% and solar power is 53%. The European Commission has expressed concern about the rapid changes in feed-in tariffs that are destabilizing the investment environment for renewable energy. There is a need to focus on policy changes in Spain which is a "Renewable Energy Pioneer" in the world.

5. Prospects of Renewable Energy Policies in the APEC Region

Renewable Energy Target for a Community Strategy and Action Plan

The agenda is variable for APEC economies to set a common renewable energy target as a community strategy and action plan. Currently, there are several frameworks for regional cooperation all over the world, but only the EU has set up the renewable energy target with a binding force. The discussions on renewable energy installation targets and common policy in EU were initiated in 1996, when the European Commission (EC) announced the "Energy for the Future Renewable Sources of Energy Green Paper for a Community Strategy". The contents of this Green Paper are summarized in the following three points.

- The proportion of renewable energy in total energy consumption accounted for 12% in 2010.
- Support the member economies to install the policies.
- Mobilize the policies of member economies to promote the development of renewable energy

The "Green Paper" described above was a weak binding of a relatively objective effort within the EU. Before the Kyoto Protocol of COP3 1997 was approved, the EC had announced the "White Paper" and greenhouse gas reduction targets were set at 15% reduction based on year 1990. In the "White Paper" more detailed measures and numerical targets have been included than in the "Green Paper". In addition, the "EU Directive" on renewable energy generation had been incorporated to develop renewable energy. This had set the later direction of expanding renewable energy power as a common policy for the EU. However, there was intense debate on the directive power for renewable energy in terms of standardization of policy support for renewable energy under RPS and FIT between member economies inside the EU. The common policy for renewable electricity resulted in a power directive of 22.1% of the total power consumption in the region in 2010. The EU has formed common goals based on long term negotiations, and the targets provide the market for renewable energy.

Key Considerations for Policy Selection or Evaluation

(1) Expansion Speed

As described above, the speed of expansion for renewable energy installations is largely dependent on policy. Based on experience, it was evident that the RPS and FIT systems had contributed to the dissemination of renewable energy more effectively than other policies. In the case of RPS, if the quota was set at a higher target value, the installation of renewable energy will be speeded up, while if the target value was low the adoption does not proceed. Similarly we can control the speed of the system introduced by setting the level of the FIT tariff. Of course, both systems will result in an increase in additional cost if the target was set at a higher level.

(2) Reasonable Tariff or Reasonable Quota

The most important point on policy design for renewable energy is the setting of the auxiliary level. In the case of the FIT, if the introduction of tariff level is set too high, the amount of installation of renewable energy will expand. On the other hand, the amount of increase or decrease of renewable energy is determined by the level of the quota set in RPS. In other words, "reasonable" tariff or quota will become the main point for policy design. If the tariff or quota is "reasonable", the burden to the public can be justified and the system is acceptable. With policies leading to renewable energy penetration "market failure", it is necessary to consider the extent to which the tariff or quota is "reasonable".

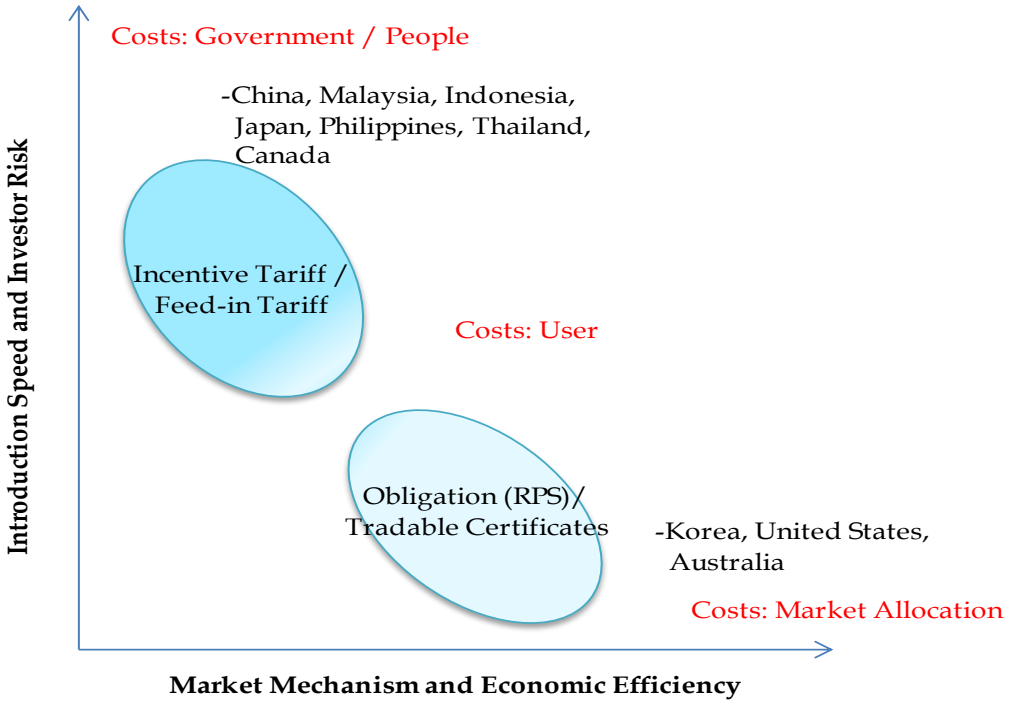


Figure 17. Quota Obligation and Feed-in Tariff

(3) External Cost

External costs are important in the introduction of renewable energy policy. Studies on the accumulation of external costs of power generation sector have progressed over the years and the level of external costs has been formulated in many developed economies. Especially famous are the study of the "Extern-E" project by the European Commission, and the study on "social cost of power" conducted by Professor Anil Markandya in the Department of Economics, University of Bath in England. The EC project called "CASES"[12], has calculated the cost of separate external power until 2030 for the EU. Both studies had precisely analyzed the costs, which have become the basis to promote renewable energy policy in Europe. Such an objective analysis is required for the APEC region.

(4) Regional Trend

While in some economies there are differences in the respective objectives, most of the member economies in Europe have placed emphasis on the development of early expansion speed and industry spread, and have adopted a fixed price. On the other hand, the economies of the Pacific region including the United States, Korea, Philippines and Australia have adopted a market-oriented allocation of costs and obligations.

(5) Potentially biased to a particular technology

Renewable energy technologies are a developing technology, and there is a choice of technology used in a variety of choices in addition to a variety of energy sources. On the other hand, to promote energy sources and technologies chosen arbitrarily may crush the potential of an energy source (in particular, the specific subsidies, feed-in tariffs and allocation of duties). Normally it is desirable to choose the best technology by a market mechanism. However, there is a view point that the market is going to rely on the policy itself. Immature political decisions may influence specific industry development that is dominated by the politics of the time. For example, the biofuel technology has been promoted in Thailand, Malaysia, United States, Philippines, Indonesia and China because of the possibility of feedstock supplies. The promotion of geothermal power in the Philippines, United States, Indonesia and Japan was because of available geothermal resources.

(6) Intermittency and grid connection

As a natural energy, the output of renewable energy is dependent on the nature conditions. Unstable renewable energy output is known as "Intermittency". For example, hydropower depends on the season, solar power depends on sun movement and wind power depends on wind speed. Major changes will become a major problem for the transmission system. Control and management requires additional costs and how to bear this cost has become a major policy issue.

[12] http://www.feem-project.net/cases/

Bilateral Credit System in APERC Region

Bilateral credit system is a relatively new system. Under the commitment any two economies can make a credit rating of their own contributions to emission reductions in other economies with low-carbon technologies. The basic concept is a system that aims to acquire credit, and disseminates significant expansion proceeds in addition to renewable energy. Current technology to be applied to this system includes nuclear and CCS. The current system is not permitted by the mechanisms under the Kyoto Protocol, but the possibility is open to economy-specific institutional design of the Copenhagen COP15. However, the system may be effective in promoting renewable energy framework in future.

6. Conclusion

This report describes the trends in renewable energy introduction in the APEC region and the significance of the introduction of renewable energy policy. As mentioned at the beginning, large supplies and energy conversion are a major issue on renewable energy policy implemented to-date. The third issue is the reformation from the centralized supply system to the micro-grid supply system suitable for renewable energy.

Several major trends can be pointed out.

- Renewable energy policies have been integrated with industrial policy and environmental policy and are changing to become more complex.
- The practical use of research and development with a focus on the subsidy policy for dissemination has shown that the emphasis is shifting towards the application of market principles.
- Generation of new policy issues related to renewable energy based on technical problems such as "Intermittency" issue.
- There appears to be no policy that works best for all situations.

Currently, in addition to feed-in tariffs and quota obligation systems, various methods have been attempted depending on local circumstances. The significance of renewable energy is dependent on the issue of urgency on climate change. The renewable energy system relies on fixed price subsidies and is supported by more than duty assignment. If the economy and the market are emphasized, the obligation system will be selected as a driver for renewable energy promotion. If the installation quantity has been targeted, feed-in tariff system will be more suitable as a policy driver. In other word, the relative merits of each policy, features and functions have been derived based on a number of practices. Issues that must be considered include how to match the policy to the current situation of the economies and the sense of purpose that governments have introduced.

Introduction of renewable energy in developing economies in APEC was relatively slow after the 1997 financial crisis. However, it has made remarkable achievements in the field of geothermal utilization, biofuels development, wind and solar equipment manufacturing industry, and biogas and small hydro development. In the introduction and implementation of renewable energy policy, APEC developing economies have been promoted to reference while exploring the world of experience. What's missing in this area is a framework that can share information, technology and experience on renewable energy. With a set of common goals for renewable energy promotion policies in APEC, it is possible to create a common market for renewable energy. This would mean developing common market in the region for promoting renewable energy standards (fuel, equipment, etc.), trade, technology diffusion and transfer. Experience in low technologies for renewable energy is needed for cooperation among developing economies in the region.

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Appendix

(Summary of Renewable Energy Policies in Member Economies)

Australia

Target RE 20% of total electricity supply Amendment 1st Jan 2011: LRET by 2020~2030: 41,000 GWh*		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Renewable Energy (Electricity) Act 2000 (1 April 2001) ➢ Mandatory Renewable Energy Target (MRET) Additional 9,500 GWh renewable generation by 2010.	➢ Prime Minister's Biofuels Taskforce (May 2005) Biodiesel: 350 ML Bioethanol: 28 ML ➢ Biofuels Grant Programs ➢ Solar Flagships Program ➢ Feed-in Tariff	➢ RD & D

Notes: * Australian Energy Resource Assessment

Summary of Key Policy

➢ Renewable Energy (Electricity) Act 2000 (1 April 2001)

The Renewable Energy (Electricity) Act was enacted in Australia on 1st April 2001. The electricity purchasers are required to purchase by obligation the renewable energy generated. The Mandatory Renewable Target (MRET) was enforced by facilitating Renewable Energy Certificates (RECs).

Amendment: 1st January 2011 Enforcement

The amendment on 1st January 2011 divided the Renewable Energy Target (RET) to "Large-scale Renewable Energy Target (LRET)" and "Small-scale Renewable Energy Scheme (SRES)". The target of LRET amount of power generated was set at 41,000 GWh by 2020~2030. On the other hand, for SRES that are subject to an upper limit aid was not provided, but the status of implementation will be reviewed in 2014.

With the enforcement of the amendment, the RECs were divided into "Large-scale Generation Certificates, LGC" and "Small-scale Technology Certificates, STC". Both of the certificates are tradable in the free market. STC can also trade at the Clearing House. (Solar water heaters are include with the issuance of the STC)

➢ Prime Ministry's Biofuels Taskforce (May 2005)

Taskforce Action Plan Target by 2010: Biodiesel 350 ML, Bioethanol 28 ML

Biofuels Grant Programs - Capital funding ($ 37.6 million)

- Production Funding

($61.2 million Ethanol Production Grant, July 2006)

($4.5 million Biodiesel Cleaner Fuels, June 2006)

Brunei Darussalam

Target No renewable energy target.		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Brunei Darussalam does not currently have a dedicated policy framework for renewable energies.	➢ Non	➢ Non

Summary of Key Policy

➢ Tenaga Suria Brunei (TSB), (2008)

On 13 August 2008, a Memorandum of Understanding was signed between Brunei Darussalam and Mitsubishi Corporation for a Photovoltaic (PV) demonstration project called "Tenaga Suria Brunei Project" in Brunei Darussalam. The project has a capacity of 1.2 MW and is situated at the Seria Power Station in Belait District. The project was commissioned in August 2010. Anticipated generated electrical energy from the TSB system is approximately 1,344 MWh/year supplying power to about 200 houses.

Six different types of PV modules will be installed to evaluate the suitability for use in Brunei Darussalam over a three year demonstration period.

Canada

Target The introduction of renewable energy is implemented by the state government. The representative is the feed in tariff system in state of Ontario.		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ "Green Energy, Green Economy Act" (Oct 2009)	➢ Feed in Tariff (Ontario) Hydro: 40 years Other RE: 20 years	➢ RD & D

Sources: Ontario Power Authority

Summary of Key Policy

- Since December 8, 2010, the following project 10kW is now possible to apply for the new micro-FIT program. Micro-FIT is the application process has been more simplified purchase price.
  - The law enforcement basis the "Green Energy, Green Economy Act" on October 2009.
  - Ontario has been the phasing out coal-fired power generation by 2014, with the aim to achieve this to promote economic activity and leverage renewable energy technologies.

- Tariff Level

  Solar PV: <10kW (operation start from 2009 and 2010: >40%, 2011: >60%)

  Solar PV: >10kW (operation start before 1st Jan 2012: >25%, after or on 1st Jan 2012: >50%)

  Wind Power: >10kW (operation before 1st Jan 2011: >50%, after or on 1st Jan 2011: >60%)

Chile

Target Short Law I & II: Generators must secure 10% of power generated through renewable sources by 2025		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Proyecto de Electrificación Rural (PER) (1994) ➢ Short Law I & II (2004-2005)	➢ Removal of Barriers for Rural Electrification with Renewable Energies (2001~2008)	➢

Summary of Key Policy

➢ Proyecto de Electrificación Rural (PER) (1994)

It was started in 1994 to overcome poverty, improve quality of life and integrate rural areas into the economic and social development of Chile. Its main goals were to create a market for renewable energies (including rural electrification); standardize and certify renewable energy equipment; build capacity; implement financing mechanisms to reduce investment risks; introduce market evaluation; collect data on renewable resources; and develop rural electrification investment projects.

➢ Short Law I 'Ley Corta' (Jan 2004) and Short Law II (May 2005)

The Short Law I & II are legal frameworks which favor the promotion of new investments in power generation, including alternative energy. A law passed in March 2008 obliges new energy projects to generate an escalating percentage of total energy from renewable sources. The law requires new energy generation contracts to include 5% to be generated from renewable sources starting in 2010, with possible fines in place starting in 2014. That quota of renewable energy will then increase, starting in 2014, by 0.5% each year through to 2025, when generators must secure 10% of power generated through renewable sources. The law gives a fairly broad definition of renewable energy, and includes hydropower projects under 40 MW of installed capacity.

China (People's Republic of China)

Target
12th Five-Year-Plan (on renewable energies)
- 11.4% of non-fossil fuel in primary energy supply before 2015 (Wind: 10,000 MW, Solar: 1,500 MW)

Renewable Energy promotion framework	Policy Implementation	Other Incentive
➢ Renewable Energy Law (Jan 2006) ➢ 12th Five-Year-Plan (on renewable energies)	➢ FIT policies for renewable power **Wind power (July 2009)** On-shore: 0.51~0.61 RMB/kWh Off-shore: Tendering **Solar PV (July 2011)** Before 31st Dec, 2011: 1.15RMB/kWh After 31st Dec, 2011: 1RMB/kWh **Biomass power (July 2010)** 0.75RMB/kWh	➢

Summary of Key Policy

- 12th Five-Year-Plan (on renewable energies)

  Before 2015: Wind power capacity, 10,000 MW within which 5,000 MW of off-shore wind power (with generation of 190 billion kWh /year). Solar power capacity, 1,500 MW (with generation of 20 billion kWh /year)

  (※The above targets was announced by the NEA in Dec, 2011. The targets could be modified in the formal launch of the 12th five-year-plan for renewable energies)

  -Targets for cost reduction before 2015: PV module, 7,000 RMB/kW, PV power system, 13,000 RMB/kW, LCOE of solar PV power generation, 0.8 RMB/kWh

  -Targets for cost reduction before 2020: PV module, 5,000 RMB/kW, PV power system, 10,000 RMB/kW, LCOE of solar PV power generation, 0.6 RMB/kWh

  (※ 12th five-year-plan for solar PV industry development, Ministry of Industry and Information Technology February, 2012)

- Grid integration

  Wind and solar radiation resources are rich in the west and the northern part of China, while electricity consumption centers are along the south-east coast. Therefore investment on new transmission lines delivering the renewable power to consumption centers is important for further penetration of renewable. As a matter of fact, not only the renewable energy resources, but traditional energy resources for power generation in China, like coal and hydro, also have most of the reserves in the western part of the economy. Construction of new transmission lines from west to east as well as from north to south is also an urgent issue for China to relieve the electricity shortage in some southeast provinces.

  Furthermore, grid inter-connection capacity between different provinces and regions is relatively small in China (a similar situation as in Japan). The renewable power's impact on grid

is a major issue for provinces with tremendous renewable energy resources but small inter connections with other provinces.

- Electricity pricing mechanism

  According to the current FIT mechanism, the difference between the tariffs of coal-fired thermal power and renewable power (the extra cost to the grid operating companies) will be passed on to the consumers. However, the tariff of coal-fired thermal power is artificially set very low, which means that the FIT cost could become very high with the expansion of renewable energy installations.

- Operation of renewable power plant

  China experienced an extremely high speed of growth in renewable power installations in a very short time. Therefore, the mechanism to maintain effective operation of renewable power stations over their life time of service is an area that needs to be reinforced.

Hong Kong, China

Target Sustainable Development Strategy for Hong Kong (May 2005) RE target: 1~2% total electricity supply by 2012		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Sustainable Development Strategy for Hong Kong (May 2005)	➢	➢

Summary of Key Policy

➢ Sustainable Development Strategy for Hong Kong (May 2005)

1. Organize more public education programs on RE and sustainable energy consumption that links these issues to local and global sustainable development.

2. Aim to have between 1 and 2% of Hong Kong's total electricity supply met by power generated from renewable sources by the year 2012; targets to be regularly reviewed in the light of advances in technological solutions and emerging sustainability considerations.

3. Develop plans to promote energy efficiency and conservation as part of a sustainable energy policy.

Indonesia

Target 17% of primary energy supply by 2025 (Biofuel: 5%, Geothermal: 5%, Coal to liquids (CTL): 2%, Nuclear, Hydro, Biomass, Solar, Wind: 5%)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Presidential Decree No. 5 Year 2006, National Energy Policy ➢ Presidential Instruction No.1/2006 for Supply and Utilization of Biofuel as Alternative Fuel ➢ Geothermal Law (2007)	<Feed in Law> ➢ Electricity Pricing Purchased by PT.PLN from Small and Medium Scale Renewable Energy Power Plant or Excess Power, Ministerial Regulation No.31/2009 ➢ Assignment for PT. PLN to purchase prices and electricity generated by geothermal power plant, Minister Regulation: No. 2/2011 <Other> ➢ Ministerial Regulation No. 32/2008 concerning Supply, Utilization and Marketing of Biofuel as an Alternative Energy	➢ Investment Tax Allowance, 30% investment income tax deduction for six years ➢ Reduction of import duty on some equipment ➢ Depreciation period ➢ Loss carry forwards within 10 years ➢ Mortgage loans

Summary of Key Policy

- Small Distributed Power Generation using Renewable Energy, by Ministerial Decree: No. 1122 K/30/MEM/2002

  RE power generation capacity below 1MW, PLN will have an obligation to purchase. The actual purchase price will be decided between PLN and investors.
- Medium Scale Power Generation Using Renewable Energy, by Ministerial Regulation No. 002/2006

  RE power generation capacity between 1 ~ 10MW, PLN have an obligation to purchase for 10 years. The actual purchase price will be decided between PLN and investors.
- Electricity Pricing Purchased by PT. PLN from Small and Medium Scale Renewable Energy Power Plant or Excess Power, by Ministerial Regulation No.31/2009

  All RE except geothermal. Rp656/kWh × F (with medium pressure), Rp1, 004/kWh × F (low pressure))
- Assignment for PT. PLN to purchase prices and electricity generated by geothermal power plant, by Minister Regulation: No. 2/2011

  Mandatory for PLN to buy the geothermal electricity below 9.7 cents (US) / kWh without any negotiation based on the biding.
- Presidential Instruction No.1/2006 for Supply and Utilization of Biofuel as Alternative Fuel

An Administrative Order mandating the introduction of biofuels by decree of the Ministry of Energy and Mineral Resources (No.32/2008). Biofuel mixture ratios are set at 20% biodiesel by 2025 in diesel, 15% bioethanol in gasoline and 10% bio-oil in kerosene, respectively.

Japan

Target Since Fukushima nuclear accident, three scenarios have been presented in 2030. 1. RE (35%), Nuclear (0%), Thermal (65%) 2. RE (30%), Nuclear (15%), Thermal (55%) 3. RE (25~30%), Nuclear (20~25%), Thermal (50%)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Strategic Energy Plan (June 2010)	<Feed in Law> ➢ Special Measures Law Concerning the Use of New Energy by Electric Utilities (RPS) (2002) ➢ Upgrading the Energy Supply Structure Law (2009) ➢ Special Measures Law Concerning the Purchase of Renewable Energy Generation by Electric Utilities (2011)	➢ Investment Tax Allowance, 30%

Summary of Key Policy

- Strategic Energy Plan (June 2010)

  Target of renewable energy to total primary energy supply: 10% (2020)

  Proportion of low carbon power generation to total power mix: about 70% (2030)

  Revise of "Strategic Energy Plan (2012)"- On process

- RPS (2002)

  Special Measures Law Concerning the Use of New Energy by Electric Utilities (2002)

  Target equipment: Wind, Solar, Geothermal (binary), Small Hydropower (<1 MW), Biomass

  Abolition at 2012

- FIT(1)

  Upgrading the Energy Supply Structure Law (2009)

  Target equipment: Solar PV (<500kw)

  Duration: 10 years

- FIT(2) (July 2012)

  Special Measures Law Concerning the Purchase of Renewable Energy Generation by Electric Utilities (2011)

  Target equipment: Solar PV (>500kw), Wind, Hydropower (<30 MW), Geothermal, Biomass

  Duration:

  Solar: > 10 kW: 42 yen/kWh (20 years)

  < 10 kW: 42 yen/kWh (10 years)

  Wind: > 20 kW: 23.1 yen/kWh (20 years)

  < 20 kW: 57.75 yen/kWh (20 years)

  Hydro: 1,000 kW~30,000 kW: 25.2 yen/kWh (20years)

  200 kW~1,000 kW: 30.45 yen/kWh (20 years)

Geothermal: > 15,000 kW: 27.3 yen/kWh (15 years)
< 15,000 kW: 42 yen/kWh (15 years)
Biomass: Biogas: 40.95 yen/kWh (20 years)
Biomass: 13.65~33.6 yen/kWh (20 years)

Korea (Republic of Korea)

Target 11% of New and Renewable Energy in Primary Energy Supply by 2030 (Note)Korean New Energy Include Hydrogen/Fuel Cell, CTL, IGCC		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ "National Energy Basic Plan", 2008～2030 ➢ "Low carbon Green Growth Strategy", 2008 ➢ "Basic Law of Low carbon Green Growth", 2010 ➢ "Green Growth 5-year Plan", 2009	➢ Feed in Tariff (RPA) (Renewable Portfolio Agreement) Implementation until 2011 ➢ RPS (Renewable Portfolio Standard) Start from 2012 Target will be increased from 2% in 2012 to 10% in 2022 ➢ RFS (Renewable Fuel Standard) Obligation only for biodiesel Start from 2% in 2012	➢ "1 Million Green Homes Program"(~2020)

Summary of Key Policy

➢ "National Energy Basic Plan", 2008

Long-term energy policy until 2030 was designed to prepare for the "after the Oil Era", and to promote low carbon green growth in the energy sector.

➢ "Low carbon Green Growth Strategy", 2009

This Long-term vision of energy policy was designed to promote low carbon green growth in the energy sector by 2050 to prepare for "After the Oil Era". In this strategy, Korea aims to become the 7th major economy in the field of green energy in 2020 and the 5th by 2050.

➢ "Basic Law of Low carbon Green Growth", 2010

The Basic Law was legislated based on the above "Green Energy low-carbon growth strategy" as a paradigm of the new national development which creates new jobs and growth with clean energy and green technology.

➢ "Green Growth 5-year Plan", 2009

The 5 year action plan until 2013 was consistent with the 2020 introduction target, which consists of 10 fields, including reduction of fossil fuels and the development of green technologies.

Malaysia

Target 17% (4,000MW) of total power generation capacity by 2030 (Biomass generation: 1,340 MW, Biogas generation: 410 MW, Mini-hydro: 490 MW, Solar PV: 854 MW, Municipal waste generation: 390 MW)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ "Tenth Malaysia Plan (2011~2015)"(Energy Policy) ➢ "Renewable Energy Act." (Under parliament process) ➢ "National Renewable Energy Policy and Action Plan" (Enforcement from middle of 2011) ➢ National Biofuel Policy (2006)	➢ Feed in Tariff (RM/kWh) Biomass: 0.24~0.35 Biogas: 0.28~0.35 Mini-hydro: 0.23~0.24 Solar PV: 0.85~1.75 Municipal waste: 0.30~0.46 ➢ Malaysia Building Integrated Photovoltaic ➢ Small Renewable Energy Power Programme	➢ Malaysian Electricity Supply Industry Trust Fund ➢ Incentives for Utilizing Biomass As a Source of Energy

Summary of Key Policy

- Feed in Tariff (2011)

  This was addressed in the National Assembly on "Renewable Energy Act" in October 2010, with implementation beginning the second quarter of 2011. "National Renewable Energy Policy and Action Plan" was published simultaneously with this process, and the target was 5.5% of total power generation by 2015.

- Small Renewable Energy Power Program (2001)

  The purpose of this project was to promote the construction of grid-connected small power generation by renewable energy resource. The approved projects will be issued licenses by the licensing committee of the Ministry of Energy, Green Technology and Water as an independent power producer (IPP). The investors of the project will sign a Power Purchase Agreement (PPA) with Tenaga National (TNB).

- Incentives for Utilizing Biomass As a Source of Energy (2005)

  The investors that use biomass as an energy source can apply for "Pioneer Status" with incentives including a 5 years tax holiday and 60% of Investment Tax Allowance for the first 5 years.

- Malaysia Building Integrated Photovoltaic (2005)

  A proposal support by United Nations Development Program (UNDP) and the Global Environment Facility (GEF) to provide subsidies for the initial cost of introducing solar PV by up to 30 to 40%.

- National Biofuel Policy (2006)

  The strategy was for the development of biodiesel from palm oil for use as fuel and for export. The pilot project was carried out with a 5% mix with diesel for use in government official cars (130 units).

Mexico

Target In the "Special Program for the Use of Renewable Energy" released in 2009, a target for renewable energy's share in capacity is set to 7.6% and in generation to 4.5~6.6% for 2012.		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Renewable Energy Usage and Energy Transition Financing Act (Nov 2008) ➢ National Energy Strategy (ENE) 2012-2026	➢	➢

Summary of Key Policy

➢ Renewable Energy Usage and Energy Transition Financing Act

The Act raises three main goals.

1. Installation of renewable energy.
2. Facilitating international process related to CDM and renewable energy.
3. Promotion of renewable energy and providing education and information on the use of renewable energy.

In July of 2011, the law was modified and upper limits were set for the share of fossil fuel use in electricity production over a future time scale (in 2011 – 20%; 2024 – 65%,2035 – 60%, 2050 - 50%)

➢ National Energy Strategy (ENE) 2012-2026

Mexico's Secretary of Energy had put forward a policy to reduce reliance on fossil fuel. However, this policy was not specifically targeted at increasing renewable energy.

The policy target was 35% of electricity to be generated from non-fossil fuel sources in 2024. The current plan is to replace fossil fuel by renewable energy (mainly wind) or by nuclear power.

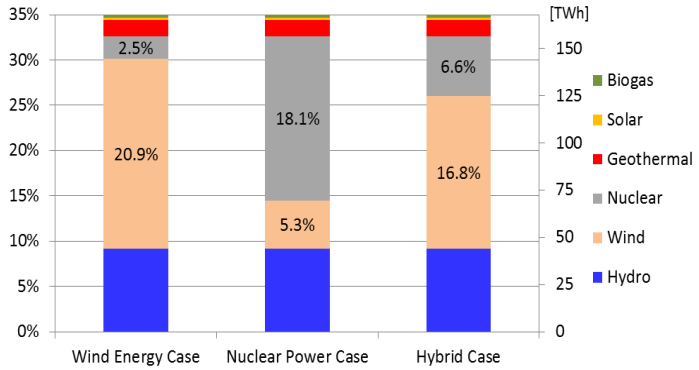

Figure: Electricity production share in 2026

In the "National Energy Strategy" released in March of 2012, there were three scenarios considered. Depending on the nuclear power scenario, the contribution from renewable energy varied from 17% to 33%.

New Zealand

Target RE 90% of total electricity generated by 2025 (NZES)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ New Zealand Energy Strategy (NZES)(2007)	➢ New Zealand Energy Efficiency and Conservation Strategy (EECS) (Oct. 2007)	➢ Financial Incentives

Summary of Key Policy

➢ New Zealand Energy Strategy (NZES) (2007)

This strategy was a primary statement of energy policy, setting the direction for energy supply as well as demand. As part of the 2007 NZES, the Government had set a target for 90% of electricity to be generated from RES by 2025. RE (mainly hydropower and geothermal) already accounts for more than two-thirds of electricity generation.

➢ New Zealand Energy Efficiency and Conservation Strategy (EECS)(Oct. 2007)

The EECS is the main program for promoting energy efficiency. This was a requirement of the Energy Efficiency and Conservation Act 2000, which was released in October 2007. The NZEECS replaced the inaugural Strategy, released in 2001. The Strategy is a companion document to the New Zealand Energy Strategy (NZES) and sets out the government's policies and actions on energy efficiency, conservation and renewable energy. The strategy also assigns responsibility for the delivery of each action to a central or local government agency. The programs in the EECS are expected to support the attainment of the following goals:

- Savings of 30 pet joules (PJ) in non-transport energy by 2025,
- 9.5 PJ of additional direct use RE per year by 2025,
- Savings of 20 PJ in the transport sector by 2015,
- 90% of total electricity generation derived from renewable sources by 2025.

Papua New Guinea

Target		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Draft Rural Electrification Policy (REP) (2006) ➢ Draft Geothermal Energy Resources Policy ➢ National Strategic Plan 2010–2050	➢ Promoting Access to Renewable Energy in the Pacific	➢

Summary of Key Policy

➢ Promoting Access to Renewable Energy in the Pacific

The regional technical assistance is helping the PNG Power prepare the Rouna hydropower cascade development plan, as well as build the capacity of the power utility on system management and maintenance. The project was approved in 2009 for $3.0 million, and is being implemented in PNG, Solomon Islands and Vanuatu.

Peru

Target RE 25% of total energy consumption by 2021. (Solar + Wind: 1,300 MW, Hydro: 320 MW, Biomass: 4,000 MW, Biogas: 120 MW, MSW: 160 MW, Ethanol: 9 Million L/day, Biodiesel: 4.5 Million L/day, Ocean: 2 MW, Geothermal: 1 MW) ※Renewable Energy Development Plan (REDP)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Política Energética Nacional del Perú (2010 – 2040) (Nov 2010) ➢	➢ Ley 28054 de Promoción del Mercado de Biocombustibles (2003) ➢	➢ RD & D ➢ BOI Tax incentives scheme

Summary of Key Policy

➢ National Energy Development Strategy 2020 and 2050 Vision (2007)

The proportion of renewable energy (not including traditional biomass) primary energy supply is 5% by 2025 and 11% by 2050. Since the announcement on November 12, 2007, there have been no reports on the progress implementation and evaluation of results.

➢ Ley 28054 de Promoción del Mercado de Biocombustibles

The goal of this legislation is to promote investment in the production and commercialization of biofuel, and to disseminate the environmental, social, and economic advantages of biofuel use that can be attained through the protection of public health, the environment, and the creation of new jobs.

Philippines

Target REPF2009: 2020:10,835 MW (Geothermal: 3,097 MW, Hydro: 6,767 MW, Wind: 548 MW, Solar: 35 MW, Biomass: 257 MW, Ocean: 120 MW)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Renewable Energy Act of 2008 (R.A.9513) ➢ Renewable Energy Development Plan 2009, REPF ➢ Biofuel Act 2007 (12 Jan)	➢ Feed in Tariff (July, 2012) Hydro: 5.90P/kWh Biomass: 6.63P/kWh Wind: 8.53P/kWh Solar: 9.68P/kWh ➢ RPS (March, 2011)	➢ Income Tax Holiday (ITH) – 7 years ➢ Duty-free Importation for RE Equipment – 10 years ➢ Special Realty Tax Rates on Equipment and Machinery ➢ Net Operating Loss Carry-over ➢ Corporate Tax Rate – After ITH 10% ➢ Accelerated Depreciation ➢ Zero Percent Value-Added Tax Rate ➢ Cash Incentive of Renewable Energy Developers for Missionary Electrification ➢ Tax Exemption of Carbon Credits ➢ Tax Credit on Domestic Capital Equipment and Services.

Summary of Key Policy

➢ Philippine Energy Plan (PEP 2009–30)

The plan has an overall vision of 'ensuring the best energy choices for a better quality of life'. The 20-year plan incorporates the government's mission to ensure the delivery of secure, sustainable, sufficient, affordable and environment-friendly energy to all economic sectors.

➢ Renewable Energy Act of 2008

Subsequently, the Implementing Rules and Regulations were signed on 25 May 2009, and in accordance with the Act, the National Renewable Energy Board (NREB) was created. The NREB's members are representatives from other government agencies, stakeholders and non-government organizations.

➢ Biofuels Law (2006)

It mandates the use of biofuel blends in the fuel supply in the Philippines, aiming to: reduce dependence on imported oil; mitigate toxic and greenhouse gas emissions; increase rural employment and income; and protect the ecosystem, biodiversity and food reserves of the economy.

Russia

Target By 2030: Renewable energy will account for more than 355 GW in capacity By 2030: Renewable energy will account for more than 1,800 TWh in generation		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Electricity Reform (2003) ➢ Energy Strategy (2009) ➢ Federal Law On Energy ➢ Saving and Increasing Energy Efficiency (2009)	**Government order:** ➢ The main direction of state politics in the sphere of increasing energy-efficiency of electric power on the base of renewable sources of energy for period till 2020 (2009) **Re-organize and creation of governmental agencies:**	➢ EBRD and IFC have set up financing scheme to support investments in energy efficiency.

Summary of Key Policy

➢ Electricity Reform (2003)

The reform de-regulated the vertically integrated structures of the electricity companies. It established a new structure and rules, which led to relatively liberalized wholesale and retail markets for network and system operation. It was implemented in 3 different phases, with the last phase ending in 2009.

➢ Energy Strategy of Russia for the Period to 2030 (2009)

The strategy aims to increase energy efficiency and renewable energy installation in order to mitigate growing energy demand and environmental pollution. The long term development goals are as follows:

1. Energy security
2. Improve energy efficiency
3. Improve efficiency of budget for the energy sector
4. Environmental security in the energy sector

➢ Federal Law On Energy Saving and Increasing Energy Efficiency

The law promotes energy efficiency through funds to energy efficient firms and tax benefits. The main actions taken were as follows:

1. Inefficient equipment of 100 W incandescent light bulbs will be banned from the market starting in 2011.
2. All the electrical equipment will be required to have an energy efficiency label from 2012.
3. Energy efficiency regulations for buildings, and promotion of energy metering.

➢ Alternative Energy Development Program (2010)

The order requires that the share of renewable energies to reach 4.5% by 2020 (2015: 2.5%).

Singapore

Target

2015: RE industry contribute 1.7 billion S$ to the GDP
To create 7,000 jobs
Biodiesel Production capacity: 3 million ton/year

* As the region herbs on renewable energy related product development, manufacture and export

Renewable Energy promotion framework	Policy Implementation	Other Incentive
➢ Clean Energy Blueprint Targets	➢ Venture Funding Support - Budget (350 million S$) ➢ Clean Energy Programme Office, CEPO -Solar Capability Scheme, 2010 >30% of Initial cost >Max 1 million S$ -Venture Soft Loan ➢ Feed in Tariff (Municipal Solid Waste Generation Only)	➢ Support export-oriented industrial development -Tax exemption for pioneer -Tax exemption for existing facilities expansion -Income tax deduction of interest on foreign currency borrowings -Preferential taxation Trade Promotion

Summary of Key Policy

- National Energy Policy Report (12 Nov 2007)

  The report is summarized into four basic issues: (1) Maintenance of economic competitiveness, (2) Energy security, (3) Improvement of sustainable environment, (4) Industrial development. According to the report, the aim is to increase to S $ 340 billion from S $ 200 billion in added value of the energy industry by 2015, and employment goal of the energy industry is to expand to 15,300 from 5,700 people at the time it was set.

- Clean Energy Blueprint Targets (2008~2012)

  >Budget: 350 million S $

  A comprehensive policy designed to foster a new energy industry. The policy was configured on the five pillars of research and development, human resource development, enterprise development, the internationalization of industry, and Eco-system of industry. This policy was aimed at enterprise development on renewable energy, and formed as a hub for the new industry in this region. The target was to create 7,000 jobs and contribute S $ 17 billion to the GDP by the year 2015.

- Clean Energy Program Office, CEPO

  The program was implemented on the basis of this CEPO, that the budget is turned on wide-ranging research and development, promote the introduction of PV solar energy system, etc. to new venture financing.

- Solar Capability Scheme (1 March 2010)

  A system to support companies designed in the fusion of architecture and solar PV. It requires incorporation of solar PV over 50kW for a new construction in the private sector. Although 30% of the cost is to assist in the sum of investment, but the upper limit was set at S $ 100 million.

Chinese Taipei

Target RE 15.1% (2025): Hydro (4.4%), Wind (5.3%), Solar (1.8%), Geothermal (0.3%), Biomass (2.5%), Fuel Cell (0.4%), Marine Energy (0.5%)		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢ Renewable Energy Development Act (2009.7.8) ➢ Framework of Sustainable Energy Policy (2008.6.5)	➢ Feed-in Tariff Solar: 7.33~10.32 NT$/kWh Wind: 5.56~7.36 NT$/kWh Hydro: 2.18 NT$/kWh Geothermal: 4.80 NT$/kWh Biomass: 2.18 NT$/kWh Waste power: 2.69 NT$/kWh Others: 2.18 NT$/kWh	➢ RD & D

Summary of Key Policy

➢ Renewable Energy Development Act (8 July 2009)

The feature of "Regulation for Renewable Energy Development" is to provide the incentive for generation capacity of renewable energies by 650-1,000 MW within 20 years. Further, it is expected to achieve the goal of over 845 MW in 2025 and occupy the share of more than 15% in the total energy generation capacity in Chinese Taipei. The legislation of this regulation represents Chinese Taipei's government has made a clear and strong commitment to develop renewable energy）

➢ Framework of Sustainable Energy Policy (5th June 2008)

Several measures were proposed including:

(a) To improve energy efficiency over 2 % among 2008-2015 for decreasing the energy intensity over 20% in 2015 and over 50% in 2025 compared with it in 2005;

(b) To reduce nationwide CO_2 emission for aiming to return it in the standard of 2008 among 2016-2020 and in the standard of 2000 in 2025. Further, the share of low carbon energy in electricity generation systems should be from 40% currently to 55% in 2025;

(c) To build a security system of energy supply to meet the goal of annual economic growth rate up to 6% among 2008-2012 and US$30,000 per capita income by 2015.

Thailand

Target

RE 25% of total energy consumption by 2021. (Solar + Wind: 1,300 MW, Hydro: 320 MW, Biomass: 4,000 MW, Biogas: 120 MW, MSW: 160 MW, Ethanol: 9 Million L/day, Biodiesel: 4.5 Million L/day, Ocean: 2 MW, Geothermal: 1 MW)

※Renewable Energy Development Plan (REDP)

Renewable Energy promotion framework	Policy Implementation	Other Incentive
➢ Draft of the Fifteen Year-Alternative Energy Plan, (DEDE 2008) ➢ Renewable Energy Development Plan (REDP) – Committed to the Development of Low-Carbon Society ➢ AEDP Master Plan, 2012~2021（2011.8）	➢ Feed in Premium (Adder) ➢ Power Purchase Program from Small Power Plant (SPP) and Very Small Power Plants (VSPPs) ➢ ESCO Venture Capital Fund※Established in 2008 base on "Energy Conservation Promotion Fund, ENCON Fund" ➢ Revolving Fund ※Energy soft loan ➢ Investment Grant (10-30%)	➢ RD & D ➢ BOI Tax incentives scheme

Summary of Key Policy

➢ Feed in Premium (Adders), Started: 2007, amended at March 2009

"Adder" is a system to add a fixed premium tariff on power purchase price from SPP and VSPP (2.0~2.5baht / kWh). The solar power generation tariff is about 8 baht per kWh, the highest tariff in this premium system. Because of the high tariff level at the initially period, it increased speculative investment, and the first revision was amended in March 2009.

➢ Power Purchase Program from Small Power Plant (SPP) and Very Small Power Plants (VSPPs), 17 March 1992: SPP, 2002: VSPP

This program was introduced for the purpose of reducing the government financial burden on power generation and transmission, and to promote private sector participation in power generation projects, and the use of renewable generation and byproducts of local industry. Both SPP and VSPP play an important role in decentralization of power generation and the effective utilization of domestic produced energy, although the percentage of total power generation is not large (10% for SPP and less than 1% for VSPP at installed capacity in 2007).

➢ ESCO Venture Capital Fund

As a program of co-investment by private sector and investors, it was established in 2008 as the "Energy Conservation Promotion Fund, ENCON Fund". It includes: (1) Equity investment, (2) Lease of equipment, (3) Carbon credit trading, (4) Venture capital, (5) Technical assistance, and (6) Loan guarantee. The initially scale of the funding was $15 million USD, but with a long-term plan to expand to 100 to 200 million USD.

➢ Revolving Fund

Revolving fund is one of the fund targets for the energy sector. The cooperation is between government and financial sectors to promote private investment on energy efficiency improvement and renewable energy projects. DEDE was the budget allocation of funds to domestic financial institutions, and the financial institutions are required to provide low interest loans for private businesses. The current executive scale for the fund has reached 27.5 million USD.

- AEDP Master Plan, 2012~2021 (2011.8)

  The plan has a target of 25% Alternative Energy in Total Energy Consumption by 2021.

United States

Target No target for Federal Government		
Renewable Energy promotion framework	**Policy Implementation**	**Other Incentive**
➢	➢	➢ RD & D

Summary of Key Policy

- Role of state government

  In the United States, mainly the formulation and implementation of policies for promoting renewable energy is a state government than the federal level. The attention should pay to the movement of the state government.

- Stability of the policy

  Since there is no long-term renewable energy policy, the current of the policy trends in the United States promoting the existing renewable energy has such great impact on the introduction of renewable energy. In the United States with an emphasis on market principles, feed-in tariff is difficult to become policy driver. However, in order to guarantee the recovery of investor funds, promote a stable policy environment is needed.

- The typical as renewable energy promotion policy at the federal level can be given "production tax credit renewable generation (PTC)". Since the embodiment in the year 1992, PTC is repeatedly performed several times. The current system has been extended until the end of 2013", American Recovery and Reinvestment Act of year 2009 (ARRA)". PTC has such a large impact on the amount of wind power introduction in the United States. The extension of the PTC since 2013 has been attracting attention.

- Smart grid construction of transmission lines

  The transmission network in the United States is dividing to western region of Texas and the eastern region. The coupling between the region transmission areas is small. Renewable energy resources in the United States are concentrated in the western and central regions; load power is concentrated in the eastern region. To expand the use of renewable energy in the future, grid coupling between regions is important.

Viet Nam

Target

- 11% of Total Primary Energy Supply by 2050 (3% in 2010, 5% in 2025)
- Biofuel (2015: 0.25 million ton, 2025: 1.8 million ton)

Renewable Energy promotion framework	Policy Implementation	Other Incentive
➢ "National Energy Development Strategy 2020, with a Vision 2050" (Decision No.1855/QD-TTg, 27.12.2007) ➢ "Development of Biofuels up to 2015, with a Vision to 2025" (Decision No. 177/2007/QD-TTg, 20.11.2007) ➢ "Power Master Plan VII" (2011.7) ➢ "Renewable Energy Development Strategy and Plan (2008.12)	➢ Initial Cost Subsidy ※Biogas by Manual Programme (2003-2012). By Government and International support by SNV ➢ Promotion Scheme ※Biofuel development Plan ➢ Purchase Scheme ※Power supply and utilization provisions (2001)	➢ Biofuel Development ※Provide loan and land ※Tax free for equipment import ※ RD&D support

Summary of Key Policy

➢ National Energy Development Strategy 2020 and 2050 Vision (27.12.2007)

The proportion of renewable energy (not including traditional biomass) to primary energy supply was 5% by 2025 and 11% by 2050. Since the announcement on November 12, 2007, there have been no reports on progress of implementation or evaluation of results.

➢ "Development of Biofuels up to 2015, with a Vision to 2025" (20.11.2007)

Projected 250,000 tons in 2015 (1% mixed with biodiesel and bioethanol), and 1.8 million tons in 2025. Issues like securing raw materials, market price, and government support have not been resolved, and the future progress is unknown.

➢ Power Master Plan VII (2011. 7)

The Prime Minister of Viet Nam approved the national power development plan for the 2011-2020 period with a vision to 2050 (the "Power Master Plan VII") on 21 July 2011 by decree No. 1208/QD-TTg. The Power Master Plan VII places strong emphasis on energy security, energy efficiency, renewable energy development and power market liberalization. It also aims to address various problems encountered during the implementation of the previous Power Master Plan VI.

➢ Renewable Energy Development Strategy and Planning (2008. 12)

The plan was designed to address: (1) Setting the target value of renewable energy to connect to the network transmission line, (2) Rate setting electrification using renewable energy at off-grid, (3) Set the target value of available heat from the biofuel renewable energy, (4) Execution plan in terms of legislation.

- Initial Cost Subsidy: ※Biogas by Manual Program (2003-2012)

  A program with the assistance of the SNV, designed to support household biogas projects in rural areas throughout the economy. More specifically, to assist provide approximately 50% of the initial investment, for construction and operation of technology guidance equipment. The project is designed to reach 165,000 homes. (Bio-gas programs similar to this have been there, and have been rated as the most successful in the introduction of renewable energy in Viet Nam)