CHAPTER VI
CONCLUSION

6.1 Challenges Faced by Low Carbon Electricity Systems

Thailand faces energy and environmental challenges as being both a contributor and victim of the effects from climate change. Renewable energy was identified as having great potentials for greenhouse gases emission reduction, due mainly to ample physical supply of the agricultural and industrial by-product such as rice husk, wood chips, bagasse, and other available biomass on fields. Based on potential installment of energy technology, the major proportion of renewable energy will mainly derive from biomass to fulfill target of 3,700 MW in 2022, Thailand need to increase about 230 percents from current capacity 1,610 MW in 2009. The expected goal under AEDP is not too hard to achieve, but government must help increase efficiency of technology and methodology of biomass utilization, and explore other energy-derived biomass that should be more utilized. The climate change is a direct threat to energy security, particularly to existing energy infrastructure. Examples of disruptions to energy supplies that cause disruptions to power supply include droughts reducing hydropower availability and withering field crops and other food supplies. The effects of climate change may affect the trade-off between food supplies in term of food plantation areas and purposed uses for biomass energy supplies.

For solar energy utilization, it is still uncertain about technological breakthrough to drive down the economic cost for this type of technology. This is a major challenge that government has to solve in order to promote widely implementation of the solar energy. Government released many tools for motivate utilization of electricity generation from renewable energy in many different ways. For example BOI investment scheme in renewable energy by giving fiscal incentives and tax exemption in hardware and equipments using in construction of renewable power plants, special soft loans via ESCO funds. Before implement financial incentives for renewable development, the government may need to assess actual

renewable potential and should revise the potential of renewable energy development in order to set up "precise" and "effective" target before implementation. In addition, government should promote the zoning policy for renewable energy because of each part of country containing different types of supplying potential on biomass, hydropower, and wind. Thailand has plenty of resources to generate electricity from the sun and wind, however, the challenging action for government is whether it should wait for technology to maturely developed and later adopt the cost-effective technology or should strongly subsidy research to develop low cost solar cell by encouraging the co-operation of research and development.

Moreover, government may urgently set up a policy to promote the roof-top solar energy system to reduce energy demand and increase energy efficiency as in Europe. Promotion of decentralized energy production in household sector is important and collectively could create a big impact, including technology transfer to the public to become energy self-sufficient at local level. In summary, Thailand has set a very ambitious intention for developing low carbon electricity sector. With the government strong will in providing financial & regulatory incentives for business investment, R&D and public involvement to be part of the development, is really the key to build a strong foundation to secure the country's economy and environment. Another excuse to sit by and do nothing, maybe it is already too late, or perhaps the debate has already been shaped by various political agendas to polarize the right and the left to a point where one must pick a side, despite the amazing ability of humans to rationalize, and create this as an either/or discussion about our economic model and its future. It seems asinine to believe that the human civilization has not held any impact upon the global weather/climate system in the last four hundred years since the Industrial Revolution. Effective policy and regulation will be at the core of the response to global warming. In fact, the transition to a low-carbon economy might be the first global economic transition of this scale to be driven largely by policy.

Designing the low carbon electricity policy is a huge challenge to political leaders and regulators: it needs to achieve aggressive emission reductions, incorporate many sectors of the economy, be acceptable by many countries, be cost effective, and be equitable among the many stakeholder groups that are concerned. However, this study does not take a view of what regulation should be put in place

and how aggressively targets should be set. These are political decisions that need to be made considering all the aspects above, and also considering many non-climate related political priorities.

6.2 Policy Recommendation for Low Carbon Electricity Development

Thailand's Electricity demand is rising and there are no indications that this demand will be curbed significantly in the short and medium term, despite the energy savings and improved efficiency measures that have been implemented. At the same time, the electricity generation infrastructure is aging and a large number of power plants are scheduled for retirement. Unless new electricity generation capacity is developed to fill the emerging gap between electricity demand and supply, Thailand's power generation sector will be under severe constrain in the coming years, with negative consequences for the economy and the standard of living of citizens. Specific strategies may be required to be developed for a low carbon electricity development as follows.

6.2.1 Promotion of energy efficiency and demand reduction

Conventional or fossil fuels are highly polluting and non-renewable. Reducing use has both environmental and health benefits. Those on fixed incomes such as the elderly are vulnerable to fuel poverty and higher efficiencies can reduce the amount spent on fuel. Energy efficiency and renewable energy are tending to be the "twin pillars" of a sustainable energy policy. Both strategies must be developed concurrently in order to stabilize and reduce carbon dioxide emissions. Efficient energy use is essential to slowing the energy demand growth so that rising clean energy supplies can make deep cuts in fossil fuel use. If energy use grows faster than, renewable energy development, this will chase a receding carbon emission target. Likewise, unless clean energy supplies come online rapidly, slowing demand growth will only begin to reduce total carbon emissions; a reduction in the carbon content of energy sources is also needed. A sustainable energy economy thus requires major commitments to both efficiency and renewable.

Energy efficiency is the lowest cost and most immediately accessible way to reduce carbon emissions and it reduces the extent to which abatement must be

delivered through other means. Improving efficiency is both a technological and social challenge. Energy efficiency is a low-cost, rapidly deployable, and large-scale energy resource. Reducing growth in energy demand is essential to any clean energy strategy: without efficiency advances, clean energy supplies might not keep up with demand and carbon emissions could continue to grow. Policy makers are now focusing on ways in which different policy instruments can influence technological developments and users' behavioral changes with respect to energy efficiency. End-use energy efficiency improvements mean that fewer resources are consumed and emissions are avoided. The use of such resources is expensive, and at such times there is marked upwards pressure on electricity prices. Measures on the demand side, the electricity consumer offer important opportunities to reduce system costs.

6.2.2 Strengthening collaborative efforts and coordination among all governmental agencies

Government should strengthen collaborative efforts and coordination among all governmental agencies will create the great momentum to speed up the process toward low carbon society. However, it is essential to reduce the policy inconsistency between government organizations as well as policies that promote clean energy expansion in regulation, generation, financial support and expansion policies. Making progress on energy and climate will require greater public understanding of the challenges we face, the sacrifices that must be made, and the opportunities that lie ahead. Any new policy initiatives must be accompanied by a coordinated effort to communicate directly with the public about the role they will play in helping to reach these goals. It is recommended to set a national agenda for becoming a low carbon society in year 2030 by establishes a vision for the future. Articulate a long-term vision for addressing energy security and climate change against which all policies will be measured. Integrate energy security and climate change priorities into all aspects of domestic and international policymaking. Governments can take a number of steps to reduce uncertainty, including:

- Removing non-economic barriers, such as legal obstacles to grid access and financial rules that foster inefficient electricity market
- Improving worker training;

– Sponsoring education campaigns that promote acceptance of renewable technologies;

– Creating a predictable and transparent investment framework; and

– Offering incentives that are tied to a technology's maturity and promise.

6.2.3 Providing incentives for fuel diversification into low carbon emission

6.2.3.1 Identification of new kind of renewable energy

The world is not running out of energy. But it is becoming more difficult to access, produce, and convert energy resources and deliver them to the people who need them. For instance, supplies of oil, natural gas, and coal are increasingly located far from demand centers. Moving these products requires an increasingly complex delivery infrastructure that increases vulnerability to disruptions. The adequacy and security of this infrastructure, which is already transporting large volumes of oil and gas over long distances through increasingly crowded transit points, is a critical concern. For improving grid securities and decreasing emission from power generation, government should strengthen energy security through greater effort in increasing access to further utilize renewable energy and other alternative energy as future energy choices is essential.

However, government should concern and promote the 'small and distributed' mode of energy production and consumption at the rural community levels where several hundred units of community biodiesel, biogas, biomass electricity and PV-solar units have been installed in the past decades. Some of such community is a classic showcase that 'small can be beautiful and competitive'. In this regards, the small farm holders and SME energy producers can be part of the development process of the country and can in fact energize the revival of rural community developments into the new modes of knowledge bio-based economy.

6.2.3.2 Revised the potential area for renewable energy development

Logistics and transportation of renewable resources especially biomass fuel are the another barrier of renewable energy utilization. Most of renewable energy

is bulky and distributed over vast areas, which could cause high transportation expenses such as the transportation of rice husk for biomass power plant, is averagely farther than 200 km to the plant location. If the policy is to minimize the use of petroleum fuels, biomass resources should be utilized by nearby facility. Biomass has to be transported by farm equipment much over 100 km to a processing point or use facility, a substantial fraction of the energy content of biomass itself is consumed in the transportation process, therefore, carbon emission from renewable energy are not nil, as is generally assumed while evaluating carbon credits. Also the more promotion of biomass to generate electricity could also lead to further forest destruction and encroachment.

6.2.3.3 Applied various policies for renewable energy expansion

Provides private-sector energy incentives to promote low-carbon fuels and technologies, and remove barriers to their deployment. The current mix of regulatory regimes and incentive structures favor conventional fuels and have created significant barriers to new forms of energy that require different production and delivery infrastructure. In addition, the current system of frequently expiring incentives, such as the tax credits offered for energy efficient appliances, inhibits technology progress. The new administration should evaluate the effectiveness of these current regulations and incentives in promoting efficiency, fuel diversity, new technologies and fuels, and reducing greenhouse gas emissions. Successful programs should be extended for a longer period.

The government controls just a subset of clean technology incentives and regulatory barriers. Many of these entities are far ahead of government and would welcome greater action and leadership. For long-term policy, government should align private-sector economic and financial incentives and remove barriers to promote investments in low-carbon energy technologies and also implementation of financial incentives such as loans guarantees and grants (See also in Appendix F for more information of renewable promotion policies in many countries).

6.2.4 Introduction of Clean Coal Technology (CCTs)

Coal used worldwide is projected to increase significantly and is expected to be the fastest growing primary energy source in the next 20 years primarily due to the increasing demand for fuel for electricity generation and in the industrial sector. At present, there are already substantial capacities of coal-fired power plants and coal resources remain largely untapped (The Energy Data and Modelling Center, The Institute of Energy Economics et al., 2009; The International Energy Agency, 2006).

In Thailand, its energy plans indicate the rapid growth of coal utilization for power generation and this presents itself an opportunity to promote and increase cleaner coal use and clean coal technology that could bring in benefits towards national energy security. Despite growing environmental controls, more coal power projects are moving forward, with increasing preference to use clean coal technologies. The importance of collective action to strengthen cooperative partnerships, promotion and utilization of coal and clean coal technologies among government, private sector and NGOs are strongly required. For the sake of national energy security in the long term, Thailand strongly encourages the use of clean coal technologies and promotes collaborative image-building for coal and CCTs in the light of global environmental concerns.

Government should promote CCTs by conducting studies, among others, on upgraded brown coal, coal liquefaction and integrated coal gasification and looking into the potential of carbon capture and storage (CCS) technology as well as encouraging private sector investment and participation. While enhancing environmental planning and assessment of coal projects, harmonizing emission standards and minimum efficiency requirements for coal-fired power plants is also important. To support future CCTs, it is essential to establish coal laboratory and standards, development strategy and action towards harmonization of local practices to encourage coal utilization, resources and facilities. Moreover, education, positive perception and public understanding are key success factor for implement CCT technology today.

6.2.5 Encouraging and Promotional of Local Research and Development

Government could support researchers for carry out their research to extend country potential, and create in-house technology to promote industrial start-up. It should be note that accelerating the pace of technology improvement and deployment could significantly reduce cost of achieving emission reduction goals. The critical role of new technologies is underscored by the fact that most anthropogenic greenhouse gases emitted over the next century will come from equipment and infrastructure built in the future. Energy research is facing tremendous challenges to enhance knowledge and develop new technologies for cleaner and more efficient energy production, transport, conversion and final use. Therefore, measuring the best state of the art of given technologies against a set of relevant parameters, identifying ambitious but realistic objectives to be attained over various time lines, and assessing the progress made over time are major issues for program managers, researchers or decision-makers. For example, domestic wind power technology has not well developed in the country, so the advanced and large wind power sector has to rely on imported technology. Given the available wind resources and climatic conditions, it is difficult to further develop wind power sector in Thailand by using imported technologies. The technology has to be tailored to adopt in the hot and humid climate and low wind speeds prevalent in Thailand. In long-term, this can pose substantial barrier if we continue importing foreign technology for wind energy development in Thailand.

As a result, new technologies and energy sources have the potential to transform the nation's energy system while meeting climate change as well as energy security and other important goals. The international political frameworks must be aligned with the long-range business investment cycle so that investments in GHG abatement technologies can be justified commercially. Many technology projects require government policies on issues such as R&D, risk management and large demonstration projects. The utilization of possible instruments, price signals should be created to promote innovative product and technological design. Policies that promote GHG emissions reductions will send the required signals to capital markets.

Moreover, policies must include education programs encouraging consumers toward low-GHG products and services. Strong financial commitments by

multilaterals will encourage development and transfer of leapfrog technologies to developing countries. Good governance must accompany additional financing and technical support for energy and technology markets. Most of the technologies needed to achieve dramatic reductions in energy use and a significantly increased use of renewable energy already exist and have been used successfully in at least some jurisdictions. There is, nevertheless, a role for continued technological development in reducing the cost and increasing the market penetration and technical performance of many technologies. However, government support for research and development in the areas of energy efficiency and renewable energy has been stagnant for the past decade, in spite of increasing awareness of the urgency of dealing with the global warming problem. Governments can provide incentives and promotion for research such as; Biomass cogeneration, electricity generation from biogas, Capturing CO_2 emission using algae, Battery for energy storage, etc.

6.2.6 Gaining More Benefits from CDM

The CDM was designed to be flexible since new types of carbon reductions are being devised every day. This flexibility allows new methodologies to be proposed. In Thailand, the project developers of Rice Husk Power Plant (A.T. Biopower) decided to propose a new methodology called New Methodology 0006 (ACM0006: Consolidated methodology for electricity generation from biomass residues). The logic behind proposing this methodology was that it would allow more reduction credits to be earned from renewable energy CDM projects in the country. The rice husk power plant was originated under Thai Government policy, which was to encourage private sector to develop and invest in renewable energy under the Small Power Producers (SPPs) scheme. This energy policy has major objectives to promote alternative energy to complement and strengthen Thai Electricity system by using own resources from biomass such as rice husk, sugar cane-bagasse, corn leaves, tapioca, palm shell and woodchip, to reduce the import of fossil fuels and to replace Thai's supply of fossil fuels which is forecasted to run short in the next 30 years.

Project developers have had difficulty timing the start of their projects with CDM registration because of all of the complicated steps and unforeseen delays that can occur in the process. Having uncertainty about the methodology one is using and the timing of when the project will be registered adds a layer of complexity to the

CDM process that has discouraged project developers. Significant CDM-specific procedural and methodological barriers have discouraged the development of some projects. However, each complex procedure in the CDM project cycle has a purpose that attempts to filter out the non-additional projects. As the process of CDM rule refinement continues and new versions of methodologies are released, the process gets more complicated. Sometimes these changes further discourage development, but they can also stimulate it as is the case with the methodology. The flexible nature of the CDM process allows project developers and consultants to propose changes to the operating and build margin ratios and existing methodologies, but sometimes these changes can have unexpected consequences that do not generate more CERs. Future adjustments to CDM renewable energy methodologies to account for countries with low emission factors and high levels of imported energy could help level the playing field for all countries.

As the CDM develops, issues of regulatory additionality[26] will continue to be clarified and hopefully will be modified to clearly allow state-run utilities to register CDM projects even if they are planned capacity additions. Also, the EB will hopefully make a ruling to clarify issues of financial and regulatory additionality for host countries that have legislation that mitigates greenhouse gases so as to prevent these countries from having a perverse incentive to do nothing about climate change. The necessity for more, local carbon consultants and DOEs obvious as the cost of hiring foreign firms is often prohibitively expensive for developers. These consultants and DOEs need to be more careful in their evaluation of projects to pass the Executive Board's new stringent requirements.

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[26] Additionality of CDM is defined as follows: "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity".

Table 15 Summary of solution for gain more benefit from CDM

Barrier	Segment	Solution
Technical Barrier	Project developer	Train local experts; create system for ordering parts; include a budget for replacement parts; create strict quality control; and include technical best practices in monitoring plan
Social Barrier	Project developer	Follow documented best practices of groups experienced from IPCC
	Government	Provide incentives for municipalities to develop projects; mandate that communities be part owners of projects in exchange for water or land permit; offer income tax exemptions if some CERs are reinvested in community; have companies comply with international standards for environmental responsibility; create incentives to stimulate a culture of paying for electricity; and make a policy for how developers should handle land and water permit disputes
Financial Barrier	Project developer	Utilize a CER insurance product to ensure delivery
	Government	Have DNA office explain value of CERs to local banks; provide money for feasibility studies; create incentives for the same developer or DOE to engage in more than one CDM project; reduce excessive paperwork for renewable energy interconnection in grid; require power wheelers to charge uniform transmission and distribution rates; eliminate the import tax on system requirements and annual income tax; require CDM revenues to be included in future state-run least-cost planning processes; and incorporate CDM in the long-term energy policy strategy
International Barrier	Government	Have DNA offices take a small percentage of CERs and use it for advertising, assisting project developers in the early CDM stages, and the creation of clear registration guides in the host country language, CDM workshops, CDM website, CDM databases and CER price guides. Host countries could also pressure CDM capacity building organizations for equal access to information.

Source: Modified from Lokey (2009)

6.2.7 Preparing for Post-Kyoto

The Bali Action Plan (BAP) highlighted the importance of "Measurable, Reportable and Verifiable[27]" (MRV) greenhouse gas mitigation actions and commitments, as well as support for GHG mitigation actions, in the post-2012 climate framework. This language on MRV was introduced to apply both to developed countries' commitments and actions, as well as to "nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building". However, extending MRV provisions to actions undertaken in developing countries (as well as in developed countries) could have many benefits, including more comprehensive information on global GHG mitigation actions, more information available to assess the effectiveness of such actions, and greater recognition of GHG mitigation actions undertaken in developing countries. Developing a reporting and/or recording framework that collects information on GHG mitigation actions and commitments in a single place, and that is flexible enough to evolve over time, could also help the international community better keep track of global mitigation efforts, and to enhance them as needed.

At present, information on greenhouse gas mitigation (GHG) actions, and the support for such actions, is reported internationally in countries' National Communications.[28] This information is patchy, particularly from non-Annex I countries, as current requirements allow for very irregular reports. There is thus growing interest in having a more comprehensive, and timelier, picture of GHG mitigation actions particularly in developing countries where information is scarcest.

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[27] Measurable, Reportable and Verifiable (MRV) was introduced to apply both to developed countries' commitments and actions, as well as to "Nationally Appropriate Mitigation Actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building"

[28] As well as including information on GHG mitigation actions, countries' National Communications also contain information on several other issues, including a country's adaptation measures; national circumstances; activities in research and systematic observation; education and public awareness; and technology transfer. Non-Annex I countries also need to include a national GHG emissions inventory.

A reporting or recording mechanism could thus identify enhanced GHG mitigation actions, and also support for these actions, in a measurable, reportable and verifiable (MRV) manner, as per the Bali Action Plan. Suggestions for a "registry" and for "National Schedules", both of which could perform the function of recording and reporting GHG mitigation actions in developing and developed countries, have been made in UNFCCC negotiations for a post-2012 framework (Ellis, Moarif et al., 2009).

Table 16 presents list of activities for greenhouse gas emission reduction from Ministry of Energy in 2010-2012. It should be noted that the developing countries are also likely to need to provide more information than at present. This could include a more comprehensive and timely picture of GHG mitigation actions (implemented and planned, as well as those contingent on provision of support), as well as information on support received. Information may also be needed on the expected/actual GHG impacts of mitigation actions. Moreover, in a post-2012 agreement, developed countries may need to expand reporting to strengthen information in two areas: on GHG actions, and also on support provided, where the latter includes financing and other support for capacity building and technology development and/or transfer. The frequency and detail of reports may also need to be increased, particularly regarding how much support (and of what type) is provided. This may, in turn, require increased co-ordination, within governments and the various divisions and agencies dealing with provision of support, as well as between governments, multilateral development banks and other international institutions (such as the OECD, IEA) involved in the provision and/or monitoring of support. Increased reporting on support received for climate-specific and climate-relevant support by developing countries would be a useful step forward in improving the effectiveness of support.

Currently, the internationally agreed guidance on quantifying the effects of GHG mitigation actions focuses on projects or programmes undertaken via the CDM. Extending such guidance to methodologies, approaches and/or tools to quantify the effects of GHG mitigation actions while not straightforward, this would facilitate countries' MRV-related efforts, and could thus help in developing a more comprehensive and timely system for measuring, reporting and verifying enhanced action on GHG mitigation in the post-2012 climate framework.

Table 16 List of GHGs emission reduction activities in 2010-2015

Activities	Organization	Amount of emission reduction (tCO_2-eq)	CDM Methodology
Fuel switching from fuel oil to natural gas	Bangchak Plc.	60,000	ACM0011 – Consolidated baseline methodology for fuel switching from coal and/or petroleum fuels to natural gas in existing power plants for electricity generation (version 2.2)
Install new co-generation for electricity generation	Bangchak Plc.	100,000	ACM0048 – New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels (version 2)
Boiler efficiency improvement	Bangchak Plc.	75,000	AM0054 – Energy efficiency improvement of a boiler by introducing oil/water
Install new PV system for electricity generation	Bangchak Plc.	25,000	AM0019 – Renewable energy project activities replacing part of the electricity production of one single fossil-fuel-fired power plants that stands alone or supplies electricity to a grid, excluding biomass projects (version 2)
Utilization of waste gas in refinery	Department of Mineral Fuels		AM0055 – Baseline and monitoring methodology for the recovery and utilization of waste gas in refinery facilities (version 1.2)
Replacement of high efficient light bulb in residential sector	EGAT	3,208,722	AM0046 – Distribution of efficient light bulbs to households (version 2)
Improvement of boiler efficiency in electricity generation	EGAT		AM0054 – Energy efficiency improvement of a boiler by introducing oil/water
Energy efficiency improvement in existing EGAT power plants	EGAT		AM0061 – Methodology for rehabilitation and/or energy efficiency improvement in existing power plants
Electricity generation from wind	EGAT		ACM0002 – Consolidated methodology for grid-connected electricity generation from renewable resources (version 10)
Flare gas utilization	PTT Plc.		AM0055 – Baseline and monitoring methodology for the recovery and utilization of waste gas in refinery facilities (version 1.2)
Fuel switching from fuel oil	PTT Plc.		ACM0011 – Consolidated baseline methodology for fuel switching from coal and/or

Activities	Organization	Amount of emission reduction (tCO_2-eq)	CDM Methodology
to natural gas in PTT power plant			petroleum fuels to natural gas in existing power plants for electricity generation (version 2.2)
Electricity generation from biogas	Energy Policy and Planning Office		ACM0002 – Consolidated baseline methodology for grid-connected electricity generation from renewable sources (version 10)
Electricity generation from biomass	Energy Policy and Planning Office		ACM0002 – Consolidated baseline methodology for grid-connected electricity generation from renewable sources (version 10) ACM0006 – Consolidated methodology for electricity generation from biomass residues (version 9)
Waste heat utilization	Department of Alternative Energy Development		AM0036 – Fuel switch from fossil fuels to biomass residues in heat generation equipment (version 3) AM0029 – Methodology for Grid connected electricity generation plans using natural gas (version 3)

Source: Using data from Cheif of Climate Change Officer in Energy Sector (2010)