Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 32 (2012) 440 – 448

Procedia Engineering

www.elsevier.com/locate/procedia

I-SEEC2011

Subsidy schemes of renewable energy policy for electricity generation in Thailand

S. Keyuraphan[a,b], P. Thanarak[a*], N. Ketjoy[a], W. Rakwichian[a]

[a]*School of Renewable Energy Technology, Naresuan University, Phitsanulok 65000, Thailand*
[b]*Enervision Co., Ltd. Bangkok Thailand*

Elsevier use only: Received 30 September 2011; Revised 10 November 2011; Accepted 25 November 2011.

Abstract

The dissemination of renewable energy subsidy schemes around the world has prompted dialogue and debate on the comparative merits of different policy schemes, whether it is monetary or non-monetary support. Some countries have announced the legislation to force power producers to build or buy electricity from renewable power plants (i.e. the power plants using renewable resources as the source of fuel) at the government electricity rate. In some countries, the production of electricity from renewable energy by the government has been promoted by purchasing that electricity at a higher rate than the normal rate. In order to encourage the application of renewable energy, the most prevalent policies for supporting new renewable electricity are variations of the Feed-in Tariff (FIT) and the Renewable Portfolio Standard (RPS). The Feed in tariff offers a long-term, fixed price payment to renewable energy generators, whereas the RPS has a mandatory to supply electricity from renewable resources, either by self-production or out-source at a defined ratio. RPS seeks to create price competition between renewable energy generators to meet defined targets, and typically define a maximum cost through a price cap instrument.
This study was aimed to comparison of renewable subsidies scheme policies in various countries like USA and Europe. The results of the study suggest that a reasonable approach to encourage the electricity production from renewable resources in Thailand is an integrated scheme of a mandatory and voluntary base.

Keywords: Subsidy scheme; Feed-in tariff; Renewable portfolio standard; Renewable energy

* Corresponding author. *E-mail address*: prapitat@nu.ac.th.

doi:10.1016/j.proeng.2012.01.1291

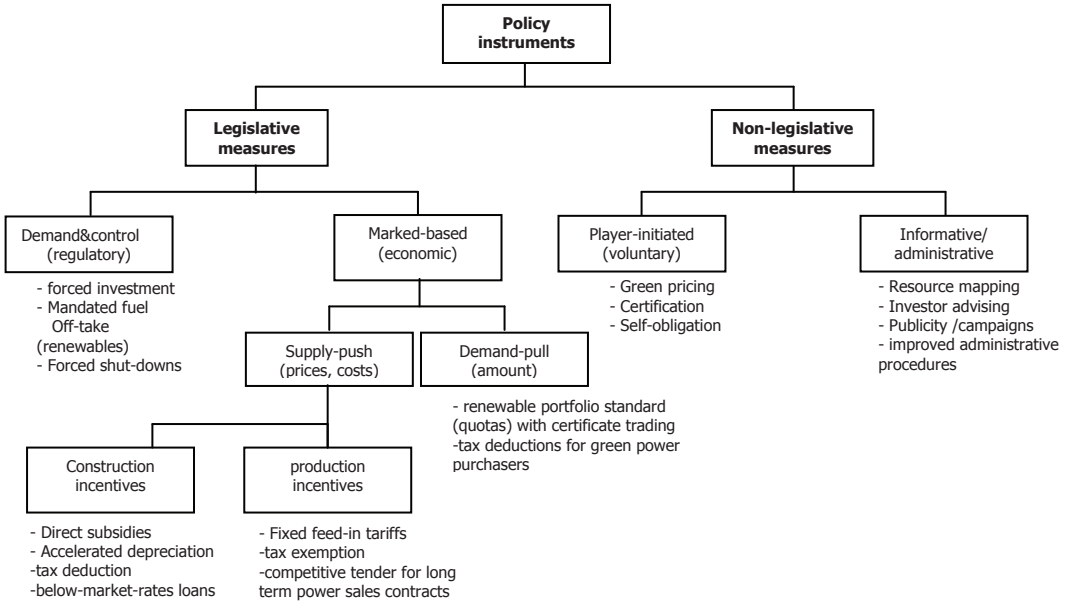
1. Introduction

1.1. Renewable energy subsidy scheme

Renewable energy become important issue because of the conventional energy source are limited. So the policy planner around the world are try to fill out how to promote renewable energy source to generate the energy expectancy on the power generation. However, to facilitate a breakthrough for renewable source barriers have to be overcome. There barriers are the economic, institutional, political and legislative. They include problems arising from lack of awareness. Also there are social and environmental barriers, which may result from a lack of experience with planning regulations, which curtail the public acceptance of a new technology. To overcome these barriers, careful strategies have to be applied.

Renewable energy subsidy scheme support mechanisms are required to stimulate the deployment of most renewable technologies until they have matured and become competitive with existing energy technology options. Developments such as carbon tax and emissions trading could enhance the relative competitiveness of renewable. It is essential therefore that any national support mechanism gives sufficient long term security to the market to ensure projects can commence the preoperational phase with some certainty while maintaining sufficient flexibility to incorporate changing economic conditions in the consumer interest and incorporate any binding measures on support. A number of different measures can be employed to stimulate the development of renewable energy generation capacity in any market sector.

There are many way to explain the renewable energy subsidy scheme support mechanisms. A paper by Thomas Faber [1] categories the mechanisms into 2 types of promotion strategies call regulatory base and voluntary base. There are [2] places various policy instruments into discrete categories. It is useful in conceptualizing the wide variety of instrument possibilities



Source [2]

Fig. 1. Schematic of various renewable policy mechanisms

It is a widely held view that market based mechanisms provides the most economically efficient means of achieving renewable energy policy objectives. Market-based mechanisms are those that enhance private sector interest in a field through some form of economic incentive, as opposed to command and control instruments, that achieve policy objectives through direction. These include fiscal measures, subsidy measures, and obligations imposed on market players, and can be expected to be the principal means of achieving targets. Market based mechanisms can be roughly categorized in terms of how they address the market, providing an incentive based on output by offering a price support directly or indirectly, or as a means of upfront capital support. The focus of this consultation exercise is on the options for direct price support mechanisms. However, the interaction between those options and secondary support measure options, such as indirect price supports - emissions trading and carbon taxes, tax incentives and capital supports, will be an important consideration in the design of policy going forward. Most direct price support schemes for renewable energy electricity production have an element of obligation. The Government obliges the public (exchequer), consumers (electricity account holders), or electricity suppliers to purchase renewable energy sourced electricity. An obligation to pay a specific price creates a supply-push mechanism. If the obligation is in the form of an imposed target, it creates demand and is thus a demand-pull mechanism.

1.1.1. Feed in tariff

Feed in tariffs have been employed in many European countries during the past decade.[3]. A feed in tariff involves the government setting a tariff price, or a set of prices for specific renewable technology, at which the country's supply companies or vertically integrated utilities are obliged to purchase all renewable energy exported to the grid. The obligation is on the supply company who will in turn pass on price premiums paid to consumers in the form of higher retail electricity prices. Some of the initial feed in tariff systems are being replaced with advanced feed in tariff systems that offer a high premium in the initial years of a project, and decrease over the life of the project. In some cases the advanced tariff is based on an agreed rate of return and requires an adjustment in the tariff based on returns to the project over an initial period so that the agreed return will be achieved over the life of the project. Other systems fix a tariff relative to the average price of electricity generated in the entire system.

Developers benefit from predictability and consistency provided in a feed-in tariff system if access to the tariff is guaranteed for a reasonable minimum period of time to facilitate long term planning. Additionally, the fixed price is government guaranteed. The projects therefore have guaranteed cash flows, which increases their borrowing capacity.

1.1.2. Renewable Portfolio Standard

The renewable portfolio standard (RPS) is a policy tool to force greater production of electricity from renewable energy that has attractive social and environmental characteristics. The main purpose of an RPS is to promote renewable energy into the electricity market without significant increase of the electricity prices.

The popularity of RPS is increasing due to three main reasons [4]:

- RPS provides incentives for renewable energy generators to decrease the cost of energy as a result of cost competition among producers for their share in the RPS;

- RPS target is being established by the government, thus it ensures that the implementation of the policy will lead to specific environmental and economic benefits;

- In the same time the RPS minimizes government involvement into the process, as the main forces that affect the implementation of the policy after it being adopted are the market forces.

1.1.3. Rebates

This is a first step regulatory strategies mechanism to promote renewable technology with financial incentives, aim to make investment in renewables more economically attractive. Fundamentally, there are two approaches to the provision of financial incentives, investment in new capacity and funding towards each unit of electricity produced[1]

1.1.4. Incentive

Several different options have been used to promote the generation of electricity from renewable with fiscal instruments [1] lower VAT rate applied for renewable energy systems and dividends from renewable energy source investment made exempt from income taxes.

1.1.5. Green Pricing

A number of electricity supply companies currently sell renewable electricity tariffs, often referred to as "green" tariffs. Renewable electricity has significant environmental benefits due to the low levels of carbon dioxide emissions associated with its production. However, despite the benefits of renewable electricity, there is currently significant uncertainty regarding the additional environmental benefit of the green electricity tariffs on offer i.e. whether these tariffs achieve any new renewable capacity or carbon saving beyond that created by regulation. In addition, there are concerns about potential double counting of the carbon benefit from renewable generation.

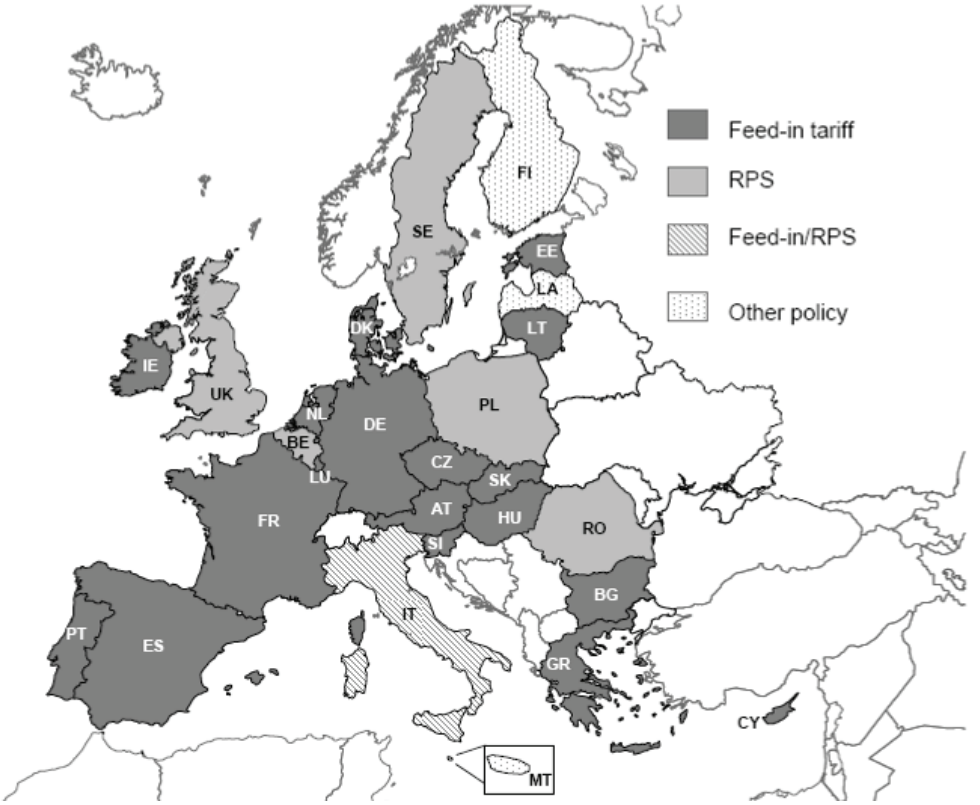
1.1.6. Bidding

The bidding system combined with a supply side direct subsidy to generators. Renewable generators provided a bid essentially an offer to provide a certain amount of renewable electricity at a certain price and the government then accepted all bids at or below a cut off price. For each of the bidding cycles, the government set a cut off price within a distinct technology or type of renewable generation [5]

2. Experience with subsidy scheme in other countries

2.1. EU countries

The commission of the European Communities drive the Renewable Energy Road Map [6] an integral part of the Strategic European Energy Review, sets out a long term vision for renewable energy sources in the EU. It proposes that the EU establish a mandatory (legally binding) target of 20% for renewable energy's share of energy consumption in the EU by 2020,



Source: [7]

Fig. 2. National renewable energy policies in the EU-25 countries

There has been vigorous debate in Europe as to whether feed-in tariffs or policies based on tradable renewable energy credits (RECs) are more efficient for promoting renewable energy [7] The European Commission (2005) determined that feed-in tariffs were both more effective and efficient than tradable renewable energy credit systems, largely because feed-in tariffs provide greater investor security. European REC systems are viewed as direct descendents of US renewable portfolio standard (RPS) policies [8] As a result, it has been assumed that US states would not adopt feed-in tariffs, given the conflict between feed-in tariffs and tradable credit policies in Europe. The past two years have seen a remarkable shift in the US policy landscape, however, as numerous states have introduced feed-in tariff legislation to supplement RPS policies, and proposals for a federal feed-in tariff have been developed.

2.2. United States

There are many different incentive programs that exist in different states to promote the use of renewable energy technologies. The three main categories of policies to promote green power are financial incentives, volunteer and outreach programs, and rules and regulations[9] The financial incentives include personal income tax exemptions, corporate tax exemptions, sales tax exemptions, property tax exemptions, rebate programs, grant programs, loan programs, industry recruitment programs,

leasing/lease purchase programs, and production incentives. There are currently 200 financial incentives in place that promote renewable energy in the United States [10]. Volunteer and Outreach Programs include green pricing programs, voluntary installer certification programs, and outreach programs. At present, there are 201 volunteer and outreach programs in place to promote renewable energy in the United States (DSIRE, 2003). Rules, regulations, and policies include public benefits funds, generation disclosure rules, renewable portfolio standards, net metering rules, line extension analysis requirements, contractor licensing requirements, equipment certifications, solar access laws, construction and design standards, green power purchasing/aggregation, and mandatory utility green power options. There are currently 216 rules, regulations, and policies in place to promote renewable energy in the United States [10].

For the RPS policies were initially developed in the United States in the mid-1990s in response to the introduction of electricity market competition [7] report that many state of the US. Already apply the RPS policies include setting up the RPS targets show the following Table 1.

Table 1. RPS targets by State of USA

State	**Target**	**State**	**Target**
Arizona	15% by 2025	Montana	10% by 2015
California	20% by 2010 33% by 2020 (goal)	Nevada	20% by 2015
Colorado	10% by 2015	New Jersey	20% by 2020
Connecticut	10% by 2010	New Mexico	10% by 2011
Delaware	10% by 2019	New York	25% by 2013
Hawaii	20% by 2020	Pennsylvania	18% by 2020
Illinois (voluntary)	8% by 2012 15% by 2020 (goal)	Rhode Island	16% by 2019
Iowa	105 MW by 1999	Texas	5880 MW by 2015 10,000 MW by 2025 (goal)
Maryland	7.5% by 2019	Vermont (voluntary)	Incremental growth from 2005 to 2012 with 10% cap6
Maine	30% by 2000	Washington, DC	11% by 2022
Massachusetts	4% by 2009	Washington State	15% by 2020
Minnesota	30% by 2020 (Xcel) 25% by 2025 (all others)	Wisconsin	10% by 2015

Source: [7]

2.3. China

In China Renewable energy policy is in the developing stages and crucial to further renewable energy development goals. Under the direction of the National Development and reform commission china', Center for Renewable Energy Development (CRED) has been given the task of drafting a new law the Renewable Energy Development and Utilization Promotion Law[11] The goal of the law is to meet short-term energy need while strengthening long-term sustainable development objectives. The law aims to reduce air pollution, safeguard human health and the environment, and provide power to off-grid rural area as well as contribute to mitigating climate change. The law will synthesize basic principles of the market economy and the political objectives of energy security Incentive policies will be structured to encourage the development of renewable technologies and provide market opportunities for renewable energy companies so that local governments, energy enterprises and the public can themselves promote and utilize renewable energy.

2.4. Taiwan

Government of Taiwan [12] promotes the development of renewable energy aggressively. Responding to the approval of "Kyoto Protocol" in 1997, the first National Energy Conference was held in May 1998. The conclusions emphasized energy conservation and call for an accelerated introduction of clean energy. A target for renewable energy is set to be 3% of total energy supply by 2020. In order to execute the conclusions and promote the utilization of new and clean energy, a task force was set-up resulting in a five-year implementation plan for 2000-2004. The incentive measures for renewables include equipment subsidy and tax incentives. According to "Statute for Upgrading Industries", 7% of income tax can be deducted for the first 5 years on the investment of renewable energy equipment or technology, and the purchase equipment can qualify for accelerated depreciation. The import tax and business tax can be exempted for those imported renewable energy equipments. The income tax can be deducted for 10%~20% of renewable energy stock owned by individual or company. Low interest rate loans will be provided by Renewable Energy Development Fund to the company to purchase renewable energy equipment, and the maximum annual interest rate will be not more than the Post Office's 2-year fixed interest rate plus 2.45%.

3. Thailand Renewable Energy Policy

Thailand wishes to diversify its energy mix and to promote the use of Renewable Energy within its energy mix. The use of Renewable Energy within Thailand's energy mix has the added benefits of reducing the environmental impact of using conventional fossil fuels and simultaneously displacing Thailand's need to spend foreign exchange on the import of fossil fuels. It is anticipated that the majority of Renewable Energy in Thailand will be generated by biomass-fuelled projects [13] This will significantly benefit the agricultural community in Thailand.

The Ministry of Energy (MoE) has a stated policy objective that 8% of Thailand's overall installed generating capacity by 2011 be contributed by Renewable Energy projects. It is estimated that this will represent approximately 2,300-2,400 MW of installed capacity by 2011.

Thailand's present Renewable Energy capacity is approximately 1,240 MW; of which only approximately 640 MW is delivered to the Thai electricity grid. The Energy Policy Planning Office (EPPO) reports that the MoE's objective is to increase the installed generating capacity of Renewable Energy by 2,000 MW by 2011. Against this background, it is important that Thailand establishes a Renewable Energy policy, tariff structure and contractual framework (i.e., Power Purchase Agreement ("PPA")) that will support investment in Renewable Energy projects and maximize the energy delivered, accepted and purchased from these investments.

4. Methodology

This study was aimed to compare renewable subsidy scheme policies in various countries and apply the subsidy scheme to the renewable power plants of thailand. The initial analysis was started with the SWOT analysis (strengths, weaknesses, opportunities and threats) of the power plants using renewable resources as the source of fuel. The experience of renewable subsidies scheme from other countries was reviewed and integrated with interviews of the major stakeholders like government, private, state enterprises and educational institutions.

5. SWOT Analysis

The SWOT analysis is a useful tool for understanding and making decision for all sorts of situations in business and organizations. In this study, the SWOT analysis was applied to understand the situation of renewable energy power plants in Thailand as following:

5.1. Strengths

- Ensuring energy security with renewability.
- Reducing the burden on fossil fuels imported from overseas.
- Having low environmental impact as compared to conventional energy sources.
- Automatic operation with very low maintenance (solar, wind power plant).
- Power is available at a fairly constant rate and at all times. In case of hydro power plant, it is subjected to water resource availability (hydro power plant).

5.2. Weaknesses

- High capital/initial investment costs.
- Performance is dependent on local season and weather conditions (solar, hydropower, wind).
- Site-specific technology (requires a suitable site).
- Production can create land use competition (for food or energy resource).
- Difficulty in storage and transportation of biomass and the risk of providing or collecting. biomass to be used at a constant year round.
- Power plant is not large enough, comparatively to other fuels.
- Uncertainty of biomass cost.

5.3. Opportunities

- Greater social support for renewable energy than other types of power plants.
- Fossil fuel prices have been risen steadily and fluctuated over time.
- Thailand has a lot of potential for renewable resource.
- Policy support / encouragement from the government.
- Being recognized as environmental friendly technology.

5.4. Threats

- Lack of stable and continuous policy support.
- Inadequate financing options for renewable energy projects, including insufficient access to affordable financing for project developer.
- Poor public perception of renewable energy system.
- Lack of stakeholder/community participation and co-operation in renewable energy projects.
- Lack of developed technology to produce electricity from renewable energy with sufficient capacity.

6. Result

Based on SWOT analysis, an interview of all stakeholders from different regions of Thailand and lesson learned from other countries, significant criteria were established to promote the power plants from renewable sources in Thailand including.

- Implementation of US mandated subsidy scheme in Thailand should be considered as the expense of the power plant will be higher.

- Application of some promoting measures being implemented in EU as one of supporting mechanism in Thailand should be considered considerately. For instance, the rate of power purchasing by types of renewable energy, life time of incentive and target of subsidy must be considered cautiously.

- Source of subsidy budget is one of the main concern. Previouly, in Thailand the source of money has been typically from the Energy Conservation Fund, i.e. the fund being collected from the petroleum tax. In some countries, the money is collected directly from end users or those who release greenhouse gas as a carbon tax.

- Establishment of public knowledge and awareness of using renewable energy is of great importance.

- Systematic development plans of renewable energy should be established and supported intensively by the government.

The power producers have commented that the government should provide them an appropriate preparatory period to manage their system in agreement with the subsidy scheme policy. In addition, the government has to promote renewable energy systematically and continuously. The educational institution also suggests that there must be preparation in various fields, for example technology, domestic industry, human resource and renewable energy master plan.

7. Conclusion

A reasonable approach to encourage the electricity production from renewable resources in Thailand is an integrated scheme of a mandatory and voluntary base ex. renewable portfolio standard, feed-in tariff and indirect subsidy scheme (green tariff, environmental tax). In addition, the government needs to set up the renewable master plan by brainstorming of all stakeholders ex. government, state enterprise, power producer and educational organization. Last but not least, public awareness and participation should be created to support the government subsidy scheme.

References

1. Faber T, et al., and Haas R(Ed.).(December 2000). Promotion strategies for electricity from renewable energy sources in EU countries. Retrieved August 15, 2009, from www.tuuleenergia.ee/uploads/File/ reviewreport.pdf
2. Department of communication marine and natural resources. (2001). Options for future renewable energy policy, targets and programmes. Department of communication marine and natural resources, Ireland. 31p.
3. Grace, R., Rickerson, W., and Corfee, K. (September 2008). California feed-in tariff design and policy options. California energy commission. 5-21p.
4. Berry T. and Jaccard, M., 2001. *The Renewable Portfolio Standard: Design Considerations and an Implementation Survey*. *Energy Policy*, 29(4): 263-277.
5. Komor, P. 2004. Renewable Energy Policy. Newyork Universe. Inc, Trent Berry, Mark Jaccard, Energy Policy 2001;29:263-277.
6. Commission of the European communities. 2007. Communication from the commission to the council and the European parliament renewable energy road map renewable energies in the 21st century; building a more sustainable future. Brussels.20p\
7. Rickerson, W., and Grace C. R. (February 2007) The debate over fixed price incentives for renewable electricity in Europe and the United States: Fallout and Future directions.30p
8. Lauber. V. (2005). Switching to Renewable Power A Framework for the 21st Century. Earthscan. London, England.
9. Rickerson, W., Bennhold, F., and Bradbury J. (May 2008). Feed-in tariffs and renewable energy in the USA-a policy update. World future council, USA.
10. Sissine, F. 2006. Renewable Energy Policy: Tax Credit, Budget, and Regulatory Issues. The library of Congress.32p.
11. National Renewable Energy Laboratory. Renewable Energy in China. Retrieved (November, 10, 2009). from www.nrel.gov/docs/fy04osti/ 35786.pdf
12. British Trade and Cultural Office. (2007). Renewable energy in Taiwan. Retrieved January 10, 2010, from http://www.re.org.tw/renew_en/knowledge/f1.aspx
13. Energy policy and planning office (EPPO). (2003). Energy strategy: energy for Thailand's competitiveness. Retrieved January 10, 2010, from http://www.eppo.go.th/doc/strategy2546/strategy.html