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The Small Hydropower Project as the Important Renewable Energy Resource in Thailand

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Abstract: For several decades that Thailand has been importing large amount of fossil fuel for electricity generation to cope with the domestic demand. In 2003, the electricity produced by the imported fuel was around 32% of total electricity demand of the country. Continually increasing of the world fuel price forces the government to seek for indigenous renewable energy to replace some portion of imported fuel. Then, it becomes the nation policy. This policy responds to not only the country economic status and stability issue but also environmental concern of the world trend. As hydroenergy is one of renewable and clean energy, the small hydro projects are deemed fitting to the future energy strategies of the country. Estimatedly, its potential is more or less 1,100 MW. In this paper, the existing status and potential of hydropower in Thailand are reviewed, and then strategies and plan to develop this source of energy are figured out. The others such as expected benefits in developing this resource and technology are considered as well.

Keywords: Renewable Energy, Hydro-energy, Small Hydropower, Clean Energy, Energy Portfolio Standard.

Introduction

Thailand is the same as other developing countries in the world that consumes the energy from fossil fuel which is mostly imported. The value of imported fossil fuel in each year is in large proportion of national expenditure. This value is increasing in every year due to the increments of demand of the country's activities and of the world price of fuel. In past decades the price of fossil fuel was increasing while the value of Baht was falling. In such situation, all development activities of the country are highly affected. It is possible that if the fossil fuel price is still growing up, many development activities of Thailand will be slowed down in near future.

Figure 1 below shows of the national supply quantity of crude oil and natural gas was increased around 2 times in past 10 years and Figure 2 reveals that within 5 years the value of imported crude oil increased about 2 times while the value of imported natural gas increased around 3 times

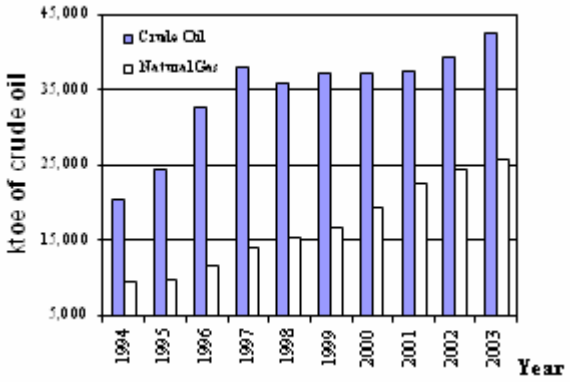

Fig. 1 Total national supply quantity of crude oil and natural gas in past decade

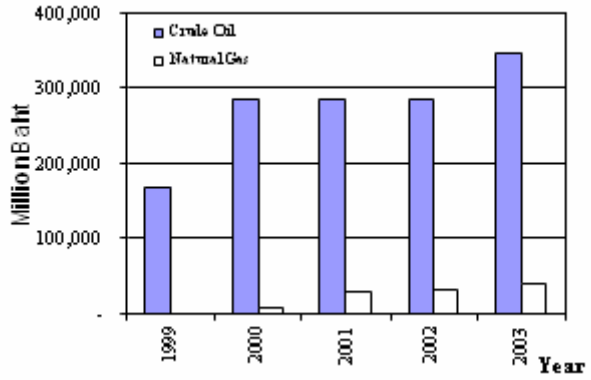

Fig. 2 Value of imported crude oil and natural gas (It could be remarked that there is no data of natural gas value shown in the year 1999).

In order to manage risk of above situation, the energy save program was promoted by Royal Thai Government. Many measures in energy save program are practicing through out the country for past several years. Right now, the new challenge to manage risk of dependency on imported fuel of the Thai Government is renewable energy portfolio policy. Thus, all kind of indigenous renewable energy is in discussion to establish the suitable energy portfolio standard for Thailand. The percentage of renewable energy portfolio that the Thai Cabinet approved is at 5 percent for new installation of fossil fuel power plant. The percentage of renewable portfolio standard for all national energy use is established at 8% within the year 2011.

In all kinds of renewable energy such as solar, wind, biomass, hydropower, geothermal etc., the energy from water has been proved that economical and clean for electricity generation. Also, hydro power is one of the oldest energy form of mankind. Small and mini hydro project is one of the mostvaluable answers to the question of how to provide electricity to isolated rural communities for improving quality of life in many countries for long time of past decades.

As no clear definition exists regarding to the terminology of micro, mini, small, medium and large hydro power projects, in this paper all those terms are classified [1] as shown in Table 1:-

Table 1 Hydropower plant sizes and related capacity

Size of Plant	Capacity (kW)
Micro	0 – 100
Mini	100 – 6,000
Medium	6,000 – 20,000
Large	> 20,000

For the small scale of hydropower project that appeared in this paper, the authors attend to call for all scale of projects which are smaller than large scale.

Adventageous Nature of Hydro Energy

Hydro energy has many advantages compared to other sources of energy

- It is the cheapest renewable energy.
- Hydropower plant is long life; for being listed in long term plan of the power development plan is possible. Long term guarantee for supply electricity to the network and stable cost can be assured, compared with the thermal plant as price of fossil energy which always fluctuates.
- Hydro turbine posses quick start – stop operation, faster than thermal turbine, so it is easy to control the supply to load on grid. Altogether, hydro turbine can be efficiently operated in the wider range than thermal machine.
- Hydropower plant is possibly managed for energy storing in reservoir to produce electricity in the best period of economical interests. That is storing energy in off- peak hour and releasing energy during peak hour.This character of hydro plant is very good point compared with other renewable energy such as wind and solar.
- Hydropower site is available in rural and remote area, easily providing electricity for local load demand.
- Electricity which is generated from hydro machine is more reliable when comparison with other sources such as wind energy which fluctuate rapidly and unpredictably.
- The impacts of environment and social can be minimized.
- Hydropower is the cleaner energy system in which it concerns no carbon dioxide, sulphur dioxide, nitrous oxide or any air emissions and no solid or iquid waste generation. The promotion of the other kind of renewable energy for energy crisis solution could not be a response to greenhouse effect cure of the world
- The reservoirs of hydro energy are well recreation resource of the region in which it located.They support tourism's activities and fishery production. Thus hydro energy reservoir contributes to local economies.

Generally, hydropower is very useful source of energy. It is easy to control and manage. Also it is available in any part of country in which there is water flow. The very important advantage is hydropower is clean and indigenous renewable energy

Hydro-Power Potential in Thailand

Many survey of hydropower potential in Thailand, especially the potential of small and large scale project, had been studied in the past decades. Though the data might not exactly accurate at the present due to the change of many parameters, these data are still very useful in planning about hydropower in Thailand.

In 1990,Electricity Generating Authority of Thailand (EGAT) had evaluated hydropower potential in Thailand based on 1:50,000 scale map. The outcome of hydropower potential data are presented in a report – Hydro Power Database Series Volume 1,Hydro Power Potential in Thailand (Medium

to Large Scale) [2]. The study was focused mainly on the projects of 5 MW and larger capacity because at that time the projects of less than 5 MW are very less economy. Upon the database and with the changing of the formal study potential projects which have been already developed to be the existing projects, it can be shown hydropower potential in Thailand as follow :-

Table 2 Hydropower potential in Thailand

	Installed Capacity (MW)	Annual Energy (MkWh)
Existing Medium to Large Plants of EGAT		
Central Region	1,058.0	1,507.0
North-Eastern Region	743.2	598.0
Southern Region	329.5	527.0
Northern region	1,279.2	1751.0
Total	3,409.9	4,383.0
Potential Medium to Large Projects		
Central Region	1,592.7	4,338.70
North-Eastern Region	363.3	781.1
Southern Region	645.6	1,447.80
Northern region	1,896.6	5,361.8
Total	4,498.2	11,929.4
Potential Pumped Storage		
Central Region	6,019.00	7,576.20
North-Eastern Region	3,400.00	5,801.80
Southern Region	395.00	519.00
Northern region	993.00	1,330.00
Total	10,807.00	15,227.00
Existing Small Plants	43.78	184.66
Potential Small Projects	362.27	1,529.39

The estimation of mini and micro hydropower potential figured out in 1979 by Prapath Premmani [1], based on 1:250,000 scale map covering an area of 68,760 km^2 gave the figure of 1,066 MW with the flow rate varying 2.05 liters/sec/km^2 to 10.55 liters/sec/km^2. The investigation on hydropower potential for medium and large projects prepared in 1978 showed that there was possibility of developing at least 24,576.9 MW which would yield annual energy around 106,710.5 MkWh. This given figure includes the potential on the international rivers between Thailand and neighboring countries.

In 2003, there was the investigation of renewable energy in Thailand by Ministry of Energy [3]. This estimation revealed the figure of 700 MW of small hydropower potential in Thailand.

The other potential sources of small hydropower which are under evaluation are hydro energy from irrigation dams, which have more or less 600 sites around country. Also, the potential to generate electricity from sea or ocean could be study in near future.

Existing Condition of Mini and Micro Hydro-Power in Thailand

In present, many small sizes of hydropower plants are operating in rural and remote area of Thailand. From database of Department of Alternative Energy Development and Efficiency (DEDE) [4], in 2002 there are 21 sites of small hydropower plant. Fifteen plants are located in

northern and 6 plants are located in the other regions of Thailand. The installed capacity of all plants is around 40,688 kW which can yield annual energy approximately 80.3 MkWh. Most of these small hydropower plants are generating current supply to local demand of communities directly and some of them are connected to national grid. All that figures are not include micro or village size of hydropower plant, in present [5], there are 75 projects of village plants located around country with installed capacity around 2,487.50 kW and they provide electricity to approximately 11,809 households. The village size hydropower plants of 4 projects are under installing with capacity of 125 kW for supplying electricity to 627 households. All these small hydropower plants meet the purpose in rural and remote areas. The critical problem of that small hydropower plants is not the method of operation or the price of fuel, the problem is maintenance, which is a big difficultly for people who has local know-how.

Another important point that we could consider is most of small hydropower machines were imported. It means that our country spent a lot of money in buying technology which is not the new kind. Generally hydropower is a mature technology which is developed for more than 100 years.

Impression of the Small Hydro Power Plant

It is known that energy is the basic resource in developing. The value of energy is taken account into every activity of country development. Thus it might be worst economy for country in export Baht for import energy. To save Baht, the indigenous energy resources could be developed as much as possible. However, Baht could also be saved by not dependent on import technology of energy generating machine too.

Among all kinds of renewable energy, hydropower is proved that it is green energy, available potential, cheapest, etc.Unfortunately, large scale hydropower project is hardly to develop in present time due to the resistant of people who is possibly affected from the project and due to there is few potential sites left in Thailand. However, the alternative of small size of t hydropower project is still opening. Under the existing potential of small hydropower projects in Thailand, if all projects will be developed, it can lead into big amount of saving Baht in each year (by roughly estimated, it can save at least 40,000 million Baht in importing energy per year).

Technical Aspect

Even small hydro power plants were installed in many regions of country in order to generate electricity to communities or network; however they are not as many as their potential. Altogether, if all small hydropower projects will be developed by importing, it may not make any economy for the country. The suitable solution is self dependency technology by using local content of hydropower machine more and more until local manufacturer can produce whole parts of machine. Thus, the aspect of research should be the experimental research and development, emphasis on using local content as much as possible without expectation in very high efficiency of machine in first step. When the experience and skill is gained enough then the research could go on into. each detail of content of hydro machine.

Nevertheless, research aspect is necessary aims to adapt small hydro design for the local condition such as very low head turbine, which is a break for many potential small hydro projects. The other helpful researches could also concern on the topics such as searching for new potential hydropower in country, hydro energy management hydropower for ecological system, civil

construction, low cost hydro machine with higher performance and the study in which to set up knowledge base of hydro power in Thailand.

Policy Aspect

The development and adaptation of small hydropower projects in Thailand can go on very well by not only there are good researches in country but also it could be driven from national policy.Thus the aspect of policy could point to dependency on indigenous renewable energy which is clean and cheap. Altogether, policy could aim to independency on imported technology. The appropriate subsidize from government for local technology could be taken action to support local manufacturer and local researcher in field of small hydro energy. The percentage increment of local content in hydro machine could be forced within suitable time in order to motivate and support Thai manufacturer and technologist. The financial support for development of small hydropower technology could be funded.

Conclusion

Small hydropower is the important alternative choice of future renewable energy projects that will be developed in Thailand. It is available, clean energy and cheap. However, the appropriate development of small hydropower in future of country could be upon self-dependency in technology as much as possible. The aspect of research, development and policy could be stipulated appropriately and if all aspects are good promising, the benefit of small hydropower projects will be gained significantly.

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