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Prospects and Challenges of Harnessing Renewable Energy Source in the Philippines: The Pico-Hydro Experience

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Abstract:

Philippines is rich not only in natural resources but also in renewable energy sources. As an archipelago that consists of more than 7,000 islands, water as a source of energy is abundant. Wind in its coastal areas is also abundant. Considering its long coastlines, tides and waves could also be harnessed as potential sources of energy aside from the all year round availability of solar energy from the sun that could be harnessed in the Philippines. In spite of these, the country is still dependent on non-renewable sources of energy.

The Philippines, however, is also a developing country where energy is not only a necessity for most people but a luxury. There are still more families who cannot afford to have electricity in their homes. And most of these families live within rivers where energy could be found. In this case, a pico- hydro that can provide 500 watts could light up more houses. But the question is, would it make an economic sense to produce more pico-hydro in the country?

This study provides an analysis of using pico-hydro in the Philippines and its prospects and challenges which include some policy hindrances in the country. Pico hydro is installed in various areas in the Philippines with water flowing bodies and had been used by many families since 2008. Unfortunately, there is no solid national policy

pronouncement or support to increase the numbers in most areas where there is no electricity.

Key words: Harnessing Renewable Energy, Pico-hydro Electric Generating System, Philippines

INTRODUCTION

Philippines is rich in renewable energy. In fact there are about 264,228 MW (Alternative Energy Blog, 2008). In a study conducted by Renewable Energy Coalition, it states that the Philippines has the following energy potentials: Geothermal - 4,531 MW, Hydro-electric - 13,097 MW, Wind -76,600 MW, Wave - 170,000 MW, Biomass - 277 Million Barrels Fuel Oil equivalent (MBFOE)/year, and Solar Power - 5 ~ 5.1 kilowatt hour per square meter per day.

However, the Philippines remain to be dependent and one of the top importers of petroleum products which are fossil fuels that is high in the market considering it as a depleting resources. Notwithstanding the fact the there is a continuing crisis in the Middle East that affects the price of petroleum considering that these countries which is now politically unstable are oil producing countries.

Fortunately, there are efforts on the part of the government that tries to resolve the issue of continuing dependence to petroleum products, the reason why it created and energy summit. Although they are convinced that there's a need to tap other energy sources, they are actually differs in strategy. For instance, Jose Juliano of National Academy of Science and Technology proposes a nuclear energy to support the energy requirements of the country, while on the other hand Kelvin Rodolfo, a Professor at National Institute of Geologic Studies proposes a more conservative geothermal energy as a more innovative source (Ocbina, 2008).

In 2008, Republic Act 9513 was enacted or the Renewable Energy Act of 2008 and tits declaration of policies are as follows, to wit:

(a) Accelerate the exploration and development of renewable energy resources such as, but not limited to, biomass, solar, wind, hydro, geothermal and ocean energy sources, including hybrid systems, to achieve energy self-reliance, through the adoption of sustainable energy development strategies to reduce the country's dependence on fossil fuels and thereby minimize the country's exposure to price fluctuations in the international markets, the effects of which spiral down to almost all sectors of the economy;

(b) Increase the utilization of renewable energy by institutionalizing the development of national and local capabilities in the use of renewable energy systems, and promoting its efficient and cost-effective commercial application by providing fiscal and non-fiscal incentives;

(c) Encourage the development and utilization of renewable energy resources as tools to effectively prevent or reduce harmful emissions and thereby balance the goals of economic growth and development with the protection of health and the environment; and

(d) Establish the necessary infrastructure and mechanism to carry out the mandates specified in this Act and other existing laws.

As far as policy pronouncement is concern, there is a growing concern on harnessing renewable energy in the Philippines. In fact there is already a new and existing laws and promotes and encourage the use of renewable energy. This paper will try to look for prospects and challenges facing the renewable energy sector in this country and will try to analyze the extent from which small pico-hydro which is known machines that can harvest small energy are not getting popularities in this country.

METHODOLOGY

This paper used secondary data to explain the prospects and challenges facing the renewable energy sector in this country. In addition this paper presented the breakthroughs of pico-hydro that was used in Central Luzon region and how it can be used to harvest energy. A presentation of those who benefitted from the pico-hydro technology was likewise highlighted in this paper.

RESULTS & DISCUSSION

Renewable Energy in the Philippines

The Philippines is one of the largest producers of geothermal energy in the world and perhaps second only to the United States of America in terms of installed capacity due to its location within the so-called Pacific Ring of Fire. Sprawled through its islands are volcanoes, hot springs, fumaroles, and areas that spurt sulfurous gasses and steam.

The seemingly endless wind power across the archipelago could be converted to wind energy, which in turn could be transformed into consumable electricity. Today's wind turbines use blades that are rotated by the wind's kinetic energy. These blades are connected to drive shafts that propel electric generators to produce electricity. Potential sites for wind power are in Batanes, Babuyan Islands, Ilocos Norte, Mindoro, Samar, Leyte, Cebu, Palawan, Panay, Negros Islands, among others.

The Philippines do not claim monopoly of tapping solar power but being in a tropical setting with continuous sunlight throughout the whole year, the country is on spot to maximize its energy potential. It has already benefited with the aggressive expansion of SunPower Philippines that invested

about Php27 billion on its second solar cell manufacturing site in the country.

Given its archipelagic landscape and wide coastlines, the country has unmatched potential for generating tidal power where its estimated theoretical capacity is about 170,000 MW. The initial list of these identified areas includes the Hinatuan Passage, Camarines, Northeastern Samar, Surigao, Batan Island, Catanduanes, Tacloban, San Bernardino Strait, Babuyan Island, Ilocos Norte, Siargao Island, and Davao Oriental.

To date, the total installed capacity of the Philippines' power generating plants is recorded at 15,937 megawatts. Although coal-fired power plants reflect 26% of power generation followed by oil-based at 23%, the renewable sources such as hydro, natural gas, and geothermal now account for 21%, 18%, and 12% respectively. In the industrial horizon, the wind and solar-based sources are evolving and in the future, could progress from its current share of 1%.

With its growing industrial demand, the Philippines still needs an additional 4,000 to 4,350 megawatts to sustain its national requirements. This is why power projects using renewable energy sources continue to be preferred activities in the 2009 Investments Priorities Plan (IPP). This means that a wider scale of tax and non-tax incentives could be provided to investors (DTI, 2011).

Renewable Energy and the Pico-Hydro

The Philippines, as a small electrical power producing country, has her people to pay a high price for its energy cost since the most of the power production in the country is mainly on fossil fuel-powered generating system. Based on our recent DOE data (October 2009), around 87.6 % - 95.8 % of power generated is produced from non-renewable emission sources.

Our natural energy resources should be calculated properly and given an in-depth attention to lessen the dependence on imported fossil fuel and by accelerating the development and proper harnessing of alternative energy sources such as wind, solar, hydro and other available resources which will suffice to meet future power requirements of our country in general.

Effective harnessing and utilization of the available natural and renewable energy sources such as the hydro energy can lead a country to a more sufficient power generation system, lower power consumption cost, reduction of power failures occurrence and system abnormalities, and decreased amount of maintenance cost (Naignis, et al., 2008).

In line with this national thrust for self-reliance and policies on energy, the developments of this project contribute to sustainable beneficial factor for remote rural villages. This study originated through establishing of the potentials but un-tapped water streams and irrigation canals that are abundantly found in the Province of Pampanga particularly in Barangay San Juan, Baño of Arayat, Pampanga. The residents and farmers of Barangay San Juan, Arayat had been relying on the abundance of continuous free flowing water of irrigation canals and water channels/streams that are coming from the natural springs of Mount Arayat.

Under a volume of almost 38 liters/sec water source coming from the main tributary streams of Mount Arayat, the research team focus on the development and evaluation of a 200 watts, single phase, 220 volts, 60 hertz Low Head type Pico-Hydro Generating System.

After considering all the possibilities, comments and suggestions, the team re-channeled and re- direct other sub - streams of water sources to have one common stream, and almost 76 liters / sec of water was acquired and sufficient enough to run a 500 watts LH type Pico-hydro generating

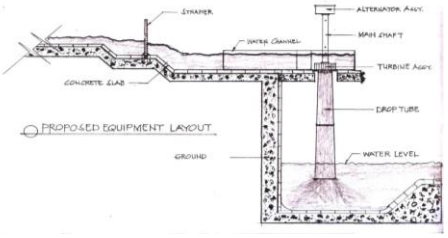
system, then team decided to re-design, modified and evaluate the performance of the improved Project.

According to Worksman, as mentioned by Buer, et al., experimental research is a type of research in which something is tried; one or more independent variables are manipulated or varied by the researcher. At least one variable is deliberately manipulated to determine the effect.

This improved type of low head - pico-hydro generating system designed at the Don Honorio Ventura College of Arts and Trades, is capable of producing 500 watts of electrical power output that can be used to energized 15 sets of 15 watts capacity of Compact Fluorescent Lamps (CFL) with individual switching controls and 2 sets of power outlets with not more than 100 watts of load capacity.

The Pico-Hydro Experience

The Pico Hydro was designed through Figure below. Also the actual installation and utilization in the area can be seen in the following Figures below.



The Water Main Stream

The Installed Pico hydro Electric Generator System

The installed park lighting system

The installed electrical system inside the 703rd brigade military barracks

The generated electrical power used for Cellphone charging

The Pico Hydro was installed at San Juan Baño, Arayat, Pampanga with the following environmental condition:

1. The area has two natural springs with volume capacity of no less than 125 liters on its reservoir;
2. The speed of water flows is at approximately 125 liters per second;
3. Water is available all year round with an average volume and flow velocity.
4. The community has around 150 individuals belonging to the armed forces of the Philippines (AFP)

The technical efficiency of the pico-hydro is as follows:

a. the pico-hydro has a distance of 10-12 meters from the source to the panel board inside the house with losses of around 1.7 volts
b. There were 3 barracks that uses the pico-hydro for pure lightning system and battery charging with around 10 CFL bulbs of n15 watts each, and two outlets that can served through battery charging and electric fan and one radio.

Important comparative equipment applications of pico-hydro available in the market are shown in the Table below.

TYPE / MODEL	**LH-PHEG-200**	**LH-PHEG-500**	**LH-PHEG-1000**
Rated power	200 watts	500 watts	1,000 watts
Water head	1.5 meters	1.5 meters	1.5 meters
Water Flow	35 liters/sec.	70 liters/sec.	130 liters/sec.
Net Weight	25.47kg.	45.4 kg.	N/A.
* Generator output	220 volts AC, 60 Hertz, single-phase, magnetic alternator		

This technology, the pico-hydro is a very handy and mobile in terms of its structures. But also it can provide enough energy to as many households, given its characteristics and description as could be seen in the Figure below.

With the introduction of energy from pico-hydro to the AFP in the area, there was a great appreciation and acceptance. Similarly if this technology will be delivered not only to AFP but to the marginalized communities in the area, chances are there will be additional dev elopement that can be imparted through this technology aside from providing energy for their effective livelihood activities.

Note, however that despite it being so cheap and can easily be put in areas where electricity can nowhere to be found and can be provided using the pico-hydro, still we cannot see many if not none at all.

The truth is this pico-hydro advocacy has been awarded in the region for being one of the innovative and readily available for extension project in providing electricity in marginalized areas where electric companies could not invest easily. And for more than two years, no effort has been made by agencies involved in mass producing this technology to be put in areas where there is the same environment and where electricity is not available.

CONCLUSION

This technology not only provides energy to the marginalized and rural communities but also harness what is available in the area. This is an exemplary example of providing energy using alternative renewable energy source, an energy that does not harm the environment but helping the marginalized and poor people of this country.

However, although, it has been made clear in most national policy pronouncements that there is a need for these renewable energy to be harness and harvested, less effort on the part of line agencies and the government to invest on this type of technology.

This is a classic case where the government seems to be favorable in capitalizing the available energy which is also renewable by in reality; they are much favorable to other sources of energy which can easily and readily be bought elsewhere.

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