

DOES AN ENERGY INDEPENDENT VILLAGE BE FORMED IN NORTH SUMATRA PROVINCE? CASE STUDY: BULUH AWAR VILLAGE, SIBOLANGIT SUB-DISTRICT, DELI SERDANG DISTRICT

*Apakah Desa Mandiri Energi dibentuk di Provinsi Sumatera Utara?
Studi Kasus: Desa Buluh Awar, Kecamatan Subolangit, Kabupaten Deli Serdang*

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Abstract

The potential of renewable energy in the province of North Sumatra has not given confidence to the provincial government to establish Energy Independent Village (EIV). This paper aims to describe the utilization of renewable energy in the village Buluh Awar who have had success using a water-based renewable energy as a source of electrical energy for 25 (twenty-five) years. The approach in this study is qualitative and uses data collection techniques such as observation and interview. The study was conducted in May 2016 and took place in the Buluh Awar village, Sibolangit sub-district, Deli Serdang District. The village was chosen because it has been using the power source coming from renewables for 25 (twenty-five) years, but has not been designated as EIV. The informants were: the user community; plant manager; headman; Department of Mines and Energy (Distamben) North Sumatra Province; and, Distamben Deli Serdang. Analysis of the factors that play a role in the utilization of renewable energy shows that the North Sumatra Province has the ability to form the EIV. Based on the analysis of the factors that play a role in the utilization of renewable energy, it can be concluded that the village Buluh Awar has the ability to set as DME, if followed by the intervention of the local government by providing technical assistance to improve generating capacity so that it can generate more electric power so that society can do creative activity that can push economic growth at Buluh Awar village.

Keywords: electricity, IV, renewable energy, water

INTRODUCTION

Potential sources of renewable energy, particularly water resources, spread over 20 (twenty) district in North Sumatra, but until now this potential has not been optimized to meet the power demand, especially in villages that have not affordable electricity network of PT PLN. Deli Serdang is one of the district that has potential water resources for Micro Hydro Power (MHP) reached 79,909 MW (Table 1). Deli Serdang District is only 2 (two) hours from the capital of North Sumatra Province, but there are still

villages that have not been reached by the electricity from PT. PLN. A total of 34 villages from 12 sub-districts in Deli Serdang District until 2016 have not yet electricity. Since 2007 The Government of the Republic of Indonesia has launched a program of Desa Mandiri Energi (DME)/Energy Independent Village (EIV) as the government's efforts in the development of energy in rural areas and making the supply of energy as an entry point in the development of rural economic activities (Prasetyo 2011).

Some provinces in Indonesia, which has an EIV namely: West Nusa Tenggara has 13 EIV and West Sulawesi with 128 EIV (Badan Penelitian dan Pengembangan ESDM 2013).

Table 1. Potential of Micro Hydro Power Plant in North Sumatera

No.	District / City	Potential (MW)
1	Tapanuli Tengah	3.427
2	Tapanuli Utara	45.637
3	Tapanuli Selatan	76.807
4	Langkat	78.387
5	Karo	97.548
6	Deli Serdang	79.909
7	Simalungun	104.756
8	Asahan	77.934
9	Labuhan Batu	1.009
10	Dairi	74.519
11	Toba Samosir	112.096
12	Mandailing Natal	161.234
13	Humbang Hasundutan	10.048
14	Samosir	43.037
15	Serdang Bedagai	15.608
16	Padang Lawas Utara	85.397
17	Padang Lawas	70.998
18	Labuhan Batu Selatan	9.106
19	Labuhan Batu Utara	40.374
20	Padang Sidempuan	13.979
Total Potential		1201.81

Source: Directorate General of Renewable Energy and Energy Conservation of the Ministry of Energy and Mineral Resources,(2016)

The experience of other provinces in Indonesia that have been successfully formed DME and utilize renewable energy, showed that the success of the utilization of renewable energy is determined by the following factors (Badan Penelitian dan Pengembangan ESDM 2013)(Badan Penelitian dan Pengembangan Kementerian Energi dan Sumber Daya Mineral RI 2014):

1. Availability of the technology.
Technology is one thing that is very important for the development of EIV. However, in the formation of EIV can be done using simple technology. In general, areas in Indonesia which own EIV, as in Nusa Tenggara Barat with 13 EIV and West Sulawesi with 128 EIV. which for the construction of funds provided by the government through state and local budgets. Generation technologies are used according to the renewable energy potential in the local area.
2. Policy / Regulation / Government Programs.
Support for the utilization of renewable energy shown by the availability of government regulations related to energy and electricity, such as the formation of the Regional Forum of Electricity and Energy; Governor Regulation on the tariff cost of installation; Provincial Regulation on improving the quality and energy networks; General Plan Regional Energy; General Plan of the Regional Electricity; and promotion of the renewable energy potential abroad and invite investors. To fully support the development of renewable energy infrastructure necessary synchronization intergovernmental implementation of highest to lowest levels also contribute to the success of renewable energy utilization.
3. Socialization and Education.
Socialization and education is an important thing to do in supporting the utilization of renewable energy. This is done considering the success in the utilization of renewable energy depends on the involvement of stakeholders through a common perception that can be done through the process of socialization and education. The government's commitment to renewable energy utilization is indicated by incorporating the technology in the curriculum of Vocational High School as did by the

Government of West Sulawesi province. Availability of power sources that has been felt by the public, will also indirectly increase the information to be obtained through the medium of television or radio, so that the knowledge society is increased and can generate new ideas for the betterment of the village.

4. Multi-Party Cooperation / Stakeholders. The utilization of renewable energy which are driven by the government will be impacted if supported by the community, the private sector, and NGOs. Involvement of all parties is needed to optimize the implementation and sustainability of renewable energy development in the area. Multi-party cooperation must be based on mutual agreement that is poured into a Memo of Understanding (MoU) so that each party will run in accordance with the duties and responsibilities listed in the MoU.
5. Community Participation. Community participation is essential in the management of renewable energy. It is inevitable that the majority of the EIV's success is influenced by community involvement in managing the generator. The generator provided by the government will not last long if it is not followed by maintenance done by the community.

Water resources in Deli Serdang Regency is potential to become Energy Independent Village. However, until now DME has not been established in North Sumatra Province labeled DME. Until now EIV has not been formed in North Sumatra Province. This study aimed to analyze the region's ability to take advantage of renewable energy in order to establish the EIV. The results of this study can be an input for the provincial / district government to focus on the development of electrical energy from renewable resources, as well as an opportunity for investors to invest in the renewable energy sector.

METHOD

The approach in this study is qualitative and uses data collection techniques such as observation and interview. The study was conducted in May 2016 and took place in the Buluh Awar village, Sibolangit sub-district, Deli Serdang District. The village was chosen because it has been using the power source coming from MHP for 25 (twenty-five) years, but has not been designated as EIV. The informants were: the user community; Department of Mines and Energy (Distamben) North Sumatra Province; and, Department of Mines and Energy (Distamben) Deli Serdang.

RESULTS AND DISCUSSION

Deli Serdang district has an area of approximately 2497.72 km² and has 22 (twenty-two) districts, namely: Gunung Meriah, STM Hulu, Sibolangit, Kutalimbaru, Pancur Batu, Namorambe, Sibiru-biru, STM Hilir, Bangun Purba, Galang, Tanjung Morawa, Patumbak, Deli Tua, Sunggal, Hamparan Perak, Labuhan Deli, Percut Sei Tuan, Batang Kuis, Pantai Labu, Beringin, Lubuk Pakam, dan Pagar Merbau. With the number of villages as many as 380 village with a population density reach 755 inhabitants/km².

Geographically located at 2°57'00"-3°19'00" north latitude and 93°33'00"-99°27'00" east longitude at an altitude of 0-500 m asl (Badan Pusat Statistik Provinsi Sumatera Utara 2015). On the north bordering Langkat and the Strait of Malacca, the South with Karo and Simalungun, on the east by Serdang Bedagai and on the west with the city of Binjai, Karo and Langkat, Deli Serdang district in the central part around the city of Medan. Based on the geographical conditions of the area is divided into the mountainous region, lowland and the coastal plain, and there are five (5) Watershed (DAS), namely: DAS Belawan, DAS Deli, DAS Belumai, DAS Percut, and DAS Ular, with an area of

378,841 ha all of which empties into the Strait of Malacca to the upstream located in Simalungun and Karo District.

The climatic conditions of the area has an average rainfall of 1936.3 mm per year with generally rainfall in September, October, November and December. The wind that blew through the area is also different from the sea breeze and the mountain air with a speed of 0.68 meters / second, while the average temperature is

26.7° and the humidity 84%. Climatic conditions have made the Deli Serdang regency has potential, among others: agriculture, plantations (palm, rubber, cocoa, etc.), animal husbandry, fisheries (land and sea), industrial and tourism (attractions) and a potential source of energy. The Ratio of Electrification (RE) in Deli Serdang until 2015 has reached 95% with the the number of villages that do not have electricity around 33 villages and 2,746 households

Table 2. The un-electrified village in Deli Serdang District

No.	District	Village	Number of Household
1.	Hampan Perak	Paluh Kurau	111
2.	Bangun Purba	Bandar Gugung	24
3.	Galang	Paku	13
4.	Labuhan Deli	Karang Gading	70
		Telaga Tujuh	35
5.	Pagar Merbau	Perbarakan	3
		Tanjung Garbus Kampung	7
		Suka Mandi Hulu	3
6.	Sibolangit	Buluh Awar	350
		Rumah Kinangkung	220
		Sala Bulan	187
		Ujung Deleng	140
		Negeri Gugung	150
		Cinta Rakyat	160
		Bukum	200
		Tanjung Beringin	120
		Tambunen	200
7.	Tanjung Morawa	Naga Timbul	25
8.	STM Hulu	Rumah Sumbul	50
		Tanjung Bampu	59
		Tiga Juhar	60
9.	Pancur Batu	Bintang Meriah	50
		Durin Tonggal	50
		Durin Simbelang	15
		Namo Riam	30
		Sugau	15
		Sei Glugur	10
10.	Sunggal	Tanjung Selamat	40
		Sunggal Kanan	200
11.	Kutalimbaru	Pasar X	15
		Namo Mirik	16
		Suka Makmur	68
		Suka Dame	50
12.	Lubuk Pakam	Tanjung Garbus	-

Source: Agency of Cipta Karya and Mining of Deli Serdang District, 2016.

Buluh Awar village is located in Sibolangit districts, Deli Serdang counties, North Sumatra Province. Availability of electricity derived from the MHP in Buluh Awar village has been use by the public for 25 (twenty-five) years, precisely since 1991. Activities of daily community are farming and gardening with income ranging from Rp 1,000,000 (one million rupiahs) until Rp.2,000,000 (two million rupiahs) per month. The level of education is starting from Junior High School to High School. The time it takes for villagers to reach the causeway / provincial road takes less than 1 (one) hour through the village streets with the hilly topography, further to reach the district capital takes two (2) hours. Based on the condition of Buluh Awar village, Government of North Sumatra Province has not declared the village as EIV.

Based on the factors influencing the success of DME formation in other provinces in Indonesia described in the introduction to this article, the condition of each of these factors in Buluh Awar village can be explained as follows: The condition of Buluh Awar village in the terms of the factors mentioned above, can be explained as follows:

Availability of the technology

The technology used to produce energy from water resources is a cross flow turbine types and has been operating for 25 (twenty-five) years. Turbine development was first carried out by the Institute of Social Organizations (NGOs) in this case Ati Keleng Foundation Karo Batak Protestant Church (YAK GBKP) since 1988 and began operation in 1991 and was named MHP Buluh Awar. The capacity of the turbine can generate up to 25kW power is distributed to meet the electricity needs of 115 families in the village. There are 105 (one hundred and five) customers get the power supply of 450-watt, and 10 (ten) customers with 900-watt power supply. The electric power used to turn on electronic equipment such as lights, TV, refrigerator and rice cooker.

MHP available generating units at the site of research to date can only be used for household activities, so it can not contribute to the improvement of economic activities which is one of the criteria DME (Juwito et al. 2015). The technology is a hybrid could be one solution for the utilization of renewable energy in order to form EIV. Technology Hybrid Power System (HPS) based on wind and sun are already implemented in Algeria, for the house located at an altitude of 89 m above sea level Mediterranean (Derrouazin et al. 2014). As for the research site conditions, water-based HPS and solar potential for use.

One of the areas in Indonesia who have been using hybrid technology that is in Pandansimo in Bantul. Hybrid Technology Implementation in Pandansimo harness wind and solar energy (solar panels) to a power source. The development of this area is a partnership with the Ministry of Research and Technology, National Institute of Aeronautics and Space, University of Gajah Mada, and the Directorate General of Higher Education. Implementation Technology Hybrid will be one incentive research in the field of windmills and solar cell that will grow and develop the economy through community empowerment (Badan Penelitian dan Pengembangan Kementerian Energi dan Sumber Daya Mineral RI 2014).

Policy / Regulation / Government Programs

Until 2015, the electrification ratio (RE) Deli Serdang which is 95%. As a district directly adjacent to the city of Medan, the capital province, Deli Serdang is expected to achieve 100% electrification ratio as Tebing Tinggi and Pematangsiantar. Although the Medium Term Development Plan (RPJMD) North Sumatra Province in 2013-2018 had to state clearly about the crucial issues in the construction of electricity that occurred in North Sumatra, namely: a) growth in generating capacity is still lower than the growth in electricity demand; and, b) there are still many villages in remote areas in North Sumatra that have

not been entered by the electricity network. So that the public policies and regional development programs in North Sumatra Province for the construction of electricity conducted through: a) Provide a source of energy for the needs of society, particularly from renewable energy sources and environmentally friendly; and, b) Increase the availability of electrical energy capacity with a focus on the use of renewable energy to electrical energy needs for the community and the business world with the nomenclature of its program of service development and new renewable energy electricity with success indicator is the increase in the ratio of electrified villages from 84.63% to 95% and increase the RE to 96%.

Policies that have been implemented by the Government of North Sumatra province in order to utilize renewable energy derived from water resources is to build MHP funded by the local budget and the National Budget. Until now there are 7 (seven) MHP unit spread in several district, namely: Deli Serdang, Karo, Asahan, Labuhan Batu, Mandailing Natal, and Central Tapanuli. Department of Mines and Energy at provincial and district level is the executor of activities, as well as the Ministry of Energy and Mineral Resources as the executor of policies at the national level. Until now there has been no initiative to plan activities that support the sustainability of plants such as monitoring and evaluation. In line with government objectives on EIV program in order to diversify the energy, this should be the starting point for each area to form EIV in their respective areas. The field findings show that the Government of North Sumatra province have yet to plan the establishment of EIV.

Based on interviews with informants from the governments at provincial and district level, policy towards the use of renewable energy in the form of legislation/regulation is absolutely necessary for optimal utilization of the potential of renewable energy. Regulations related to renewable energy should be made in detail

from planning, organizing, implementation, monitoring and evaluation.

When compared to other provinces in Indonesia, such as West Sulawesi which has 128 EIV, North Sumatra Province has not had a General Plan of the Regional Electricity and the General Plan Regional Energy, which can be the basis in drafting other regulations related to renewable energy. This is because in the Strategic Plan (Plan), plan on the utilization of renewable energy has not been clearly defined. National Energy Policy issued by central government has not become a reference for the province or regency/city to expeditiously formulate policies/regulations in each level. Until now, the only achievement of the increase in RE that became the focus of Provincial/District to prepare a work plan related to energy management. Synchronization between the government program at the central level, provincial and district became one of the keys to optimizing the management of renewable energy. As previous research concluded that a lack of awareness for national intentions on subnational levels and vice versa as well as missing consultation during policy formulation are major obstacles for renewables support in Indonesia (Marquardt 2014).

Socialization and Education

Knowledge of renewable energy utilization by the public at the village Buluh Awar came from NGOs that providing the generating units. During the period of 2 (two) years, people given the knowledge of the operation and maintenance of generating units. After two (2) years, the generating unit handed over to the community to be managed independently. However, people are still asking for help to NGOs when facing problems related to the financing or technology. Each year the community held elections plant operators and managers in charge of tending and managing power plants. Knowledge of treatment and management of acquired hereditary and is still very limited.

Besides the local community has not taken the initiative to continue their education at vocational schools as well as to the university to gain knowledge that can be used to retain the continuity of the power plant in their village. In order to increase public knowledge to manage the plant, cooperation with other parties such as higher education is one solution. As has been done by the people in the village Sendangsari, Minggir sub district, community cooperation with various parties, especially with the Gadjah Mada University and the Ministry for Research and Technology of Indonesia (Setiawan & Setiawan 2013).

Multi-Party Cooperation/Stakeholders

Sustainability of the plant is determined by the cooperation of all parties to manage it. MHP Buluh Awar is built on the basis of non-government based on the principle of kinship, mutual cooperation as well as cooperation with YAK GBKP and villagers Buluh Awar. The absence of government elements in the utilization of renewable energy in the village Buluh Awar turned out to not be a deterrent. In previous research, the number of actors involved in renewable energy in Indonesia become an obstacle in their utilization (Marquardt 2014).

Community Participation

The findings of the field at the location of the research shows that community participation is very high in the utilization of renewable energy. As an end user, the community is very aware of his involvement. Participation is indicated by the formation of caretaker manager Buluh Awar MHP village consisting of elements of society. Stewardship is set forth in the Articles of Association (AD) and Bylaws (ART) PLTMH Buluh Awar. For the cost of plant operation independently collected through a monthly fee of Rp. 50,000 (fifty thousand rupiahs) per month per household. Another initiative has undertaken by the community

in which to borrow money from the Bank to finance the repair of damage turbine.

A socio-psychological approach for studying renewable energy communities in Germany and the Netherlands show that decreasing energy costs and addressing climate change considerations played a role in the decision, but in the background hedonic motivations were also present, such as having fun and integrating in a community. Tailor-made incentives addressing the different types of motivations can be more effective for the support and spread of renewable energy communities (Dóci & Vasileiadou 2015).

CONCLUSIONS

Based on the analysis of the factors that play a role in the utilization of renewable energy, it can be concluded that the village Buluh Awar has the ability to set as DME, if followed by the intervention of the local government by providing technical assistance to improve generating capacity so that it can generate more electric power so that society can do creative activity that can push economic growth at Buluh Awar village.

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- PLTMH:** Pembangkit Listrik Tenaga Mikro Hidro (Micro Hydro Power Plant/MHP)
PT PLN: PT Perusahaan Listrik Negara (The State Electricity Company)
DAS: Daerah Aliran Sungai (Watershed)
YAK GBKP: Yayasan Ati Keleng Gereja Batak Karo Protestan (Ati Keleng Foundation Batak Karo Protestant Church)

Abbreviations

DME: Desa Mandiri Energi (Energy Independent Village/EIV)

Dirjen EBTKE KESDM: Direktorat Jendral Energi Baru Terbarukan dan Konservasi Energi Kementerian Energi dan Sumber Daya Mineral (Directorate General of Renewable Energy and Energy Conservation of the Ministry of Energy and Mineral Resources)

Distamben: Dinas Pertambangan dan Energi (Department of Mines and Energy)

PLTS: Pembangkit Listrik Tenaga Surya (Solar Power Generator)