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A Review of Micro Hydro Power Plant (MHPP) as a Solution to Reach Remote Areas of Electricity

(Tinjauan Pembangkit Listrik Tenaga Mikro Hidro (PLTMH) Sebagai Solusi untuk Menjangkau Daerah-Daerah Terpencil)

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Abstract:
A micro hydro power plant (MHPP) is a small-scale power plant that converts the potential energy of the air into mechanical work, turning turbines and generators to generate electrical power. Small scale, which is around 0-100 kW. The construction of a Micro-hydro Power Plant (MHPP) is an alternative supply of electrical energy, especially in rural areas that are not covered by the electricity grid State Power Plant. MHPP has a high potential as an alternative to renewable energy sources. Thus, the reliability of the system built is a must forget quality electricity. In a power plant, what is considered is the stability of the output voltage generated by the generator; this is necessary to keep the consumer's equipment from being damaged. Unstable voltage can also Age-reduce equipment (lifetime) owned by consumers.
Keywords: *Micro Hydro Power Plant 2; Alternative, 3; Electric Power*

Abstrak
Pembangkit Listrik Tenaga Mikro Hidro (PLTMH) merupakan pembangkit listrik skala kecil yang mengubah energi potensial udara menjadi kerja mekanis, memutar turbin dan generator sehingga menghasilkan tenaga listrik. Skala kecil yaitu sekitar 0-100 kW. Pembangunan Pembangkit Listrik Tenaga Mikro Hidro (PLTMh), merupakan salah satu alternatif penyediaan energi listrik khususnya di wilayah pedesaan yang belum terjangkau jaringan listrik. PLTMh merupakan alternatif yang sangat potensial jika dibandingkan dengan sumber energi terbarukan. Dengan demikian, keandalan sistem yang dibangun harus melupakan kualitas listrik. Dalam suatu pembangkit tenaga listrik sangat diperlukan yang diperhatikan adalah kestabilan tegangan keluaran yang dihasilkan oleh generator, hal ini diperlukan untuk menjaga peralatan konsumen agar tidak mengalami kerusakan. Tegangan yang tidak stabil juga dapat mengurangi umur peralatan (lifetime) yang dimiliki konsumen.

Kata Kunci*: 1; PLTMH 2; Alternatif 3; Tenaga Listrik*

PENDAHULUAN

In the effort to develop the electricity system in Indonesia, a cost-effective, efficient, and easy-to-maintain source of renewable energy is needed. One of the energy sources developed is the Micro Hydro Power Plant (MHPP). As we know, a Micro Hydro Power Plant is a small-scale generator that utilizes water flow as a source of energy production it is called clean energy because it is environmentally friendly and includes a renewable and feasible energy source. The construction of a Micro Hydro Power Plant can be said to be simple, easy to operate, and in terms of maintenance, it is cheaper so it can save costs and is more efficient because Micro Hydro Power Plants only need water to drive a mill which is then converted into electrical energy by a generator.

In terms of environmental friendliness, as has been explained, a Micro Hydro Power Plant is an environmentally friendly generator because the energy source used by the Micro Hydro Power Plant is the flow of water that drives the mill. Micro hydroelectricity does not cause pollution. This is, of course, different from other power plants in Indonesia. Power plants in Indonesia, the main source of energy, mostly use fossil fuels, which are carried out by combustion, which causes air pollution.

Micro Hydro Power Plants of energy sources that utilize airflow would be very relevant if they were developed in Indonesia. This condition is because if a river or water flow complies with certain parameters related to a Micro Hydro Power Plant, for example, water discharge, potential difference, and waterfall point, it can be used as the main energy source for Micro Hydro Power Plants. Based on geographical conditions, Indonesia is located on the equator. Which has forests and mountains, in which there are many rivers. In addition, it is also supported by tropical climate conditions in Indonesia, where there are only two seasons, namely the rainy and dry seasons. This condition, of course, guarantees the availability of water to drive the Micro Hydro Power Plant (MHPP). During the rainy season, the water will fill the rivers or dams or reservoirs, and some of the water will be absorbed by the plants so that during the dry season, the availability of water in the dams and plants can drive the waterwheels.

The need for electrical energy from year to year is increasing. This is in line with the increasing economy and population in Indonesia. The process of electricity distribution is a way to distribute electricity that comes from large power sources commonly called a power plant (bulk power source) to consumers or electricity users. The process of electricity transmission is a process

of distributing the electric voltage generated by the power plant to another place that has a higher voltage than the main voltage source to the substation.

Not all areas get an equal distribution of electricity. Based on data from Tracking SDG 7: The Energy Progress Report 2020, as many as 789 million people do not have access to electrical energy. According to data from the Ministry of Energy and Mineral Resources (ESDM), the distribution of power plants and distribution of electricity in Indonesia is more evenly distributed on the islands of Java, Bali, and Nusa Tenggara. Next, it is followed by the regions of Sumatra, Sulawesi, and Kalimantan, while the regions with the lowest distribution of electricity are Maluku and Papua. This is one of the benchmarks for the progress of an area.

Reviewed in more depth, every year there is an increase in the human population which automatically increases the demand for needs in various sectors, including the provision of electricity. In remote areas to meet their electricity needs, the construction of a Micro Hydro Power Plant (PLTMH) can be an alternative solution to solving the problem. This power plant works by utilizing the existing water discharge in the river flow. For the implementation to run optimally, the surrounding community living in an area must be educated about the MHPP, one of which is by carrying out scheduled socialization, so that when they have received an overview, villages in Indonesia are simultaneously transformed into energy-independent villages.

METODOLOGI PENELITIAN

Research is qualitative with the approach used in the form of a literature study. The literature study was carried out by reviewing the results of 10 previous studies that were published from 2019 to 2023, the articles were in Indonesian, the articles came from the database in the form of perplexity and the articles were published in the text. The literature study began by selecting several articles based on their context. each article that has been selected based on its grouping, then conclusions and descriptions are made explaining the potential, utilization, and solutions of electricity in the future.

HASIL PENELITIAN DAN PEMBAHASAN

Bagian Based on the description of the method above, in this writing, ten (10) scientific articles were selected as the main articles to answer the research objectives. From this article, the authors found several things that could be

concluded: (1) how to make micro-hydro power plant technology, (2) how does micro-hydro power plant (MHPP) work, (3) what are the advantages and disadvantages of micro-hydro power plants micro hydro power (MHPP).

Table 1. Research on MHPP

Judul Artikel dan Penerbit	Penulis, Tahun	Keterangan Paper
Pembangkit Listrik Tenaga Mikro Hidro (PLTMH) Sebagai Solusi Jangkauan Daerah Terpencil Sebagai Tepat Jangkauan	Aufa aqmal labib 2021	Upaya pengembangan sistem kelistrikan di Indonesia diperlukan sumber energi baru terbarukan yang hemat biaya, efisien serta mudah perawatannya.
Proses perakitan dan pengujian Pembangkit Listrik Tenaga Mikro Hidro dengan Turbin Crossflow . Universitas islam "45" Bekasi.	Jurnal Ilmiah Teknik Mesin 2022	Perancangan dilaporan ini membangun alat Pembangkit Listrik Tenaga Mikrohidro dengan modifikasi Turbin, mekanisme gerak dan langkah-langkah Pembuatan alat PLTMH dari awal hingga pengetesan.
Potensi Pemanfaatan Pembangkit Listrik Mikrohidro(PLTMH) di kabupaten Pegunungan Arfak	Antonius D palintin 2020	Pembangkit Listrik Tenaga Mikrohidro (PLTMH) merupakan pembangkit yang berkelanjutan dan ramah lingkungan. Penelitian ini mengkaji tentang potensi PLTMH dengan menentukan debit andalan dan beda tinggi dari beberapa sungai di tiga distrik: Minyambouw, Hingk dan Sururey, Kabupaten Pegunungan Arfak.
Analisis Potensi Pembangkit Listrik Tenaga Mikrohidro Di Air Terjun Gollae Kabupaten Pangkep	Nurhadiah 2022	Di saat sumber energi lain mulai menipis dan memberikan dampak negatif, maka air menjadi sumber energi yang sangat penting karena dapat dijadikan sumber energi pembangkit listrik yang murah dan tidak menumbulkan polusi. Banyak daerah pedesaan di Indonesia yang dekat dengan aliran sungai yang memadai untuk pembangkit listrik. Diharapkan dengan memanfaatkan potensi yang ada di desa-desa tersebut dapat memenuhi kebutuhan energinya sendiri dalam mengantisipasi kenaikan biaya energi atau kesulitan jaringan listrik nasional untuk menjangkaunya.
Pengaruh Sudut Kemiringan Head Turbin Ulir dan Daya Putar Turbin Ulir dan Daya Output Pada Pembangkit Listrik Tenaga Mikro Hidro	Putu Juliana 2018	Aliran air dari suatu ketinggian tertentu memiliki energi potensial. Tenaga air (hydropower) dihasilkan dengan mengubah energi aliran air dengan kincir air atau turbin air menjadi tenaga mekanis yang berguna. Daya ini dapat dirubah menjadi tenaga listrik dengan menggunakan generator listrik

		atau dapat digunakan langsung untuk menggerakkan mesin penggiling, mesin gerinda dan lain sebagainya. Sistem Pembangkit Listrik Tenaga Mikrohydro (PLTMH) memanfaatkan sumber daya air yang relatif kecil.
Potensi Pltmh (Pembangkit Listrik Tenaga Mikro Hidro) Di Kecamatan Ngantang Kabupaten Malang Jawa Timur	Ikrar Hanggara 2017	Kondisi topografi Kecamatan ngantang yang berbukit dan banyak memiliki terjunan air sangat berpotensi untuk dimanfaatkan sebagai pembangkit energi tenaga mikro hidro. Untuk membuat PLTHM perlu dilakukan penelitian mengenai debit yang tersedia serta berapa jumlah energi dan daya yang terbangkitkan di lokasi tersebut. Maka fokus dari penelitian yang peneliti lakukan terletak pada perhitungan debit air yang tersedia serta jumlah energi dan daya yang terbangkitkan yang dapat dimanfaatkan untuk membuat PLTHM yang baik dan memenuhi kebutuhan masyarakat.
Studi Kelayakan Pembangunan Pembangkit Listrik Tenaga Mikrohidro Studi Kasus: PLTMH Minggir pada saluran irigasi Minggir di Padukuhan Klagaran Desa Sendangrejo Kecamatan Minggir Kabupaten Sleman	Ady purnama 2011	Perencanaan PLTMH Minggir telah dilakukan pada tahun 2008 oleh Dinas Pengairan Pertambangan dan Penanggulangan Bencana Alam (P3BA) Kabupaten Sleman dengan menugaskan konsultan CV. Bangun Cipta Persada. Namaun dari perencanaan tersebut, belum pernah dilakukan studi kelayakan. Karena itu, penelitian ini mengkaji rencana pembangunan PLTMH Minggir dalam hal kelayakannya
Analisis Potensi Pengembangan Pembangkit Listrik Tenaga Mikrohidro Di Kabupaten Bone Bolango	Nurhayati Doda 2018	PLTMH memiliki beberapa kunggulan dibanding dengan pembangkit listrik lainnya, bersih lingkungan, tidak konsumtiv terhadap pemakaian air, lebih awet (tahan lama/long life), biaya operasinya lebih kecil dan sesuai untuk daerah terpencil
Kajian Teknis dan Ekonomis Potensi Pembangkit Listrik Tenaga Mikro-Hidro di Bali	Made suranda 2012	Bali memiliki cukup banyak aliran sungai yang perlu dikaji kemungkinan pengembangan PLTMH, walaupun tidak sebesar sungai di Sumatera atau Kalimantan namun cukup potensial untuk dikembangkan sebagai pembangkit PLTMH. Untuk mengetahui apakah aliran sungai ini bisa dikembangkan sebagai Pembangkit Listrik Tenaga Mikro Hidro (PLTMH) perlu dilakukan kajian baik baik kajian teknis maupun kajian ekonomis.
Rancang Bangun Prototype Pembangkit Listrik Tenaga Mikro	Putu Andrea Wiranata 2020	Pembangkit listrik tenaga air yang banyak saat ini dibuat dalam skala besar. Namun, disisi lain masih banyak sungai-sungai kecil di

daerah pemukiman yang terpencil belum di manfaatkan secara maksimal sebagai alternatif potensi sumber pembangkit listrik. Untuk mengatasi hal ini maka pembangkit listrik dengan skala kecil atau disebut mikro hidro (PLTMH) dapat diaplikasikan. Pemilihan jenis turbin air dalam PLTMH disesuaikan dengan debit air, dan ketinggian terjun air (head). Ada beberapa jenis turbin untuk menghasilkan energi listrik yang optimal, salah satunya adalah Turbin Cross-Flow.

Micro-hydro Power Potential in Indonesia

Water is a cheap and relatively easy source of energy because it stores potential energy (in falling water) and kinetic energy (in flowing water). Hydropower is the energy obtained from flowing water. The territorial waters of Indonesia have strong ocean currents, so they have the potential to be utilized optimally to generate electricity. Currently, Indonesia is trying to develop current and wave power plants. Indonesia's hydropower potential is quite large, reaching 75 thousand Megawatts (MW). However, currently, its utilization through the provision of national electrical energy has only reached 10% of its total potential.

Microhydro Power Plant (PLTMH) is a small-scale power plant that uses hydropower as its driving force, such as irrigation canals, rivers, or natural waterfalls, by utilizing the height of the waterfall (head) and the amount of water discharge. Micro hydro is a term consisting of the words micro, which means small, and hydro, which means water. [citation needed] Technically, micro hydro has three main components, namely water (as an energy source), turbine and generator. Micro-hydro obtains energy from the flow of water that has a certain height difference. Micro-hydro utilizes the potential energy of water falling (head).[citation needed] The higher the waterfalls, the greater the potential energy of water that can be converted into electrical energy. In addition to geographical factors (layout of the river), the height of the waterfall can also be obtained by damming the flow of water so that the water level becomes high. Water is channeled through a penstock into a generator house, which is generally built on the riverbank to drive a turbine or micro-hydro water wheel. The mechanical energy that comes from the rotation of the turbine shaft will be converted into electrical energy by a generator. Micro hydro can take advantage of a water level that is not too large; for example, with a water level of 2.5 meters, it can produce 400 watts of electricity. The relatively small amount of energy produced by

micro-hydro, compared to large-scale hydropower, has implications for the relatively simple equipment and the small area required for micro-hydro installation and operation. This condition is one of the advantages of micro-hydro, which does not cause environmental damage. The difference between hydroelectric power plants and micro-hydro is mainly in the amount of electricity produced; hydropower under 200 KW is classified as microhydro. Thus, the micro-hydro generation system is suitable for reaching the availability of electrical energy networks in remote and rural areas.

CONCLUSION

From the literature study conducted, it can be seen that the use of micro-hydro power plants has begun to be widely used in daily life for various needs, such as turning on village streets. the application of this micro-hydro power plant can be used according to their individual needs. The use of micro-hydro power plants can reduce carbon emissions that cause global warming.

REFERENCES

NURHIDAYAH, C., et al. Analisis Potensi Pembangkit Listrik Tenaga Mikrohidro Di Air Terjun Gollae Kabupaten Pangkep. *VERTEX ELEKTRO*, 2022, 14.2: 52-59.

Shofiyah, O., Gunandar, C. M., & Ariyanti, V. T. D. (2023). Efektivitas pembangkit listrik tenaga mikrohidro sebagai penyedia energi baru terbarukan berbasis komunitas:(Studi Kasus: PLTMH Anggi, Kabupaten Pegunungan Arfak dan PLTMH Kali Ombak, Kabupaten Maybrat, Papua Barat). *Social, Ecology, Economy for Sustainable Development Goals Journal*, *1*(1).

Sinaga, L. A. G., & Prayogi, E. (2022). PROSES PERAKITAN DAN PENGUJIAN PEMBANGKIT LISTRIK TENAGA MIKRO HIDRO DENGAN TURBIN CROSSFLOW. *JURNAL ILMIAH TEKNIK MESIN*, *10*(2), 67-73.

Subandono, A. (2013). Pembangkit listrik tenaga mikrohidro (pltmh). *J. Rekayasa Elektr*, *10*(4), 1-13.

Nugroho, H. A., & Sunardi, S. (2017). Perancangan dan Pembangunan Pembangkit Listrik Tenaga Mikro Hidro. *J. Ilm. Tek. Elektro Komput. Dan Inform*, *3*(2).

Purnama, A. (2011). STUDI KELAYAKAN PEMBANGUNAN PEMBANGKIT LISTRIK TENAGA MIKROHIDRO Studi Kasus: PLTMH Minggir pada saluran irigasi Minggir di Padukuhan Klagaran Desa Sendangrejo Kecamatan Minggir Kabupaten Sleman. *Jurnal Unsa Progress*, *10*(15).

Doda, N., & Mohammad, H. (2018). Analisis potensi pengembangan pembangkit listrik tenaga mikrohidro di Kabupaten Bone Bolango. *Gorontalo Journal of Infrastructure and Science Engineering*, *1*(1), 1-10.

Suarda, M. (2009). Kajian teknis dan ekonomis potensi pembangkit listrik tenaga mikro-hidro di Bali. *Jurnal Ilmiah Teknik Mesin CakraM*, *3*(2), 184-193.

Hadiyanto, R., & Bakrie, F. (2013, October). Rancang bangun prototipe portable mikro hydro menggunakan turbin tipe cross flow. In *Prosiding Seminar Nasional Fisika (E-JOURNAL)* (Vol. 2, pp. 19-25).

Suryono, E., & Nusantara, A. E. B. (2017). Simulasi turbin crossflow dengan jumlah sudu 18 sebagai pembangkit listrik picohydro. *Simetris: Jurnal Teknik Mesin, Elektro dan Ilmu Komputer*, *8*(2), 547-552.