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The use of a micro-hydro power plant for the educational park area around the reservoir

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ABSTRACT Abstract. The community service activities carried out have the following objectives: 1) cleaning and empowering natural resource areas in the form of abandoned rivers and lots of garbage; 2) providing design and application of micro hydropower plants; 3). Creating an educational area for the community in the form of an educational park based on micro-hydro technology around the river reservoir. The method implemented is a qualitative method with a descriptive analysis approach. It was held in Malang Regency, Tajinan District, Purwosekar Village. The output target of this service activity is in the form of product design and tool making with the installation of PLTMH for Educational Parks. Thus, it is hoped that later it can become a potential development of the reservoir area into a tourist vehicle to help spread the promotion of products made by rural communities and improve the people's economy. Microhydro Education Park can provide knowledge about water-based power plants in the community.

1. INTRODUCTION

The community is the most important component in the development of an area with community empowerment that pays attention to all aspects of the existing potential. Independence in improving self-help skills in improving the quality of people's lives (called modernization) by referring to the process of acting, thinking, behaving, and wanting to be more advanced. Thus the field of community empowerment is the most important thing to be renewed and expanded. The main thing in community empowerment in rural areas is to utilize village resources that can increase participation and awareness of all parties towards community independence. Local governments are required to provide more excellent services and empower the community (Mujianto, 2019). In knowing the needs of village progress, it is the community itself who knows better what is needed. Law of 2014 Number 6 concerning Villages, General Provisions in Article 1 paragraph 12, Village Community Empowerment Regulations to develop community independence and welfare by increasing skills, attitudes, knowledge, behaviour, utilization, abilities, and awareness. Resources through the determination of policies, programs, activities, and assistance following the essence of the problem and priority needs of the community in the area (Endah, 2020).

In community empowerment activities, it can support the economy of rural communities in particular because, in rural areas, it supports the implementation of community empowerment activities. The potential of the village, if it is developed properly and with adequate ideas or concepts, will certainly provide maximum results in developing the village economy. Cooperation between residents and good cooperation with the village government will positively impact the development of the village area. The existence of empowerment activities on village potential to the maximum is one way to improve the economy (Fitriana et al., 2020).

Community empowerment is one of the village government programs to provide benefits to all existing resources to develop and help the progress of a village. Some targets in this community empowerment program cover all fields, including government, institutions, health, community economy, technology, and education.

Purwosekar Village, Tajinan District, located in Malang Regency, East Java, has natural potential in the form of a good climate and soil type for plantations, has a large land area and has public facilities. Another potential that is owned is the existence of reservoirs and rivers, which, if it is maximized it can provide great benefits to the community, and a water area is very supportive of life and can have a huge impact if its potential can be maximized. Water is an essential material in live (Febiary et al., 2016).

The reservoir's existence is adjacent to a river that flows quickly, and its location is adjacent to a pond. However, this pool has long been neglected and in disrepair. With the idea of community empowerment, it is necessary to create a concept for the use of micro-hydro energy channelled from the river. Then to support the local economy, a fish farming area can be created in the pond area. So that

the results of fish cultivation can be more and more productive, the use of aerators in ponds can be developed. This is to support the availability of oxygen in the water. With this, it can increase the results of fish cultivation that is developed.

With the flow of water used in the reservoir area, the electricity demand increases from year to year. The development of free energy technology needs to be developed to cover the rapidly increasing electricity demand. One of them that can be developed is micro-hydro power plant technology that utilizes water flow as a source of electricity. Micro-hydro consists of the word micro, which means small and hydro, which means water. A micro-hydropower plant is a small-scale power plant. This power uses water power as its driving force, such as river areas, irrigation canals, or natural waterfall areas, by utilizing the difference in water level and the amount of water discharge. The basic principle of micro-hydro work is by utilizing the potential energy possessed by the flow of water at a certain height distance from the power plant installation. A micro-hydropower plant can use reaction or impulse turbines depending on the available power sources (Erinofiardi et al., 2017). Small-scale hydroelectric power plants are an effective solution to supply electricity in the area (Bestari et al., 2018).

One of the free energy technologies that can be developed that do not depend on sunlight is micro-hydro technology. Micro-hydro technology can produce electricity only requires running water as its raw material. The turbine can be driven by the flow of water, then the turbine is connected to a generator, and the generator will produce electricity. The type of turbine angle affects the performance of the turbine in MHP.

Reservoir management efforts to maintain water quality can be made by controlling reservoir water pollution (Firdaus et al., 2020). Thus the existing potential can maximize the resulting community empowerment. With some potential that can be developed later, further promotional activities need to be carried out, namely the existence of a vehicle so that it can be known by the outside community so that later it can improve the regional economy. Namely, the idea of an educational park based on the use of river flows with the concept of introducing micro-hydro technology. The potential of hydro-renewable energy sources is large and their utilization is small; micro-hydro and pico-hydro power plants are suitable to be developed, especially in rural areas (Huwae et al., 2020).

To improve the composition of these community empowerment activities and also to support food security in Malang Regency, precisely in Tajinan District, Purwosekar Village, the distribution of micro-hydro energy produced as a driver of aeration in fish cultivation in ponds around the reservoir area. To maintain water quality, it is necessary to use aeration to increase dissolved oxygen (Patang et al., 2020). Efforts to increase the removal of dissolved iron and dissolved manganese in groundwater using a diffuser aerator by increasing airflow and increasing aeration time to meet quality standards (Batara et al., 2017).

2. METHOD

In developing strategic efforts for community empowerment activities, it is necessary to apply appropriate technology and science so that it can support good concepts or ideas in the field that can create opportunities for improving the economy of the community in the village, improving the quality of government and village communities through training, counselling, and empowerment programs. Management of tourism villages based on local potential requires community awareness and participation (Trisnawati et al., 2018).

The implementation of the activity is in Purwosekar Village, Tajinan District, Malang Regency, East Java Province. This location is a continuation of previous activities that have been carried out so that the continuity of activities extends to the river area of the reservoir flow, which is empowered for food security. Also, reservoir area can be used for fish farming and applying aeration techniques to increase the availability of oxygen in the aquaculture pond area. Micro-hydro technology can also be used as alternative energy in driving the aerator used. A micro-hydro can be operated at a certain time if it has a sufficient water supply (Weking & Sudarmojo, 2019).

The method used in this service activity is carried out by applying qualitative methods through a descriptive-analytical approach. The priority data sources in the qualitative method are words and actions, then additional data such as photos of field activities, notes, and similar works. Related to data, can describe the type of data in words and what is done, written sources, documentation, and joint results. In this community service activity, the data collection method used is in-depth interviews as well as direct observation of the object of community service. The activity begins with designing the concept of micro-hydro technology that will be applied as energy, then designing aeration techniques that will be used as an aerator in fish farming. This activity supports appropriate technology that utilizes river flow as its electric power so that it can make energy potential to support its potential.

3. RESULTS AND DISCUSSION

3.1 Development of Village Potential

According to Law Number 6 of 2014, village is a village and customary village or what is called by another name, hereinafter referred to as village, is a legal community unit that has territorial boundaries that are authorized to regulate and manage government affairs, the interests of the local community based on community initiatives, rights origin, and/or traditional rights recognized and respected in the system of government of the Unitary State of the Republic of Indonesia. Furthermore, in Article 4 of Law number 6 of 2014 it is stated that the Village Regulation aims to: a). provide recognition and respect for the existing Villages with their diversity before and after the formation of the Unitary State of the Republic of Indonesia; b). The existence of clarity on the status and legal certainty of the village in the constitutional system of the Unitary State of the Republic of Indonesia to realize justice for all Indonesian people; c). Preserving and advancing the culture, customs, traditions of the Village community; d). Encouraging Village community initiatives, movements, and participation for the development of Village potential and Assets for mutual prosperity; e). Creating a village government that is professional, efficient and effective, open, and responsible; f). Improving public services for Village residents to accelerate the realization of the general welfare; g). Increasing the socio-cultural resilience of the Village community to create a Vil-

lage community that can maintain social unity as part of national resilience; h). Improving the Village economy and overcoming the national development gap; and i). Strengthening the Village community as the subject of development.

3.2 Village Potential

Village potential is the ability, power, ability, and strength possessed by a village for the development of community welfare. Broadly speaking, the potential that exists in the village area can be divided into two, namely; First, Climate, physical potential in the form of land, geographical environment, water, livestock, and human resources. Second, in the form of the non-physical potential of the community with its patterns and interactions, educational institutions, social institutions, and village organizations, as well as village officials and civil servants(Tyas & Damayanti, 2018).

The purpose of developing village potential is to encourage and facilitate the realization of village community independence through the development of superior potential and institutional strengthening in community empowerment.

Meanwhile, specifically, the objectives of developing village potential are: 1). The need for the active role of the community in making development decisions in a democratic, open, and responsible manner, 2).Expanding business capabilities and business opportunities to increase income, 3). Optimizing and determining the function and role of the Financial and Business Management Unit as an Institution for Community Economic Empowerment, 4). Facilitate, establish, and provide guidance for Pokmas, especially in the aspect of business and institutional development, 5). Develop the village's superior economic potential that is adapted to the typological characteristics of the village, and 6). Encouraging the realization of integrated roles and partnerships between Provincial and Regency/City Offices/Agencies as well as other stakeholders as program actors and facilitators.

3.2.1 Village Pontential Development Strategy

The development of village potential can be directed according to the program objectives that have been prepared, efficient in terms of energy, cost, and time and effective according to the objectives in the sense that the results are really useful for improving community welfare, increasing community participation and independence; First, it is necessary to understand what potential is owned by the village in question, Second, the problems of life in the village must be identified, Third, determine development steps according to the potential of the village and the problems/needs of the community that have been felt so far

3.2.2 Various Village Potentials

Broadly speaking, village potential can be divided into two; The first is physical potential in the form of Climate, land, water, livestock, geographical environment, and human resources. The second is the non-physical potential in the form of the community with its patterns and interactions, social institutions, educational institutions, village social organizations, and village officials and civil servants (Fitriana, 2019).

In more detail, the village potential can be explained as follows:

A. Physical Potential

- Land includes various kinds of wealth contained in it such as soil fertility, mining materials, and minerals.
- Water includes water sources and their functions as a supporter of human life. Water is needed by every living thing to survive and also daily activities.
- Climate is very closely related to temperature and rainfall which greatly affects each region so that the climate pattern greatly affects the lives of agrarian village communities.
- Geographical environment, such as the geographical location of the village, area, soil type, fertility level, natural resources, and land use greatly affect the development of a village.
- Livestock serves as a source of energy and a source of nutrition for rural communities. In agricultural villages, livestock can also be an investment and source of fertilizer.
- Humans are a source of energy in the process of processing farmers' land, so humans are a very valuable potential for an area to manage existing natural resources. The level of education, skills, and enthusiasm for the life of the community is a very decisive factor in village development.

B. Non-physical potential

- The village community is characterized by a high spirit of cooperation in close family ties (gemeinschaft) which is a solid foundation for the continuity of development programs.
- Village institutions, such as the Village Representative Body (BPD), Village Community Empowerment Institution (LPMD), PKK Mobilization Team, Community Association (RW), Neighborhood Association (RT), Youth Organization, and others
- Educational institutions, such as schools, village libraries, counselling, simulations, and others.
- Health institutions, such as puskesmas, posyandu, and BKIA.
- Economic institutions, such as Village Unit Cooperatives (KUD), Village Owned Enterprises (BUMDes), Village Markets, and village barns.
- Village apparatus and civil servants are a means of supporting the smooth and orderly village government. Its role is very important for change and the level of village development.

The physical and non-physical potential of the village is a supporting factor for the role of the village as a hinterland, namely an area that produces basic materials for urban communities. To find out clearly what potentials the village has, of course, it is necessary to collect data carefully by involving all village stakeholders, including village officials, institutions, and community leaders.

3.3 Micro-hydro

Micro-hydro is a small-scale power plant that uses water as its driving force. This Micro Hydro Power Plant utilizes the head and the amount of water discharged from irrigation channels, rivers, or natural waterfalls. Micro-hydro, which is hydro energy on a "small" scale, provides electricity to small communities by converting hydro energy into electrical energy (Anaza et al., 2017). In spicy areas, you can take advantage of this energy because it is environmentally

friendly, besides it is easy and cheap. Rural electrification using renewable energy is the best choice for many locations that are far away from the national grid (Didik et al., 2018).

The tool that has been made has the following specifications: Dimensions 1.5 × 0.6 meters., Upper orange = generator., Bottom orange = 2 inch PVC pipe., Green = 1/2 inch pipe clamp., Yellow = 2 inches to 1/2 inch PVC reducer., Purple = 2 pipe clamp inch., Dark blue = aluminum frame., Light blue = cable from generator to panel box, Orange = 6 pcs aerator., Green = 6 pcs RGB led. 2 to the side. 4 forward towards the reservoir., Dimensions of the panel box are 220×150×70 mm. How the tool works in a nutshell:1). Water enters the 2-inch pipe, 2). The 2-inch pipe is reduced by 1/2 inch so that the pressure is higher, 3). Water entering the generator rotates the propeller, the axis is connected to a permanent magnet and coil, the rotation of the shaft causes a potential difference, and so on are described separately, 4). DC electricity flows through the cable from the generator to the box panel, 5). Electricity supplies 6 RGB LEDs and 6 aerators, 6). The LED lights up, revealing its light, and 7). The aerator turns on releasing air bubbles which are channelled into the house to the pool

The condition of the water that can be used as electricity-producing resources is that it has a certain flow capacity and height from the installation. The greater the flow capacity and the height of the installation, the greater the energy that can be used to produce electrical energy. Usually, Micro-hydro is built based on the fact that there is water flowing in an area with adequate capacity and height. The term capacity refers to the volume of water flow per unit time (flow capacity) while the difference in elevation of the flow area to the installation is known as the head. The development of the use of new and renewable energy is increasing, including micro-hydropower plants (Zaini et al., 2020).

Micro-hydro is also known as white resources, literally "white energy". It is said so because the installation of a power plant like this uses the resources provided by nature and is environmentally friendly. A fact that nature has waterfalls or other types into which water flows. With current technology, the energy of the flow of water along with the energy of the difference in height with a certain area (where the installation will be built) can be converted into electrical energy,

As said above, Microhydro is just a term. Micro means small, while hydro means water. In practice, this term is not standard, but it is conceivable that Micro-hydro, must use water as its energy source (Kusuma, 2020). What distinguishes the terms micro-hydro and mini-hydro is the power output produced.

3.4 River Area Cleaning

One of the main components of life is water. In this regard, the main priority is the management and protection of water sources. One form of management and protection of water sources is to build forest communities and ecosystems that have a good effect on water management. However, forest sustainability cannot be separated from the conditions of the surrounding environment, both ecologically, as well as economically, and socially for the people living in the area of a watershed that affects the dynamics of the forest landscape. To achieve this condition requires the active involvement and participation of many parties, especially the people living in or around the forest. In reality, the active role of the community in protecting or rehabilitating forests has not been maximized. The responsibility and sense of ownership of the surrounding forest have not been optimal. This condition is because the benefits and functions of the forest have not been understood and felt by the community. So far, community involvement has only been limited to wages if there are activities and exploiting wood/other forest products and encroaching on forest areas even though these activities violate the law. Therefore, it is necessary to change the approach (approach reorientation) so that people better understand the benefits and functions of forests, namely: one of them is by inviting them to use forest services such as water power as a micro-hydro power generation. It is hoped that with the existence of micro-hydro electricity, the community's understanding of the role of the forest in the catchment area above it can increase. The government has developed micro-hydro through the Desa Mandiri Energi (DME) program since 2007 as one of the efforts to provide renewable energy-based energy. The DME program is intended as an entry point in rural economic activities in the form of providing energy with technology that can be operated by the local community. The development of Micro-hydro Power Plants is very important in helping the government overcome the current energy crisis, especially to increase the electricity ratio in areas that cannot be reached by the PLN (State Electricity Company) electricity network. From the forestry perspective, the development of Micro-hydro Power Plants (MHP) is directed at increasing community commitment to maintaining forests. MHP is a power generation system using energy sources from hydropower and can be done by the community working together.

Benefits of Protecting the Environment for Health

Keeping the environment clean is not as easy as one might think. There are still irresponsible hands that throw garbage carelessly. It takes awareness of all parties and levels of society to create a clean and comfortable environment.

A. Healthy Environment Avoid Various Diseases Cleanliness is always synonymous with health. That is, the first benefit of protecting the environment is to keep your health awake. An unclean environment is the best place for mosquitoes to nest. The Ministry of Health of the Republic of Indonesia said that by keeping the environment clean, such as places of residence, schools, and places of worship, people can avoid dengue fever and hepatitis A. Tetanus, cholera, and typhoid fever have the potential to appear in an environment that is not kept clean.

B. Healthy Environment Related to Mental Health Clean air, clean water, lots of green space, and sanitation can improve a person's quality of life. Improving the quality of life will certainly make a person avoid mental health.

C. Healthy Environment is More Comfortable to Live in A clean environment makes it more comfortable to stay and stay for a long time. Not only that, other people will not be reluctant to visit. They judge your environment to be so beautiful and neat and comfortable to live in.

Community participation is very important to increase the usability and efficiency of the natural resource and environmental management system. The quality of community participation depends on environmental insight, level of awareness, strength, and capability of social institu-

tions and institutions as well as adequate opportunities and space for community initiatives. The non-governmental movement in handling environmental problems is still not strong enough because it is not fully supported by organizational strength, social institutions, social knowledge, knowledge, and adequate conditions. For this reason, efforts are still needed to increase the awareness of government officials, both central and regional, of the importance of growing community self-reliance in environmental conservation and improvement.

An environment is a place for humans to live, which is one of the elements of life. The environment is one of the factors that can affect human life. The environment can colour all activities of human life, ranging from lifestyle, behaviour, mindset, and even personality. In the human environment, life consists of various elements, which are factors that form the environment, including society. Society is a collection of various human individuals who interact with each other and have a specific purpose. The interaction between these individuals results in a kinship relationship that can be used as a means of communication to form a community association.

An environment is a place for human life. Therefore, it is appropriate to make the living environment as comfortable as possible so that it can create harmony for the individuals who inhabit it. One way to maintain environmental comfort is to declare and prioritize cleanliness, both individual hygiene and the cleanliness of the living environment.

Cleanliness is the most important component for humans that must be maintained properly so that harmony will be created. Cleanliness is part of one's faith. A clean environment keeps us away from various kinds of diseases, thus we will become healthy humans, and in healthy humans, there is a healthy mind.

In supporting community empowerment activities carried out on a natural basis, it is also necessary to clean the area that will be used. The activity of cleaning the environment of the reservoir area, is a step that must be carried out. Moreover, the river and reservoir areas have been neglected for a long time, so there is a lot of garbage and very dirty. It is very important to clean the river area and its flow when planning an activity based on the water environment.

3.5 Educational Park On Micro Hydro Technology

Educational tourism or educational tourism, referred to as field trips or field trips, is an activity or trip undertaken for recreation or vacation and also includes educational or educational activities. Educational tourism is a tour that has added educational value, not just traveling, but also has the aim of adding educational or educational values for tourists. Educational tourism is an activity that is generally carried out by educational institutions, such as schools and other educational institutions.

Educational tourism aims to increase the intelligence and creativity of participants in tourism activities. Usually, educational tourism destinations are places that have added value as tourist areas, such as plantation areas, zoos, rare animal breeding places, research centers, and so on. Understanding Educational Tourism or Educational Tourism is a program that combines elements of tourism activities with educational content in it. This program can be packaged in such a way that annual tourism activities or extracurricular activities have quality and weight. The materials in the scouting have been adjusted to the weight of the students and the educational curriculum. Every time you visit a tourist attraction, it will be adjusted to the object's interest and the field of science to be studied.

Educational Tourism or Educational Tourism is a program that combines elements of tourism activities with educational content in it. This community service activity can provide an opportunity to introduce appropriate technology to support fish cultivation activities in the reservoir area. The use of micro-hydro can be an introduction to electrical energy for the community so that fish farming activities are also a vehicle for education for residents in using aerators in developed fish farming areas.

Cultural diversity and tourism objects can make it possible for tourists to come to visit an area to hold educational tourism activities. The Educational Tourism Program that has been launched for a long time, has also become a necessity for residents. In addition to in-class learning programs in school programs, Educational tourism programs have proven effective in improving the learning patterns and socialization of students.

The Educational Tourism Program is also supported by university academics in delivering material in the field. So that this program is structured to fulfill school tourism activities with quality. It is time for an educational tourism program to be developed in every school as a student learning process about the love of the nation, country, and homeland.

Ideally, educational tourism is specifically designed to fulfil the scientific capacity of students to fill national insight through travel activities, getting to know the region, and the potential of local resources between districts, provinces, and islands in Indonesia. Travel activities on student tours will have a broad impact on economic development in the region because they can support the economic movement of the people while opening up pockets of art and culture that students need to know about. It is hoped that educational tourism activities can be a means for students to preserve culture and introduce the noble values of history and culture of the Indonesian nation.

The concept of educational tourism is deliberately designed specifically to fulfil the scientific capacity of students. Thus, they will be able to fill in their national insight with travel activities to get to know the region and the potential of local resources between regions, districts, provinces, and islands throughout the country. Student travel activities will become the movement of the people's economy, as well as open the pockets of art and culture that students need to know and understand. Therefore, student tourism is expected to be a means for students to participate in preserving culture and recognizing the noble values of the history and culture of the Indonesian nation.

From these activities, it is hoped that many kinds of tourism objects will emerge that can be utilized by tourism service sellers so that they can support the creation of jobs for the lower class community. Thus, educational, artistic, and cultural tourism objects visited by students can provide employment opportunities for residents so that when the tourism object develops, the government and the local community can reap the benefits. Through promotions, the Indonesian Love Educational Tour program which is specifically for school students, for example, can be one solution to improve the welfare of the community because it is predicted that this activity will be able to alleviate the residents

around the tourist attraction towards a better life. By moving the flow of school students to take part in educational tourism programs and requiring students to take comparative study programs to various regions, it will certainly provide fresh air for national tourism development.

With the concept of micro-hydro which is used as a vehicle for educational tourism, it can also introduce the community to simple technology that utilizes the energy of water flow. Micro-hydro comes from the word micro which means small and hydro which means water. A power plant that utilizes hydro power as the main medium for driving turbines and generators (Indahningrum, 2020).

Technically, micro-hydro has three main components, namely water (as an energy source), generator, and turbine. Micro-hydro utilizes the energy of the flow of water which has a certain height difference. In addition to geographical factors (river layout), the height of the waterfall can also be obtained by stemming the flow of water so that the water level becomes high. The higher the water drop, the greater the potential energy of the water that can be converted into electrical energy. The provision of an adequate, inexpensive, and environmentally friendly source of electricity is one of the requirements for sustainable socio-economic development (Bayu et al., 2017).

In short, water is flowed through pipes and is then directed to power plants which are generally built on the banks of rivers to drive turbines or micro-hydro waterwheels. Thus the mechanical energy originating from the rotation of the turbine shaft will be converted into electrical energy by the generator. There are several advantages of this PLTMH, including: 1) This power plant is considered environmentally friendly and non-polluting, 2) Its use can be combined with other channels such as irrigation and fishing grounds, 3) When compared to other types of power plants, micro-hydro is quite cheap because it uses natural energy, 4) It has a simple construction and can be operated easily in remote areas, and 5) Can encourage the community to be able to preserve natural areas.

4. CONCLUSION

Based on the community service activities carried out, several conclusions include:

1. Exploring the right regional potential can provide good opportunities in developing regional potential so that it can open up business opportunities for residents.
2. The potential for river flow can be used as energy, using micro-hydro technology as alternative energy.
3. Good use of technology in potential empowerment activities will be able to open up opportunities for better educational activities for residents.

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