SOLAR POWERED DRINKING WATER SUPPLY BUSINESS MODEL SUSTAINABLE IN IMPROVING QUALITY COMMUNITY LIFE

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ABSTRACT

The condition of densely populated areas, suburbs and 3T areas (underdeveloped, outermost, frontier) have gaps in meeting primary needs such as drinking water which is the most important human need. Objectives: Density of population and limited land for PDAM water pipelines are not accessible and are still often constrained. This includes water conditions in densely populated urban areas and urban suburbs that are not covered by PDAMs and 3T areas which are completely unreachable by clean water providers so that the water produced is polluted with household waste, groundwater exploitation and the high rate of population growth and migration to urban areas. Methodology: The research method is quantitative and qualitative methods. Qualitative information obtained from respondents related to preliminary research that is generalization of the object under study. Finding: The problem is still considered a local problem so that the solution is never complete and the concerns of people in densely populated urban areas perceive PDAM as a provider of drinking water using chemicals that have an impact on body condition compared to healthy drinking water sources originating from the soil. Conclusion: From these problems, one of the solutions is to create a source of drinking water in densely populated urban areas by utilizing solar energy for communities around densely populated urban areas, as well as for 3T communities where there is no energy source.

Keywords : Business Model; Drinking Water; Solar Energy; Solar Panels

ABSTRAK

Kondisi daerah padat penduduk, pinggiran kota, dan daerah 3T (terbelakang, terpencil, dan perbatasan) memiliki kesenjangan dalam memenuhi kebutuhan primer seperti air minum yang merupakan kebutuhan manusia terpenting. Tujuan: Kepadatan penduduk dan lahan yang terbatas untuk jaringan pipa air PDAM tidak dapat diakses dan masih sering terhambat. Hal ini termasuk kondisi air di daerah perkotaan padat penduduk dan pinggiran kota yang tidak tercakup oleh PDAM dan daerah 3T yang sama sekali tidak terjangkau oleh penyedia air bersih sehingga air yang dihasilkan tercemar oleh limbah rumah tangga, eksploitasi air tanah, dan tingkat pertumbuhan penduduk serta migrasi ke daerah perkotaan yang tinggi. Metodologi: Metode penelitian yang digunakan adalah metode kuantitatif dan kualitatif. Informasi kualitatif diperoleh dari responden terkait dengan penelitian pendahuluan yang merupakan generalisasi dari objek penelitian. Temuan: Masalah ini masih dianggap sebagai masalah lokal sehingga solusinya tidak pernah lengkap dan kekhawatiran masyarakat di daerah perkotaan padat penduduk menganggap PDAM sebagai penyedia air minum yang menggunakan bahan kimia yang berdampak pada kondisi tubuh dibandingkan dengan sumber air minum sehat yang berasal dari tanah. Kesimpulan: Dari permasalahan-permasalahan tersebut, salah satu solusinya adalah menciptakan sumber air minum di daerah perkotaan padat penduduk dengan memanfaatkan energi surya untuk masyarakat di sekitar daerah perkotaan padat penduduk, serta untuk masyarakat 3T yang tidak memiliki sumber energi.

Kata Kunci : Model Bisnis; Air Minum; Energi Surya; Panel Surya

INTRODUCTION

The COVID-19 pandemic situation that has hit the whole world, including Indonesia, has been deeply affected by all levels of society. This requires the participation of universities to be involved in solving various existing problems.

Various problems faced by the community, including loss of jobs and sources of income due to termination of employment and restrictions on activities, demand active participation from the academic community in order to assist the resolution. Another problem in everyday life in the community is in terms of providing clean drinking water that is cheap and easy to obtain for all levels of society, in order to keep people's lives healthy and free from various diseases. Lately, it has become a social problem, especially in big cities in finding raw water sources that are not polluted even though rivers still flow around them. Meanwhile, in the outskirts and rural areas, the problem of water and energy needs is no less unequal.

Conditions in densely populated areas, urban periphery (subburband) and 3T areas (underdeveloped, outermost, frontier) have gaps in meeting primary needs such as drinking water which is the most important human need. Density of population and limited land for PDAM water pipelines which are not accessible and are still often constrained. This includes water conditions in densely populated urban areas and urban suburbs that are not covered by PDAMs and 3T areas which are completely unreachable by clean water providers so that the water produced is polluted with household waste, groundwater exploitation and the high rate of population growth and migration to urban areas. This problem is still considered a local problem so that the solution is never complete and the concerns of people in densely populated urban areas perceive PDAM as a drinking water provider using chemicals that have an impact on body condition compared to healthy drinking water sources coming from the ground. From these problems, one of the solutions is to make drinking water sources in densely populated urban areas by utilizing solar energy for communities around densely populated urban areas. The next effort is the availability of drinking water sources in the area by creating a sustainable business model. The business model can be carried out continuously for survival and improving the quality of life that can be managed independently by the surrounding community.

The purpose of the research is to build a business model of a sustainable drinking water supply system using solar power. The output of the water supply system can be utilized by residents at a much cheaper price than the existing refill water supply model, even excess consumption can be sold with a blockchain model cooperative system managed by the community itself. The epicenter of the blockchain business model can be done in every village that does need solar-powered drinking water, and can then be developed in every public facility owned at the RW and RT levels. One of the important elements in building this research begins with creating a drinking water supply system using solar power in dense areas and urban suburbs, then introducing and planning the business model of drinking water supply with a blockchain system to the community according to the characteristics of densely populated areas and urban suburbs. So that the community can take advantage of the drinking water supply business model to improve the quality of life in a sustainable manner.

The research with the title Business Model for Sustainable Solar-Powered Drinking Water Supply in Improving the Quality of People's Life using the Higher Education Basic Research Grant scheme will focus on the Green Economy. Will produce a prototype water treatment and purifier system using solar cell energy sources and PLN as a backup. The drinking water supply system will be able to be utilized in urban areas that are not covered by PDAMs or in 3T areas which are completely unreachable by clean water providers or in difficult sources of energy by PLN. The blockchain business model can be carried out in every densely populated urban area that generally experiences a clean water crisis or a village that does need solar-powered drinking water due to the absence of an electricity network, and then the implementation of this effective research can be developed and placed in every public facility owned at the same level. to RW and RT.

LITERATURE REVIEW

Concept Business

Efforts to develop a sustainable solar-powered drinking water Business Model based on natural resources and new renewable energy as well as regional advantages, especially in utilizing abundant raw water and continuous solar energy, need appreciation and support from all parties.

On the other hand, efforts to develop a solar-powered drinking water supply business need to be carefully prepared. Referring to the availability of raw materials for groundwater, rivers, and reservoirs and the capabilities and resources available in other study areas, the development of a solar-powered drinking water supply business model will focus on processing raw water with blended energy sources between PLN and Shollar cells into water. ready for consumption on an IKM scale.

The development of a sustainable solar-powered drinking water supply business model in generally urban areas and particularly in rural areas that have not been reached by PLN and PDAM, is not only related to the availability of raw materials, but also highly dependent on other business aspects, such as marketing, technical and technology, availability raw materials, institutions and human resources, socio-cultural, environmental, and financial. Based on the consideration of these various aspects, the business concept becomes an activity that absolutely needs to be done, and financially it is very important considering the investment required is

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quite large and will be embedded in various assets over a long period of time, so it needs to be calculated carefully. There is a capital cost that must be accounted for and there is an opportunity cost, which has been sacrificed by many parties, especially the community, the private sector and stakeholders to decide to do this solar-powered drinking water business, so that these sacrifices must be balanced with preparation and seriousness of good and effective management. profitable.

Solar Power Plants

In principle, in planning a PLTS, factors must be considered, including: PLTS operating pattern plan and whether or not PLTS is connected to the electricity network at the planned location (Dzulfikar & Broto, 2016; Sianipar, 2014). The above factors affect the selection of the type and capacity of the main components, namely: solar modules (PV), inverters and batteries (Hermawan & Pravitasari, 2013). PLTS capacity is expressed in kilowatt peak (kWp).capacity inverter is expressed in (kW) and the battery capacity is expressed in amperehour (Ah) or kWh. The desired level of reliability affects the configuration, capacity and number of inverters. A PLTS has main components, namely: solar panels (photovoltaic), inverter and batteries (Hermawan & Pravitasari, 2013). PLTS does not have constant power (non-capacity value generation system) because its output capacity depends on the level of solar radiation which changes every time (Rahardjo, Irawan; fitriana, 2005). LTS is judged by how much energy it can produce, not how much power it has, except for systems that have a storage system (Kornita, 2020).

Photovoltaic consists of two different types of materials which are connected through a junction which, if light falls on its surface, will be converted into direct current electricity (Yulianingsih et al., 2020). To get a large enough power required a lot of solar cells. Usually the solar cells have been arranged so that they form panels, and are called solar modules. Figure 1 shows the arrangement of the cross section of a solar cell as a power source.

The battery charging controller or charge controller functions to ensure that the battery does not experience over-discharge or over-charge, which can reduce battery life. The charge controller is able to maintain the voltage and current in and out of the battery according to the condition of the battery (Nasution et al., 2019). The electric current converter or more commonly known as the Inverter is the "heart" in a PV mini-grid system. The inverter functions to convert direct current (DC) generated by solar panels into alternating current (AC). The DC voltage from solar panels tends to be not constant according to the level of solar radiation (Disemadi & Kholis Roisah, 2019; Saputra, 2016). Considering that PLTS is very dependent on the adequacy of solar energy received by solar panels, a temporary energy storage medium is needed if at any time the panels do not get enough sunlight or for electricity use at night.

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Batteries must be present in the PLTS system, especially the Off Grid type (Hadi, 2020). In general, there are 3 (three) types of PV mini-grid designs, namely: 1) PLTS Off Grid/stand alone, a PLTS system that is not connected to the grid/stand alone, 2) PLTS On Grid, a PLTS system that is connected to the grid/existing system and 3) PLTS Hybrid, an integrated PV mini-grid system with one or more power plants with different primary energy sources, with 6 integrated operating patterns. Figure 2 is a basic diagram of a PLTS Hybrid with several studies related to the water supply business model, including identifying strategies for meeting community needs through BUMD PDAMs that need to be pursued so that they can immediately operate and increase community participation in preserving raw water for consumption (Rahardjo, Irawan; fitriana, 2005)

Reviewing the evaluation of community-based drinking water and sanitation programs so that clean water needs are met (Hadi, 2020). Provision of clean water collective system in the analysis of domestic clean water needs in cluster housing (Christ et al., 2012). Assessing the sustainability of community-based rural water supply systems that affect strong social relationships and can increase the effectiveness of work teams and leadership (Putra et al., 2020).

Reviewing efforts to provide clean water for boom beach fishing groups in the kepatihan sub-district of Banyuwangi district (Swastomo & Iskandar, 2020). Reviewing pump selection planning and pump work control systems for the provision of clean water to households (Nuruddin & Susmiati, 2017). Identifying the study of the clean water supply system for the brib sub-system in Gunung Kidul Regency (Rasmini, 2017). Studying solar-powered water pump systems for the provision of clean water for the community in the coastal areas of Riau Province (Wisnu Wardhana et al., 2013). Reviewing the study of planning for solar water pumps as household clean water supply (Anto & Gussyafri, 2020). Reviewing the design of a solar water pump to transfer clean water to a holding tank (Priambodo et al., 2019).

From previous research, there has been no study on the provision of drinking water using renewable energy which is supported by a business model that utilizes technology. This study examines the business model of drinking water supply using the blockchain business model in urban areas with a business model that is in accordance with the characteristics of urban communities that can make it easier for people to pay for drinking water or order drinking water using applications that can be accessed by the public. In addition to urban communities, this research will benefit rural communities in 3T, who have difficulty accessing PLN and clean drinking water, including the management agency in the form of a Service Cooperative.

The drinking water supply system specifically aims to produce a drinking water supply business for residents to use at a much cheaper price, even excess consumption will be sold with a blockchain model cooperative system managed by the community itself.

RESEARCH METHODS

Method is a method of work that can be used to obtain something. While the research method can be interpreted as a work procedure in the research process, both in searching for data or disclosing existing phenomena (Zulkarnaen, W., et al., 2020). The research method is qualitative methods. Qualitative information obtained from respondents related to preliminary research that is generalization of the object under study. Applied research in this business model comes from a business phenomenon in the form of a gap between what should happen (das sollen) and what really happened (das sein), business doubts as a result of changes that need to be anticipatedi (Suliyanto, 2017). Furthermore, the benefits of applied research emphasize more on practical benefits for solving practical problems in the field compared to theoretical benefits for the development of science. Practical benefits for improving existing practices or for increasing efficiency and effectiveness (Suliyanto, 2017). Meanwhile, according to Muhammad firm; Data is a series of information, evidence, or descriptions of an object that has certain characteristics. Data is useful for interested parties as input to find out about the problems faced, as alternative answers, or solutions to a problem that is being faced, and as a tool to explain and fill in the ongoing analysis process (Teguh, 2014) Figure 3 shows the research stages, starting with the existing conditions, then making a feasibility study for the water supply business and the final stage in the form of a business concept.

RESULTS AND DISCUSSION

Results

This research was conducted over a period of two years (2022-2023), where each phase or stages are grouped into two; The first year provides an overview of the main design of the drinking water supply model with the concept of Solar Power which is included in the business model, while in the next phase the implementation of the model and business management. The sample or research target of the Business Model for the Provision of Sustainable Solar-Powered Drinking Water in Improving the Quality of Community Life is carried out in the Cimenyan District, Padasuka Village, Bandung Regency. Topographically, the area is hilly which until now has not been reached by PDAM services from the Regency or Municipality of Bandung. The population of the research area is 106,999 people, with 5,124 household heads. KK. The pilot project of this research was reduced to the Rukun Warga (RW) 04 area in the Padasuka village, on the grounds that RW .04 has a hilly topography and a basin. Although RW 04 is passed by a small river leading to Bandung City, residents in the RW.04 and surrounding areas have difficulty getting clean water, especially for drinking needs. Raw water needs of Padasuka area in general and RW.04 in particular are imported from mountain springs in Ujung Berung

(Cinangka, 8 km away) in the form of water supplies purchased by residents with tanks ranging in capacity from 500 liters to 5000 liters capacity. There are 7 drinking water supply businesses in the RW.04 and surrounding areas which are managed by community members with the calculation results as below (Existing Drinking Water Supply Business Model & Solar Panel Model).

Discussion

Exsisting Model

The drinking water supply business is in the area of RW.04, Padasuka Village, Cimenyan Kab. Bandung has an average capacity of 4000 liters, with a population reach of approximately 300 families with 1000 souls. In one week Needs 1 Business Unit Filling Drinking water requires 3 tanks of water every week or 12 tanks in one month. One water tank produces the equivalent of 200 bottles of 20 liter bottled water, or a total of 2,400 bottles of refilled bottled water in one month. Price per bottle Rp. 5.000,-. And total income Rp. 12,000,000,- per month. Operational Costs: the price of water per tank capacity of 3000 liters is Rp. 150.000, one month needs 12 tanks = Rp. 1.850.000,-. The electricity token fee is Rp. 50.000,-. With an initial investment of Rp. 50,000,000,- The scale of a home-based drinking water supply business can brin

Solar Panel Model

Initial investment Soil raw water (depth 60 meters, 4inc) 1500 watts, along with complete equipment Rp. 60,000,000, - (with a smarcible Groudfos engine, SQ 270 electric power 1150 watts, Kapistas 33 liters per minute or approximately 2000 liters per hour). Solar Panel HiCELL Solar Cell System PLTS Off-Grid 3000 Watt Rp. 95,000,000,- (two 3 hours battery life). Investment for refill drinking water installation Rp. 50,000,000,- with an investment of Rp. 205,000,000, the model of providing drinking water again with an off-grid solar panel model, bringing in a profit margin of Rp. 12,000,000,- per month, with a payback period of 17 months. Procurement of drinking water with the Solar Panel Model will be ideal and help the community if it is applied in areas where there is absolutely no connectivity with PLN. Compared to the existing PLN network (Conventional profit margin Rp. 10,000,000, -, while with PLTS Rp. 12,000,000, -).

Outerareas in Indonesian territory where there is no PLN electricity supply, the provision of drinking water with PLTS is very helpful. The initial budget for raw water capacity as deep as 60 meters, this will be able to meet the needs of the community of 300 families or approximately 1000 people, so that the initial investment can be borne per resident of Rp. 670,000 and at a price per gallon of ready-to-drink refill water (20 liters) at a price of Rp. 1,500, -. with the needs of residents as much as 11 gallons per head of the family. With the formation

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of the cooperative the price of a bottle can be reduced from the previous Rp. 5000 to Rp. 1500, with a payback period of 3.4 Years. Investment of Rp. 205.000.000,- this will decrease, if around the area there is raw river water that can replace artesian wells.

Cooperative Model Concept The *Blockchain*

Model business concept will be suitable to be applied in urban and/or suburban cooperatives, because it has been supported by very adequate infrastructure. However, the Blockchain concept will not be possible if it is applied to areas that are not covered by PLN. Cooperatives were established as a joint effort for the welfare of its members. Various types of cooperatives can be established including water supply service cooperatives; Water and Energy Procurement are two primary human needs that can be collaborated through cooperative institutions as managers. Energy is common in urban areas, and water is common in rural areas. In many ways, the need for energy and water conditions is always reversed between urban and rural areas. In urban areas because of dense settlements and clean water problems, while in rural areas energy problems, especially areas that are not reached by PLN, or are affordable but lack of funds to install electricity installations and monthly fees, this will be the focus of this research. Cooperative membership is open, which means that anyone can become a member and agree on the same things and goals. The same goals and objectives are specifically for community members who are constrained by problems of energy (electricity) and ready-to-drink water specifically in rural areas. With an investment of Rp. 205.000.000, Cooperative drinking water supply business can be established in rural areas. With 300 families, with an initial fee of Rp. 670,000. clean water supply cooperatives can be established or initial funding needs from the Village Revolving Fund. After running the business model for providing drinking water using solar panels, the return on investment managed by the cooperative for maintenance and return on investment is obtained from the sale of refilled drinking water.

CONCLUSION

A sustainable solar-powered drinking water supply business model, seen from its benefits, will be very relevant if applied in 3T areas (lagging, outermost and leading). This happens because the 3T area has major difficulties in providing drinking water due to the absence of a PLN network, so the development of solar panels is very important. Meanwhile, the development of urban solar panels that are already covered by the PLN network is irrelevant, this is because the energy source from PLN is much cheaper than the procurement of solar panels. As a comparison of the existing conditions, the costs required for the water drinking water business by relying on energy from PLN on average from 7 research samples in urban areas with a storage tank capacity of 4000 to 7000 liters only require electricity costs between Rp. 50,000 to Rp. 70,000 per month and the average raw water supply is Rp. 1,800,000 per month. While the business model using solar panels requires an additional initial investment of Rp. 100,000,000,-. While the Blockchain Model Cooperative business model will be more suitable to be developed in urban areas, because the digitization infrastructure is evenly available when compared to 3T areas.

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FIGURE

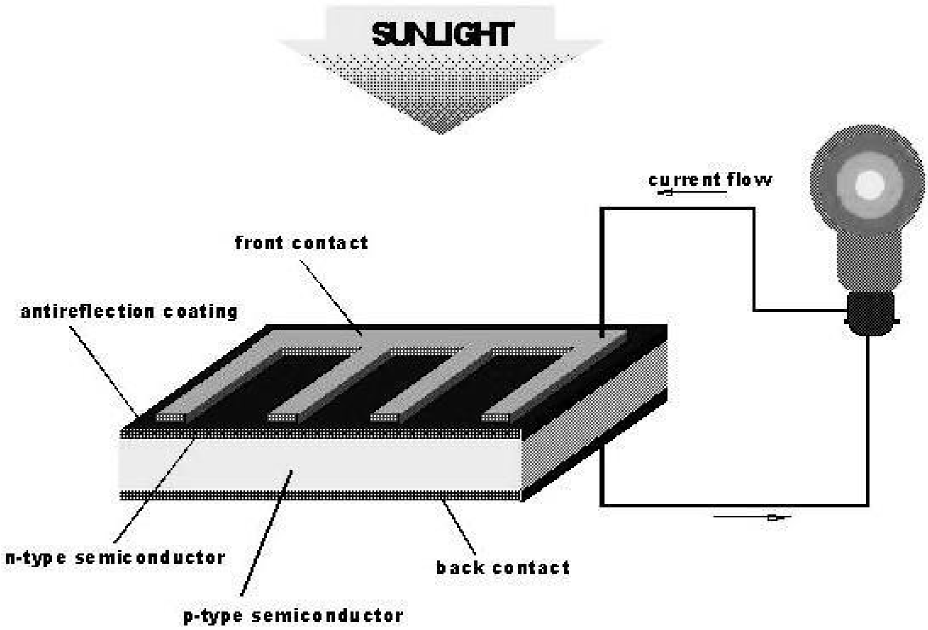

Figure 1. Sollar Cell

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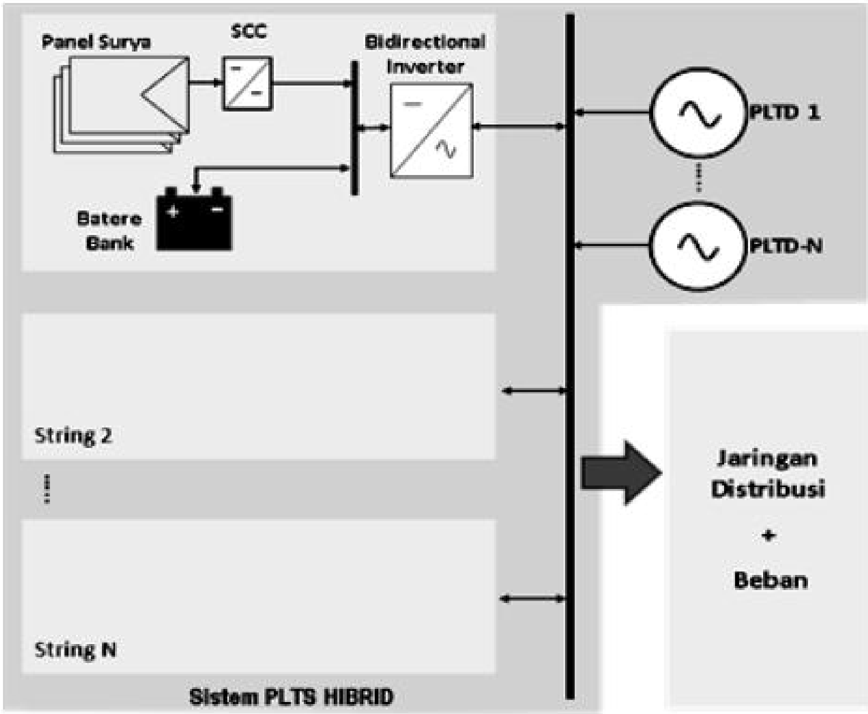

Figure 2. Hybrid PLTS Basic Scheme

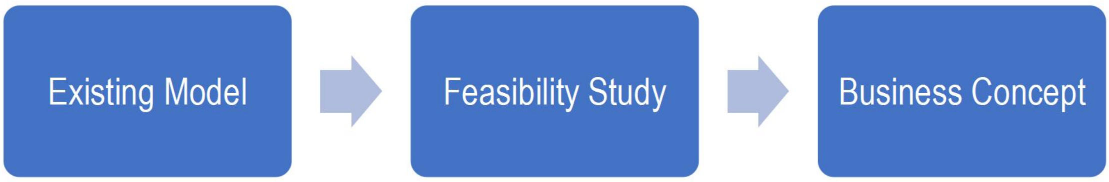

Figure 3. Conceptual Framework