

Research Article

The Implementation of Community Empowerment In Local Energy Communities: A Case Study

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Abstract.

The concept of a local energy community for community empowerment is one of the efforts to provide alternative energy for rural communities. One such community is in the Andungbiru Village, Tiris District, Probolinggo Regency that sought to bring to life this idea through the PLTMH unit by the Tirta Pijar PLTMH Group in collaboration with CSR PLN Nusantara Power UP Paiton in the Kampung Setrum program. This study aimed to examine the implementation of an Local Energy Community in Andungbiru Village based on an analysis of community empowerment outcomes. A qualitative, case study approach was used. Primary data were obtained from in-depth interviews and focus group discussions with informants who were chosen by the purposive sampling method. Meanwhile, secondary data drew from the PLN Nusantara Power UP Paiton CSR document and other documents. Data analysis was carried out by data reduction, categorization, data presentation, and drawing conclusions by employing outcome analysis, which were then tested for data validity using source triangulation techniques and expert validation. The results of this study describe how the implementation, decision making, management of human and natural resources, and response of the Tirta Pijar PLTMH group to problems within the local energy community, impact the empowerment of Local Energy Communities. This research concludes that community empowerment at the Tirta Pijar PLTMH has reached the highest (power-shift) level.

Keywords: local energy community, ladder depiction of outcome of empowerment, community empowerment, corporate social responsibility

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1. Introduction

PT PLN Nusantara Power is a subsidiary of PT Perusahaan Listrik Negara which is engaged in electricity generation. The company, formerly known as PT Pembangunan Jawa Bali, has changed its name to PT PLN Nusantara Power since the end of 2022. PT PLN Nusantara Power has several generating units, one of which is the Paiton Generating Unit or PLN Nusantara Power UP Paiton which is located in Probolinggo Regency, East Java [1]. PT PLN Nusantara Power as a State-Owned Enterprise or



BUMN company is required to carry out CSR Corporate Social Responsibility (CSR). Following up on this, PT PLN Nusantara Power regulates the implementation of social and environmental responsibility or CSR through board of directors' decision number 065.K/010/DIR/2013 [2].

CSR PLN Nusantara Power UP Paiton contributed to improving the lives of people in Andungbiru Village, Tiris District, Probolinggo Regency by developing a kampung setrum with the concept of Local Energy Community. The community empowerment is carried out through a PLTMH unit that generates electricity utilizing local river currents. Community empowerment through the CSR program is carried out with the concept of Local Energy Community or Desa Mandiri Energi (DME).

Various positive impacts of the Kampung Setrum CSR program have been felt by the Andungbiru Village community. These impacts cannot be achieved without a good program implementation process. The success of program implementation is influenced by various factors, one of which is community empowerment. In previous research, there have been many studies on the impact, benefits, and success of the Kampung Setrum CSR program such as those conducted by Muna, Astuti, and Pratiyudha [3-5]. However, there is no research that analyzes how the implementation of community empowerment occurs so as to create the impacts, benefits, and successes mentioned.

Over time, the focus of the Kampung Setrum program is no longer only on the PLTMH group but the development of the surrounding community to expand the impact of the CSR program. Therefore, research on analyzing the implementation of Local Energy Community community empowerment as a case study in Andung Biru Village needs to be carried out based on the ladder conception of the outcome of empowerment. This research fills the existing research gap regarding the extent of the implementation of community empowerment with the concept of an Local Energy Community in Andungbiru Village. In addition, this research can be an information and knowledge material for other researchers and stakeholders who carry out similar community empowerment or conduct further research on related programs.

2. Literature Review

2.1. Theoretical Framework

At the input stage, the data collected is primary data and secondary data (see Figure 1). Primary data was obtained through in-depth interviews and focus group discussions

(FGD) while secondary data was obtained from CSR PLN Nusantara Power UP Paiton and the Andungbiru Village Government. In the process, the data that has been obtained is classified to organize, group, code, and identify patterns and then data reduction. The data analysis using the ladder depiction concept of outcomes of empowerment by Coy [6] and being interpreted. The results of the data interpretation were then tested for validity using source triangulation and expert validation methods. After going through the process, the research produces an output in the form of a conclusion. At the same time, at the end of this research the author provides suggestions. The suggestions given are aimed at empowering existing communities as well as researchers who will conduct further research.

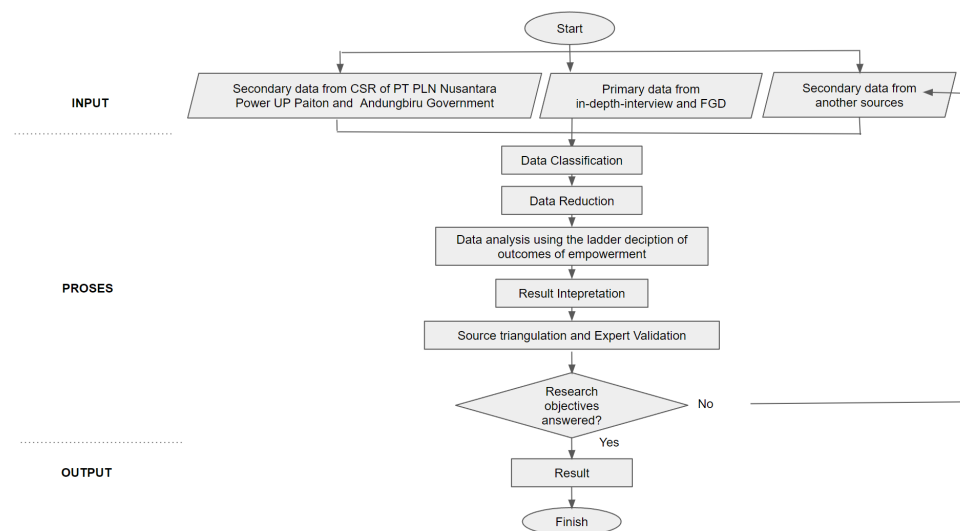


Figure 1: Theoretical Framework. Source: Author's data, 2023.

2.2. Corporate Social Responsibility

Social responsibility can generally be defined as support from company management for its obligation to consider profits, customer satisfaction and community welfare equally in evaluating the performance of a company. Basically, by carrying out corporate social responsibility, companies, communities and the government will benefit in the long term [7,8]. In the process, state-owned companies will be in line with the state's interests in making profits in an effort to improve the welfare of society. This has been regulated in the 1945 Constitution (UUD) as the highest source of law in Indonesia in Article 33 Paragraph 2 which reads "Earth and water and the natural resources contained therein are controlled by the state and used for the greatest prosperity of the people"

Corporate Social Responsibility (CSR) is the obligation and responsibility of a business which, in its motive to gain profit, must contribute to society with the aim of improving the quality of people's lives, which in its implementation must include components of protecting the environment and upholding the rights of workers and society in general. Corporate social responsibility is a company's contribution or commitment to sustainable development. In line with Good Corporate Governance (GCG) that one of the company's goals is to build the company's image and fulfill its responsibilities to the welfare of employees and society [9,10].

2.3. Community Empowerment

Community empowerment was defined by Slamet in his publication in 2000 as a development counseling process [11]. Departing from this definition, Mardikanto [12] defines community empowerment as:

The process of social, economic and political change to empower and strengthen community capabilities through a participatory collective learning process, so that behavioral changes occur in all stakeholders (individuals, groups, institutions) involved in the development process, in order to create an increasingly empowered, independent life , and participatory

Based on research entitled Rethinking Community Empowerment In The Energy Transformation: A Critical Review Of The Definitions, Drivers And Outcomes, the research results explain that every goal to facilitate community empowerment needs to first be adapted to the local context. Communities will more easily achieve high empowerment outcomes if their goal is transformative action or change action. Changing electrical energy sources or power-shift is the highest form of community empowerment which is the result of community empowerment towards renewable energy. In this case, an organization is also needed for its implementation. The benefits of shifting electrical energy sources include reducing resistance to development, habits that can reduce emissions, improving the surrounding economy, and achieving community resilience. This kind of empowerment is also known as energy citizenship where society is defined as active participants who are democratically involved in the energy transition towards renewable energy [6].

2.4. Local Energy Community

Energy Citizenship is further explained as a concept where society is actively involved democratically in a sustainable energy transition. This transition in energy use is often triggered by awareness of responsibility for climate change, energy distribution and energy justice through joint action regarding renewable energy. In the concept of energy citizenship there is a shift in energy use from fossil fuels to a more decentralized and distributed system so that energy can reach more people. Energy citizenship in the process can create new actors or roles in the existing energy system [13].

The European Union in this case uses the term Local Energy Community (LEC) which is defined as an association, form of cooperation, partnership, non-governmental organization, or legal entity that is effectively controlled by local communities, which runs based on existing values and not based on profit, involved in distributed generation and in carrying out the activities of electricity distribution system operators, suppliers or aggregators at local level, including across borders [14].

A Local Energy Community (LEC) is a legal entity that effectively controls its members, with a local community basis and whose aim must be to provide environmental, economic and social benefits rather than financial gain. LEC offers several benefits in energy transformation by involving various sustainability pillars. In the economic field, LEC, apart from being able to increase existing renewable energy, can also reduce expenditure in the energy sector, thereby reducing the level of inability to access energy for the community. In the social sector, LEC can increase the level of participation and democratic control of society over the electricity system. Apart from that, LEC can increase public awareness of sustainable development issues and can increase community cohesion and public knowledge regarding energy [15].

In the national context, the LEC concept is known as Desa Mandiri Energi (DME) or Local Energy Community which is explained in the Minister of Energy and Mineral Resources Regulation No. 32 of 2008 [16]. In this ministerial regulation it is explained that the Local Energy Community is a village that is able to fulfill more than 60% of the energy needs in the village using renewable energy. Fulfilling this need is carried out by utilizing the potential of local resources and paying attention to aspects of sustainability, environmental friendliness and local area development (Minister of Energy and Mineral Resources, 2018).

2.5. Recent Studies on Related Topic

Research on community empowerment in the same location has been conducted by Muna with the title *Desa Terang Ekonomi Gemilang through SETRUM Village Innovation (Community Renewable Energy Center) as a Form of Sustainable Renewable Energy Optimization by PT PJB UP Paiton* [3]. This research analyzes Kampung Setrum using the sustainability compass. Nature through reforestation activities, having permanent sanitation, having a waste management system. Economy through free electricity for vulnerable communities, public facilities, and groups working on PLTMH, and utilization of coffee based on PLTMH electrical energy. Social through annual work plans from group deliberations accompanied by the Village Government, having an RPJP after being released from the CSR program. Well-being through increased community income and lighting for the village.

Further research examines the success of CSR programs using SROI analysis by Astuti [4]. This research is entitled *SROI Analysis (Social Return On Investment) in Measuring the Success of the Microhydro CSR Program by PT PJB UP Paiton in Andungbiru Village, Probolinggo Regency*. After measuring using SROI analysis, the CSR program carried out found that every Rp. 1 invested in the program obtained a return of Rp. 2.29.

Another research related to CSR PJB UP Paiton Kampung Setrum was conducted by Pratiyudha with the title *Reviewing Corporate Social Responsibility in a Capability Approach* [5]. This research analyzes existing CSR programs using a capability approach. The results of the study PJB UP Paiton was able to develop the capabilities of the established community in the management of PLTMH, community capacity building in the economic sector in the local area, and capability development carried out through BUMDes. Community awareness is not yet at a critical stage so there is a negative potential for community dependence on PJB UP Paiton's CSR program.

The same company Corporate Social Responsibility (CSR) has been researched by Alvina Tsabitah Nur Zhafirah in 2022 with title *Management of the CSR Program at PT Pembangkitan Jawa-Bali* [17]. This research using qualitative method with interviews, observation and documentation. Analysis of the company's CSR is based on ISO 26000. PJB's CSR management is managed by the company secretary. The CSR program is prepared based on the results of social mapping, adapting government programs and emergency response conditions, then the implementation of activities is reported in various company reports. There are four pillars of CSR, including Smart Innovation PJB, Green Innovation PJB, superior PJB, PJB Cares, and CSV. Evaluation is carried out

through IKM and SROI. The company's CSR implementation is in accordance with ISO 26000.

The similar research on Dynamics of Community Empowerment Through the Local Energy Community in Mundu Village, Tulung District, Klaten Regency has been conducted by Fajar Istikhomah and Agus Riyadi in 2021 [18]. This research use sociological approach and observation, interviews and documentation. From the empowerment carried out, it resulted in an increase in life capacity, welfare and the process of community independence which was still continuing until the time the research was conducted. From this empowerment, among other things, there is an increase in life capacity, independence and community welfare.

Another similar research on the Implementation of the Local Energy Community are conducted by Yunia Daniati in 2018 [19]. This research is using qualitative methods for analysis and interviews and observation for data collection. The community empowerment has been successful in the pillars of Organization, Interpretation and Application. The supporting factors of its successful are deep understanding and agreement on organizational goals and structure, communication, and the existence of supporting sources. Meanwhile the inhibiting factor is the lack of availability of supporting resources such as human resources, facilities and infrastructure.

The research of impact analysis of Local Energy Community based in biogas on Bendosari Village, Pujon District, Malang Regency is conducted by Alifi Zulfa Syharina in 2018 [20]. Using qualitative method and documentation, interviews, observation for data collection method, The program implemented had a significant impact on the community because the community was unable to optimize program implementation. Social impacts include the establishment of good relationships between communities and the growing awareness of cattle breeders to manage biogas waste. Environmental impacts such as reduced pollution, healthier communities, cleaner cowsheds, and reduced deforestation. The benefits felt by the community include saving costs due to the use of renewable energy from biogas.

Literature review on previous research that has been conducted shows that there has been no research on the analysis of the implementation of community empowerment in the Kampung Setrum CSR program. Furthermore, all recent research in Local Energy Communitys community empowerment using general community empowerment theory to analyze the result. This research was conducted to be able to examine and be able to fill the research void on the analysis of the implementation of community empowerment

programs in local energy community in Andungbiru Village using the ladder depiction of outcomes of empowerment by Coy [6] that are constructed in particular for Local Energy community empowerment.

3. Methodology Research

This research uses qualitative research methods. The type of qualitative research used is a type of case study research which is a series of scientific activities carried out intensively, deeply, and in detail on an activity, event, and program, both at the level of an organization, institution, group of people, or individual to gain in-depth knowledge about the event [21,22]. In determining informants, this research uses purposive sampling technique. By using this method, the author ensures the data obtained for research with consideration of the concept of CSR and program beneficiaries so that the data obtained in this study are representative data [23,24].

The CSR team of PLN Nusantara Power UP Paiton and the Head of Tirta Pijar Group are key informants who are expected to provide general information and know community empowerment conceptually. The Tirta Pijar group in this study is the main informant who is expected to provide detailed information as the main actor of the community empowerment carried out. The Village Government and Hamlet Government as well as the Andungbiru Village Community are supporting informants who are parties related to the main informants and are beneficiaries of the PLTMH in Andungbiru Village. Supporting informants are expected to provide additional useful and relevant information.

This research used both primary and secondary data. In this research, primary data was obtained by in-depth-interview and focus group discussion. Meanwhile, secondary data in this study were obtained from physical literature, literature on the internet, data obtained from CSR PJB UP Paiton, and from other data sources obtained during the research [25-27].

In the research, data analysis was carried out by reviewing all the data that had been obtained, reducing data, categorizing, presenting data, and drawing conclusions. Data reduction is done by making abstractions in order to summarize and select key information that is in line with the focus of the research. After the data and information were reduced, the results of the reduction were compiled and categorized. Qualitative data that has been categorized is presented with narrative text, tables, and graphics.

Conclusions were drawn in two stages, namely initial conclusion drawing and verification with data validity testing techniques using the triangulation method [28,29].

Data validity testing in this study was carried out using triangulation techniques by utilizing something other than the data obtained. This is done to compare or check the results of this research with these other data [30]. This study uses the source triangulation technique as a data validity test technique [21].

In addition to using the source triangulation data validity test technique, this research also uses expert validation. Expert validation itself is a process in which researchers ask for feedback and evaluation from experts who have knowledge and expertise in fields relevant to the research topic. This review aims to strengthen the validity and validity of qualitative research findings that use new theories. Experts in this process provide feedback on research methods, data analysis, and the resulting conclusions. Review by experts provides an objective perspective and helps correct or validate the researcher's interpretation.

4. Results and Discussion

The research was conducted on the slopes of Mount Argopuro, precisely in Andungbiru Village, Tiris District, Probolinggo Regency, East Java. The village is located 42 kilometers from the city of Probolinggo Regency, and is at the South East end of the villages in Tiris Sub-district with an area of 2,210,220 Ha. Andungbiru Village itself is administratively divided into five hamlets including Krajan Hamlet, Klakah Hamlet, Sumber Kapung Hamlet, Kedaton Hamlet and Lawang Kedaton Hamlet. Broadly speaking, the majority of the community's economy is farm labor with a strong Javanese and Madurese Islamic culture. Lighting in Andungbiru Village is connected to two systems, namely PLN electricity for approximately 90% of the community and PLTMH electricity for 10% of the community (Andungbiru Village, 2022).

Although not in accordance with the definition of an Local Energy Community by (Minister of Energy and Mineral Resources, 2018) which states that an Local Energy Community is a Village that is able to meet 60% of energy needs using renewable energy, Andungbiru Village was initially able to produce renewable energy from various other sources besides PLTMH to overcome the scarcity of electricity in the area such as using biogas and solar energy. However, currently only the PLTMH is a renewable energy source that produces electrical energy and is used by the wider community. In

fact, the electricity generated by the PLTMH located in Andungbiru Village is not only used for the needs of the village, but also used by other villages, namely Sumber Duren Village in Krucil Sub-district, which is located next to Andungbiru Village.

The CSR program with the concept of Local Energy Community or DME in Andungbiru Village is supported by PT PLN Nusantara Power UP Paiton, formerly PT Pembangunan Jawa Bali UP Paiton. The program with the name Kampung Setrum has been going on since 2016. This CSR program has developed into a zero-waste program. Not only focusing on energy, the Kampung Setrum CSR program also empowers the community with downstream coffee, local livestock, organic fertilizer, nurseries, and river conservation programs [11]. The Kampung Setrum CSR program is in accordance with the definition of CSR described by WBCSD [9] and Natalylova [10]. This CSR program in its implementation has contributed to the community from the energy sector to the economic sector and the community environment as evidenced by the improved quality of life of the community.

Although the Kampung Setrum CSR Program has developed through many sectors in Andungbiru Village, the focus of the research conducted was to conduct an Implementation Analysis of Local Energy Community Community Empowerment: Case Study of Andungbiru Village by Tirta Pijar PLTMH Group and PT PLN Nusantara Power UP Paiton CSR Program. Therefore, this chapter presents the results and discussion that focuses on the implementation of the PLTMH in Andungbiru Village carried out by the Tirta Pijar PLTMH Group.

4.1. Implementation of Local Energy Community Community Empowerment in Tirta Pijar PLTMH Group

The implementation of community empowerment for Local Energy Communitys in Andungbiru Village by the Tirta Pijar PLTMH Group is presented in Table 1.

Along with the development of PLTMH electricity, PLN expanded the electricity network in Andungbiru Village. However, this did not make the people of Andungbiru Village immediately switch to using PLN electricity. According to all informants, PLN electricity often goes out for a longer time than PLTMH electricity. PLTMH electricity will only go out during repairs and is rarely repaired, while PLN electricity can go out for up to three days at an uncertain time. Sometimes there is no circular and the electricity goes out and vice versa.

TABLE 1: Implementation of community empowerment for Local Energy Community in Andungbiru Village by Tirta Pijar PLTMH Group.

Year	Implementation of Local Energy Community Community Empowerment
<1992	<ul style="list-style-type: none"> • There is no electricity at all in Andungbiru Village. • The community uses templek lamps, which are a source of night lighting derived from kerosene or cooking oil given a wick and then lit with fire. As much as 1 liter of kerosene can be used to light the templek from after maghrib until 10pm. The smoke from the fire produced by the templek makes the dirt scorch so that it cannot be lit near humans. So studying and other activities at night are very limited. • If there is an event or celebration, which in the local language is called <i>min amin bandek</i>, the local community uses torches or trucking lights.
1992	<ul style="list-style-type: none"> • At some points in Andungbiru Village, generators are used to obtain electrical energy generators with diesel fuel for electricity and village lighting at night. It is only turned on at 5-6pm and will be turned off at around 9-10pm. The expensive price of diesel fuel meant that lighting was limited at that time. • In 1992, Mr. Rasid, a resident of Andungbiru Village, had a plan to create a source of electricity utilizing the potential in his village.
1993	Mr. Rasid was concerned about the fact that Andungbiru Village did not have electricity and he thought that with more affordable and equitable electricity there would be many open opportunities to improve education, quality of life, and community welfare. The mill that was finally built finally 5000 watts of electricity and can light up 15-30 families. In the local language, the wheel is called <i>langbaling</i> .
1998	PLN electricity enters Andungbiru Village in Krajan Hamlet, Kedaton Hamlet, and Lawang Kedaton Hamlet. Several other hamlets have not been reached by PLN due to the difficult terrain. The entry of PLN into Andungbiru Village did not discourage Mr. Rasid from developing his power plant.
1999	Mr. Rasid built a dam and bought a second-hand micro hydro machine. This microhydro machine has a maximum capacity of 20,000 watts and can illuminate 72 households.
2004	<ul style="list-style-type: none"> • Mr. Rasid bought a micro hydro machine with a larger capacity of 42,000 watts with his own money from selling his truck. • The Probolinggo District Government provided assistance in the form of civil buildings, namely the construction of concrete iron, but there were problems with the 3rd party. The construction was not completed so Mr. Rasid with 3-5 of his relatives continued the construction using drums that were connected to save costs.
2010 2011	Received assistance from CSR of Perusahaan Gas Negara in collaboration with Brawijaya University in the form of a turbine unit with a capacity of 16,000-25,000 watts. PGN and UB also assisted in the formation of a PLTMH group called the Tirta Pijar PLTMH Group.
2016	Received assistance from CSR PLN Nusantara Power UP Paiton, which at that time was still called Pembangkitan Jawa Bali UP Paiton in the form of PVC rapid pipe installation.
2017	CSR PLN Nusantara Power provided assistance to the PLTMH Group in the form of turbines with a capacity of 45,000-60,000 watts. After the installation of unit 3, the electricity obtained from the PLTMH can supply 600 families.
2018	PLTMH operational training was conducted for the Tirta Pijar PLTMH Group
2019	<ul style="list-style-type: none"> • PLN expanded Andungbiru Village's electricity network in Klakah Hamlet • Certification of electrical experts to Tirta Pijar PLTMH Group carried out
2022	PLN expanded Andungbiru Village's electricity network in Sumber Kapung Hamlet

Source: Author's data, 2023

Electricity generated by PLTMH provides convenience to the community, especially in the ease of payment and affordable prices. Currently, electricity from PLTMH can be paid using money in accordance with the Kwh count, as well as in other forms such as crops such as coffee, corn, rice, fruit, livestock such as chickens, ducks, and others

whose value is adjusted to the Kwh count of electricity usage. Electricity payments can be made in various periods according to the community's ability, payments can be made directly or in installments in monthly, seasonal, annual, or even 2-4 years.

In the past, before Kwh meters were installed in every house that connected to PLTMH electricity in 2014, PLTMH electricity was priced based on the electronic devices owned by each household. One lamp was priced at Rp. 1,000, one television at Rp. 25,000, and one refrigerator at Rp. 3,000. Since 2014-2015, Kwh meters have been installed in each household that connects to PLTMH electricity. 1 Kwh is priced at Rp. 0,- to Rp. 800,- based on the economic capacity of each household. Until now, the PLTMH in Andungbiru Village has succeeded in lighting up 600 households with details of approximately 2,400 electricity users where electricity is provided free of charge to 200 underprivileged people, 12 houses of worship, 6 educational facilities [18].

At present, PLTMH electricity continues to be developed by the Tirta Pijar PLTMH group by testing a prepaid payment system. The trial has been successfully carried out with 1 unit of prepaid equipment and the plan is to continue to be developed but waiting for funds considering the cost required for one prepaid unit is IDR 1,500,000 ,-. Although using a prepaid system, the Tirta Pijar PLTMH group will still ensure that the voucher price will remain cheaper than PLN's electricity voucher.

Mr. Rasid as a pioneer has succeeded in forming groups and power alliances in the Tirta Pijar PLTMH group. In its implementation, the Tirta Pijar PLTMH group has identified existing problems and developed the PLTMH it manages from the construction process to the development of the PLTMH such as planning the use of prepaid PLTMH electricity. The movement carried out by the Tirta Pijar PLTMH group can empower the community and find solutions to the conditions of Andungbiru Village, which was initially not touched by PLN electricity until the constraints of PLN electricity conditions in Andungbiru Village. This marks that the empowerment of Local Energy Community communities in Andungbiru Village by the Tirta Pijar PLTMH Group is a bottom-up community empowerment (see Figure 2).

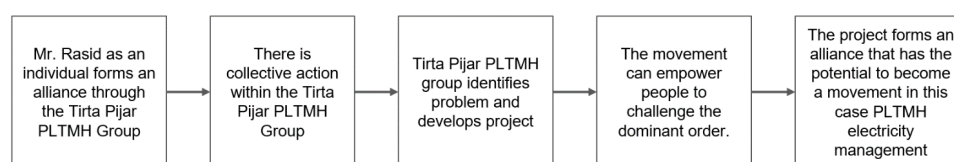


Figure 2: Bottom-Up Community Empowerment in Andungbiru Village by Tirta Pijar PLTMH Group. Source: Author's data, 2023.

The author sees that the PLTMH in Andungbiru Village managed by the Tirta Pijar PLTMH group if based on the ladder theory of depiction of outcomes of empowerment [6] has been at the highest level, namely the power-shift level. This is characterized by the empowerment process carried out where collective action grows in strength as individuals form groups, identify problems and develop projects and projects form alliances that have the potential to become dominant movements and these movements can empower communities to challenge dominant challenges. In addition, the community has been experimenting and innovating towards the community empowerment they do so that it can become what it is today.

4.2. Decision Making in Tirta Pijar PLTMH Group in Local Energy Community Community Empowerment

The highest decision-making in the Tirta Pijar PLTMH Group is held by the group deliberation. Meetings to conduct group deliberations are carried out with a frequency of 1-2 times a year and are only carried out if there are significant obstacles to the PLTMH. This deliberation process is carried out through the stages of discussion, approval of group members, agreement of group members, and implementation of decisions that have been mutually agreed upon. Mutual agreement is considered very important for Tirta Pijar PLTMH to accommodate a sense of belonging among group members.

In the deliberations carried out, several parties related to the decisions to be made were also invited. The parties involved included representatives of the village government, community leaders, and religious leaders, as well as CSR PLN Nusantara Power. As a community empowerment facilitator who assists the Tirta Pijar PLTMH group, CSR PLN Nusantara Power is always present when invited to meetings held to conduct deliberations. CSR PLN Nusantara Power does not play much of a role in influencing the decisions made. Thus, the highest decision in community empowerment carried out to the Tirta Pijar Group is in the group agreement.

From the research results obtained, it shows that the empowerment of the Local Energy Community community in the Tirta Pijar PLTMH Group is based on the ladder theory of depiction of outcomes of empowerment [6] which is at the Autonomy level. This is characterized by PLTMH groups that have acted on their own policies in this case placing the consensus of group deliberation as the highest decision and not under the influence of others. The role of the facilitator, in this case CSR PLN Nusantara Power, in group decision-making only accompanies and does not influence group decisions,

indicating that community empowerment in Local Energy Community is carried out on a mixture of community initiatives with some assistance from regulating entities.

4.3. Management of Human Resources and Natural Resources by Tirta Pijar PLTMH Group on Local Energy Community Community Empowerment

The Tirta Pijar PLTMH Group is a group of community members who independently focus on the development of PLTMH in Andungbiru Village. The group was formed around 2010-2011 when it received assistance from CSR cooperation between Perusahaan Gas Negara and Brawijaya University. The group was inaugurated in 2016 when PLN Nusantara Power CSR entered Andungbiru Village with the Kampung Setrum program. This group has been functioning for a long time and continues to develop into capabilities. With the help of CSR PLN Nusantara Power, the Tirta Pijar PLTMH Group can obtain new capital for existing capabilities. To date, there are 16 group management members, all of whom are local people and all of whom have undergone electrical expert certification.

The Tirta Pijar PLTMH group when viewed through Manso-Burgos [15] and European Union [14] is a Local Energy Community which is a self-help association controlled by local communities as members with the aim of providing environmental, economic, social benefits, rather than financial benefits. The community's role in managing the Tirta Pijar PLTMH group signifies that the community has been actively involved democratically in the local electricity system. With the community managing the new renewable energy ensures that the electricity generated will be distributed to reach more people so as to reduce the inability to access energy for the community. This is in accordance with the concept of energy citizenship [13] and the concept of Local Energy Community [15]. The Tirta Pijar PLTMH group consists of a chairman, secretary, treasurer, and members who are divided into the operator section, network section, meter section, and river waste cleaning section [5,17] (see Figure 3).

Each section holds its own responsibilities, but if there is heavy work, then all group administrators do the work together. The Tirta Pijar PLTMH group always discusses and innovates as the empowerment of the Local Energy Community progresses. This is proven by the creation of new innovations and opportunities over time such as cementing the river so that it does not damage the surrounding rice fields, making, maintaining, and even repairing dams, using kWh meters from the previous manual calculation of electricity fees calculated per item of electronic objects, plans to use

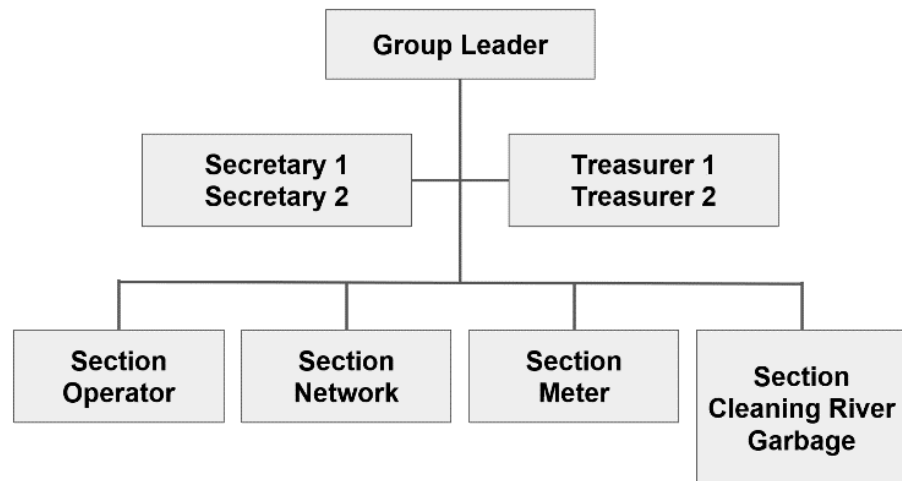


Figure 3: Organizational Structure of Tirta Pijar PLTMH Group. Source: Informant K1 processed by the author, 2023.

vouchers that have been tested, to the use of electricity for downstreaming local plantation products such as coffee which has been running and has been successful.

Monitoring work between group members, especially between the group leader and other members, is carried out using Handy Talky because of the poor signal in Andungbiru Village. The active administrators of the Tirta Pijar PLTMH group before the pandemic received a wage of around Rp. 500,000 per month from the fees of the community that utilizes electricity from the PLTMH, but currently the active group administrators have not received a wage during the pandemic that began until the time the author conducted research in Andungbiru Village. This is because the community paid electricity fees more punctually before the pandemic than during the pandemic until now. Nevertheless, the group administrators still wholeheartedly take care of the PLTMH so that the electricity can be utilized by the community without expecting any remuneration from the PLTMH.

Resource management in the form of natural resources is carried out by the group management of the river cleaning section. This section is in charge of cleaning the river flow from stuck garbage so that the flow of river water is not hampered and the turbine can work optimally. The location of the turbine house which is right above the river and adjacent to the residents' rice fields does not make it an obstacle, precisely with the electricity generated from this PLTMH, the owners of rice fields can raise water from the river to rice fields whose location is located higher than the river.

From the results obtained regarding the management of human resources and natural resources carried out by the group, the author can see that the Tirta Pijar PLTMH Group already has the power over resources and the power to create and take advantage of new opportunities and make meaningful choices. This indicates that the empowerment of the Andungbiru Local Energy Community community based on the ladder theory of depiction of outcomes of empowerment [6] has reached the highest level, namely at the Power-Shift level.

4.4. Tirta Pijar PLTMH Group Response to Problems in Local Energy Community Community Empowerment

From the various benefits and conveniences felt from PLTMH electricity, the community experiences some minor obstacles in its implementation. PLTMH electricity is sourced from river flow where the swiftness of the river flow greatly affects the electricity generated by the PLTMH turbine. If it is the dry season and the flow is not swift, the electricity generated by the PLTMH is not too large so that at night the lights will be dimmer than usual. Another obstacle is experienced during the day when people carry out economic activities using electricity such as using coffee machines together, the electricity will go out for a moment and then turn on again. At certain times, such as during PLTMH repairs, the electricity will be turned off for a moment and will turn on as soon as the repairs are completed.

Other obstacles caused by nature include lightning, flooding, and waste problems. In 2020 there was a flash flood that destroyed the PLTMH dam and the community worked together to repair it. On the first day of repairing the dam, the community did voluntary community service on their own awareness. If one day is not finished, then on the following days the community will be paid. Even so, many people do not want to be paid for doing community service because they already have a sense of ownership over the PLTMH itself. Based on the ladder conception of outcomes of empowerment, the sense of ownership in dealing with problems that occur, shows that existing community empowerment has reached the Power-shift level.

Waste problems occur because Andungbiru Village has become more densely populated, so the waste in the river is not only agricultural waste such as straw and leaves but also household waste. So the Tirta Pijar PLTMH group must clean the river flow because if it is obstructed by garbage, it will affect the electricity output generated by the PLTMH.

Despite its success in providing alternative electrical energy, the Tirta Pijar PLTMH group faced various obstacles and problems such as people not paying their electricity bills. In dealing with this problem, the group held deliberations and finally made a decision as follows.

In addition to obstacles from the community, the village government has also rejected the presence of PLTMH in Andungbiru Village because of the entry and expansion of the PLN network. However, the Tirta Pijar PLTMH Group still maintains the PLTMH it manages because according to them, the PLTMH they manage is very helpful for the community to reach cheap and environmentally friendly electricity.

Other conflicts that have occurred are differences of opinion. This is very natural where the Tirta Pijar PLTMH Group is a group of 16 people so there are many thoughts in it. Problems within the group occur usually based on the problem of lack of communication. Moreover, problem solving in the group is done by deliberation. PLN Nusantara Power as a facilitator in dealing with this kind of problem acts as a mediator.

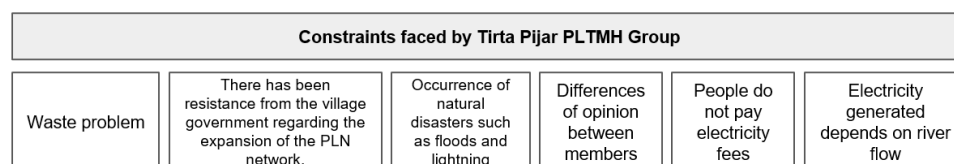


Figure 4: Constraints experienced by Tirta Pijar PLTMH Group. Source: Author’s Data, 2023.

Figure 4 indicates that the existing community empowerment based on the ladder theory of depiction of outcomes of empowerment [6] has reached the Autonomy stage, where the community has acted on their own policies and not on the influence of others. The implementation of community empowerment that takes place is also characterized by a mixture of community initiatives, in this case the Andungbiru Village community and the Tirta Pijar PLTMH group with the help of the governing entity, in this case, CSR PLN Nusantara Power.

When research was conducted in Andungbiru Village, there was one damaged PLTMH unit that left 300 households without electricity. The 300 households without electricity did not immediately switch to PLN electricity but waited for the damaged PLTMH unit to be repaired. Some of them received electricity from their neighbors who had electricity that did not fail. Meanwhile, when asked for information by the community and the head of the local hamlet, the head of the Tirta Pijar PLTMH group explained that currently the PLTMH group does not have enough capital to repair the damaged unit so they are waiting for assistance from PLN Nusantara Power CSR. In

fact, currently the CSR Program from PLN Nusantara Power has exited. This kind of dependence is a non-hierarchical constraint related to funding between the Tirta Pijar PLTMH group as an empowerment group and PLN Nusantara Power CSR as a facilitator, further strengthening that this community empowerment is based on the ladder theory of depiction of outcomes of empowerment [6] at the Autonomy level.

The community's dependence on PLN Nusantara Power's CSR program supports the findings in the research conducted by Pratiyudha [5]. In the existing community empowerment, community awareness is still not at the crisis level, allowing the potential for dependence on the PLN Nusantara Power CSR program [5]. This is evidenced by how the Tirta Pijar PLTMH Group dealt with the problem of damage to one microhydro turbine unit by waiting for financial assistance sourced from PLN Nusantara Power CSR when the CSR program status had exited.

4.5. Impact of Local Energy Community Community Empowerment by Tirta Pijar PLTMH Group

The existence of the PLTMH managed by the Tirta Pijar PLTMH Group has had an impact on various livelihoods in Andungbiru Village. The following chart shows how the impact of Tirta Pijar PLTMH electricity on various community livelihoods in Andungbiru Village as shown in Figure 5.

Overall, seen from various aspects, the impact of empowering Desa Mandiri Energi Desa Andungbiru is shown in the following matrix (Table 2).

The community empowerment carried out has been able to enable people to make strategic life choices, improve their quality of life, and increase their social and economic capital. So if based on the ladder theory of depiction of outcomes of empowerment [6], this community empowerment has reached the level of Autonomy. If analyzed further, the community, in this case the Tirta Pijar PLTMH group, has been able to become an agent of change, form sustainability with the environmentally friendly electricity produced, and bring transformative changes in various sectors such as economy, education, and social. The results of this study are in accordance with the theory presented by Mardikanto where changes that occur in various sectors occur due to the process of empowerment and strengthening of community capabilities that occur through a participatory learning process [12]. This is evident from the realization of an increasingly empowered, independent, and participatory community life. Thus, the community empowerment carried out has reached the Power-shift level.

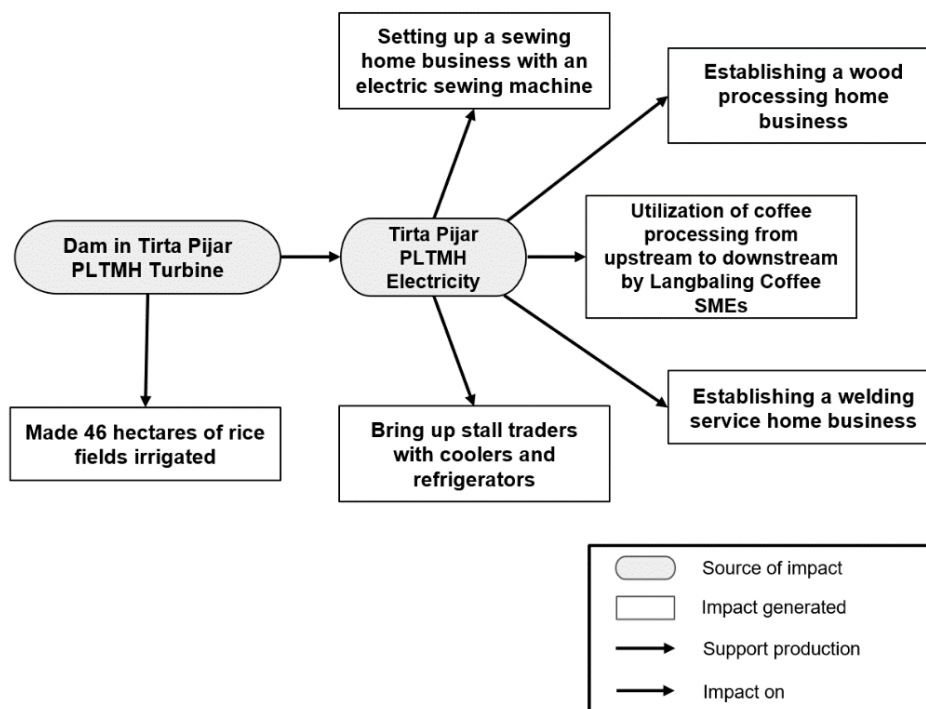


Figure 5: The impact of Tirta Pijar PLTMH electricity on various community livelihoods in Andungbiru Village. Source: Author’s data, 2023.

TABLE 2: Impact Matrix of Empowerment of Local Energy Community of Andungbiru Village by Tirta Pijar PLTMH Group.

Impact of Local Energy Community Empowerment in Andungbiru Village by the Tirta Pijar PLTMH Group.			
Economy Impact	Education Impact	Social Impact	Environmental Impact
<ul style="list-style-type: none"> • Save potential electricity usage up to Rp. 2,000,000 per year • Bring up stalls with coolers and refrigerators • Establishing home-based businesses such as tailoring, wood processing, coffee processing, and welding services • There are 46 hectares of irrigated rice fields • Free electricity to vulnerable communities, public facilities, groups working on PLTMH • The average increase in income from before and after the PLTMH was 59%. • SROI value 2.29. 	<ul style="list-style-type: none"> • Human Resource Improvement 	<ul style="list-style-type: none"> • The existence of lighting can improve the social life of the community • Easier access to information 	<ul style="list-style-type: none"> • Reduce greenhouse gas emissions by 414.64 tons CO2 every year • Reduction of potential illegal logging by approximately 2.4 ha

Source: Author’s data, 2023

The mapping of community empowerment actors is mapped using the power vs interest grid method. The method explains that there are four quadrants: players, stakeholders who have significant interests and power; subjects, stakeholders who

have interests, but little power; context setters, stakeholders who have power, but have little direct interest; and the crowd, which consists of stakeholders with little interest and power [31]. If mapped based on the interest or interest and power of the actors involved, it can be described in the following stakeholder map.

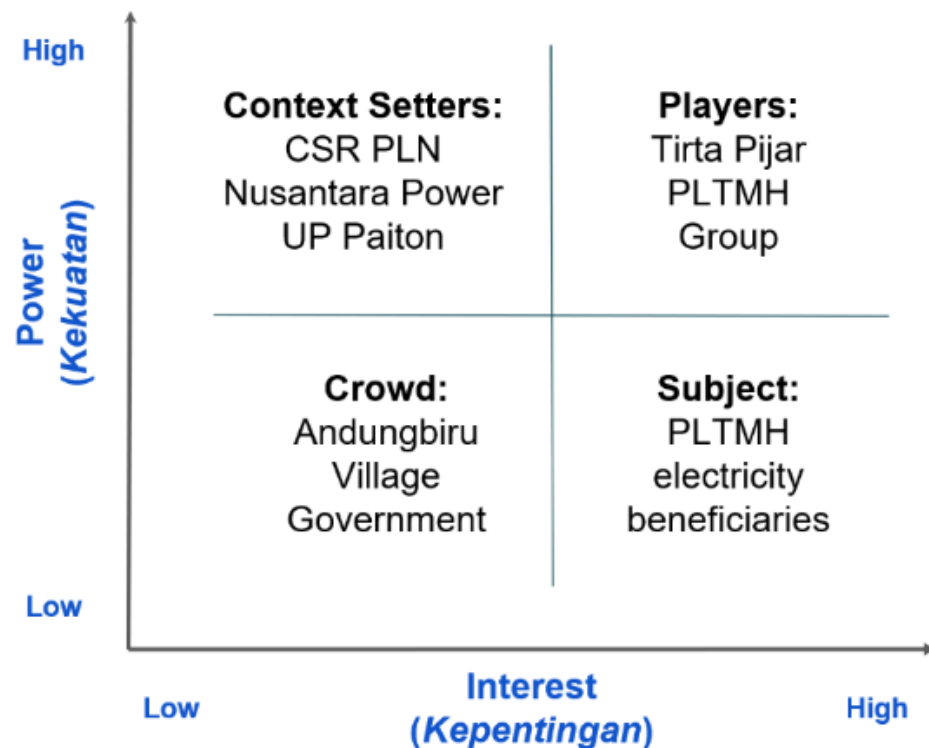


Figure 6: Stakeholder Mapping in empowering Local Energy Community communities at Tirta Pijar PLTMH. Source: Author's data, 2023.

4.5.1. Players

The Tirta Pijar PLTMH group is the main actor who contributed at the time of the establishment of the PLTMH until it developed until now. The Tirta Pijar PLTMH group is in the Players quadrant because in the existing community empowerment this group has high power and importance where they always fully contribute to the existing community empowerment. Within this group there is an initiator and as the manager of Tirta Pijar PLTMH, this group has very significant power and influence on community empowerment.

4.5.2. Subjects

The community beneficiaries of Tirta Pijar PLTMH electricity are in the Subjects quadrant. They have a great interest in community empowerment as beneficiaries, but their power or influence is limited. Of the 600 households that benefit from PLTMH electricity, there are only 15 people who join the group and have direct power or influence over existing community empowerment through deliberations and various discussions. Even so, people who do not join the Tirta Pijar PLTMH Group can still give their opinions on community empowerment.

4.5.3. Context Setters

The running of Local Energy Community community empowerment in Andungbiru Village is inseparable from the assistance provided by outsiders, one of which is the most influential is assistance from CSR PLN Nusantara Power UP Paiton. The assistance provided has a significant impact on the empowerment of the existing community as evidenced by the increasing welfare of the community of PLTMH electricity users that have been described. CSR PLN Nusantara Power UP Paiton has high power and influence, but has relatively low importance. CSR PLN Nusantara Power is in the Context Setters quadrant because it has a big influence on the success of existing community empowerment but is not too involved in the details.

4.5.4. Crowd

Despite the success of Local Energy Community community empowerment in Andungbiru Village, it was rejected by the village government due to the inclusion of the PLN electricity network in Andungbiru Village. As the village government changed, the village government has now begun to accept the existence of Tirta Pijar PLTMH. The Andungbiru Village Government in this case is in the Crowd quadrant because it has low importance and power towards community empowerment. The Andungbiru Village Government does not influence the outcome of community empowerment directly, but it is still important to acknowledge their existence by inviting them to deliberations and considering the long-term implications of decisions or actions on them considering they are in power in the area where community empowerment takes place.

The results and discussion presented in this study have gone through an expert validation process. Validation was carried out by the author sending the draft results and discussion as well as the presentation video to the expert. As feedback, the expert has validated and provided input that the author used to improve the results and discussion in this study.

5. Conclusion

Based on the results of the analysis that has been carried out, community empowerment with the concept of Local Energy Community or DME carried out by the Tirta Pijar group in collaboration with the PLN Nusantara Power Kampung Setrum CSR program has gone well. From the explanation that has been presented, it can be concluded that the implementation of Local Energy Communitys in Andungbiru Village based on the outcome analysis of community empowerment carried out by the Tirta Pijar PLTMH Group in collaboration with CSR PLN Nusantara Power UP Paiton in the Kampung Setrum Program has been at the highest level, namely the Power-Shift level or the transfer of power.

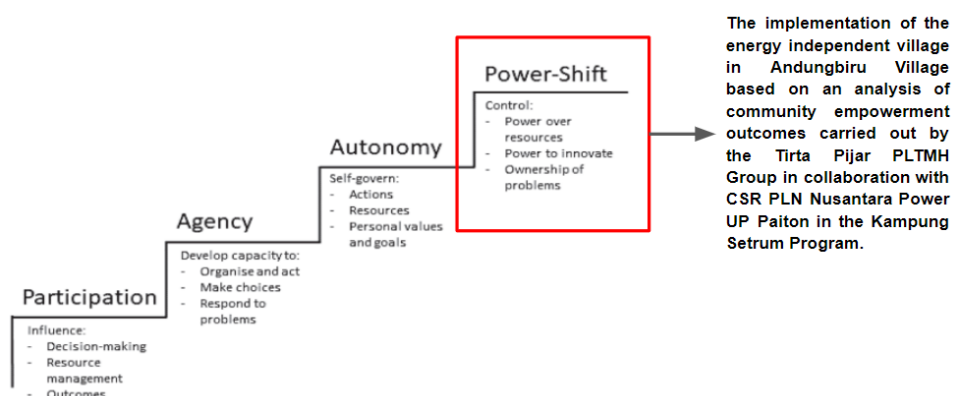


Figure 7: The results of the outcome analysis of community empowerment of Local Energy Communitys in Andungbiru Village carried out by the Tirta Pijar PLTMH Group in collaboration with CSR PLN Nusantara Power UP Paiton in the Kampung Setrum Program. Source: Author's data, 2023.

5.1. Future Research

The research conducted by the author does not avoid limitations. For this reason, future research is expected to do the following things

1. Expanding the scope of research

The research conducted by the author only examines the outcome analysis of Tirta Pijar PLTMH empowerment in Andungbiru Village, Tiris District. As is known, the beneficiaries of Tirta Pijar PLTMH are not only the people of Andungbiru Village, but also the people of Sumber Duren Village in Krucil District. Expanding the scope of research locations in future research is expected to produce more generalized research results. In addition to the research location, future research can also expand the scope of research participants/informants, different research times, and even research in different locations.

2. Using different methods

The research conducted by the author used in-depth interview and Focus Group Discussion (FGD) data collection methods. In future research, other methods such as surveys can be used. In addition, further research can use quantitative methods in data analysis methods. That way more comprehensive research results will be produced.

3. Conducting research with different theories

In this research, the author uses the Ladder Deception of Outcomes of Empowerment conception. Future research can be conducted with different empowerment outcome analysis theories. This can be used as a comparison so that it is expected to produce a deeper understanding of the Tirta Pijar PLTMH empowerment outcome analysis.

5.2. Implication of Research

Theoretically, as far as this research conducted, this research is a pioneer for using particular theory of community empowerment in local energy community. The theory that used in this research, ladder deception of outcome of empowerment by Coy [6], is a particular theory that analyze community empowerment in local energy community. Through this research, we can see the overview of the extent to which Tirta Pijar PLTMH group has been able to change existing resources, in this case river flow, into electricity which improves the welfare of village residents. Even though the community has had many positive impacts, it cannot be denied that there are still obstacles that are felt. Through this research the author presents policy recommendations that can be implement by Tirta Pijar PLTMH Group in Andungbiru Village. Therefore, this research contribute to community empowerment in local energy community research field in

Indonesia by examining the ladder depiction of outcome of empowerment and giving the policy recommendation.

5.3. Policy Recommendation

From the analysis that has been carried out, there are several things that become obstacles in the implementation of Local Energy Community community empowerment in Andungbiru Village by the Tirta Pijar PLTMH Group, which based on the author’s observations can be corrected, including.

1. People who do not pay due to economic factors
2. Lack of funding for Tirta Pijar PLTMH group
3. Problems the PLTMH Group has had with the Andungbiru Village Government

The following is a solution model table (Figure 8) and a solution model chart of the constraints that are being faced by the empowerment of Local Energy Community communities in Andungbiru Village by the Tirta Pijar PLTMH Group.

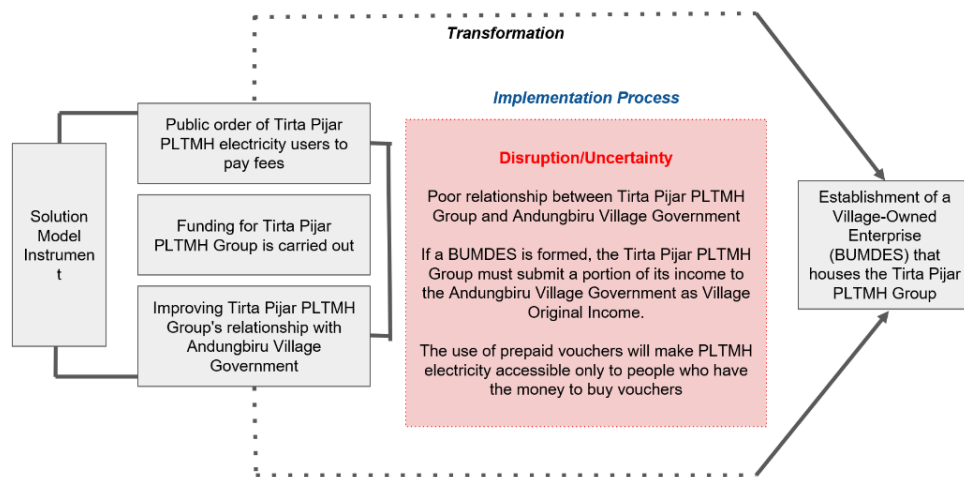


Figure 8: Solution Model Chart. Source: Author’s, 2023.

In the author’s view, the BUMDES scheme is the right solution because the PLTMH in Andungbiru Village, which was not given much attention by the previous village government, will begin to receive attention from the village. The establishment of this BUMDES at the time of the research was also planned by the Andungbiru Village Government. In addition, with the BUMDES that houses the PLTMH group, there will

also be funding provided by the village to the PLTMH group. The funding can be utilized by the PLTMH Group to continue developing the PLTMH by repairing damaged PLTMH units, purchasing new PLTMH units, and expanding the application of their innovation in the form of installation units for prepaid electricity. With a prepaid scheme that uses vouchers, there will be no arrears from the PLTMH electricity users.

This solution has its own challenges. Among these challenges is that the relationship between the Tirta Pijar PLTMH Group and the Andungbiru Village Government is currently not going well, so there needs to be a lot of approaches and discussions before a BUMDES is finally formed. If the BUMDES is established, the Tirta Pijar PLTMH Group will have to hand over part of its income to the Andungbiru Village Government as Village Original Income. This will certainly require further discussion as it will affect the finances of the Tirta Pijar PLTMH Group even though with the BUMDES, the Tirta Pijar PLTMH Group can obtain funding from the Andungbiru Village Government. However, the use of prepaid vouchers will make PLTMH electricity accessible only to people who have the money to buy vouchers. This is not in line with the group's principle of not wanting to inconvenience the community where currently all electricity users can get PLTMH electricity even if they are in arrears and pay in installments over a period of years.

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