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Energy transition: Looking at village perceptions of the energy independent village program in Mojokerto Regency

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Abstract
Purpose: The Indonesian government has set a new renewable energy target of 23% by 2024, which will play an important role in the energy transition program, particularly in rural areas. This study describes the village government's perception of energy transition through the energy-independent village program in Mojokerto Regency.
Research methodology: This article examines village government perceptions of energy transition using descriptive qualitative research, and the theory of social capital is an analytical tool for viewing village perceptions in Mojokerto Regency in realizing an energy-independent village.
Results: Findings revealed that most village governments in Mojokerto Regency do not prioritize energy transition, perceiving it as secondary to poverty reduction, infrastructure improvement, and economic empowerment. Although some villages have initiated renewable energy projects, such as biogas in Pacet and micro-hydropower plants in Seloliman, Jembul, and Kebontunggul, these initiatives remain limited and fragmented. Village governments still view energy transition as resource-intensive, requiring substantial funding, technology, and external support.
Conclusions: This study concludes that traditional development perspectives emphasizing physical infrastructure and economic growth dominate village agendas, thereby sidelining renewable energy programs. Without alignment between central, regional, and village policies, the realization of energy-independent villages will remain slow and ineffective.
Contribution: This research will be input to the government of Mojokerto Regency on the issue of energy transition, as well as for the central government through the Ministry of Villages in assessing the village's ability to face the energy transition process.
Limitations: Because only a few villages are discussed in this study, this limitation will be balanced with an overview of other villages.

Keywords: *Energy Transition, Energy Independent Village, Village Perception*

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1. Introduction

In recent years, issues regarding the global energy crisis have become a topic of discussion in various groups. The increase in the global population is directly proportional to the increase in energy consumption. The constant mobility of the world's people in carrying out their roles as individuals, professionals, and social beings is inseparable from the use of energy sources. Countries with large and

advanced industries require multiple energy sources. Unfortunately, to date, all forms of energy sources are still derived from non-renewable fossil energy sources.

Through a joint agreement on the Sustainable Development Goals (SDG's), countries have shared awareness of dealing with world crises, including the energy crisis. Through this agreement, all countries will cooperate in dealing with various global crises, with an emphasis on sustainability, universality, and inclusion. This is based on the world agreement on the SDG's in the energy sector, awareness of the use of renewable energy, and gradual abandonment of non-renewable energy, which is the basic concept of energy transition.

Indonesia, as one of the countries that actively participates in the SDG agreement, has also begun to take several steps to change. One of them is Government Regulation (PP) Number 79 of 2014 concerning the National Energy Policy as a legal umbrella that contains rules regarding energy management with due regard to sustainability. Through this regulation, the government has implemented several energy transition process strategies that focus on three important aspects: access, technology, and funding.

The energy transition process requires synergistic cooperation among various parties and sectors. However, seven years after the enactment of the PP, the development of energy transition in Indonesia remains minimal. The Indonesian government's target of 23% renewable energy by 2024 is progressing slowly. The energy transition process occurs only in special sectors involving certain groups, although the community, as the main energy user, should be the main driver of the energy transition process.

The village is the lowest government unit closest to and directly related to the community. The village is the most important area in terms of the distribution of development and the effectiveness of the central government's development program. Villages are regional government units that need to be strengthened from various perspectives to create general welfare. The government has strengthened village institutions since 2015 by distributing village fund budgets. Village strengthening through village funds aims to enable villages to develop independently using their various resources.

In the village strengthening program, the community was the main actor in every program. Thus, the concept of community, carried out by, and beneficial to, the community, becomes a sustainable concept. To strengthen village development, the community and village government are invited to map the potential and shortcomings of their territory in designing development programs that suit the needs of each of these areas.

Since the enactment of village strengthening through village budget funds, various institutional, economic, and social strengthening programs have been designed and implemented by Indonesian villages. The strengthening of villages at this time includes programs to increase the capacity of village apparatuses. Improving the economy of rural communities through economic development manifests in the development of SMEs, savings and loan facilities, and business development training. Community empowerment and public health programs have also sprung up and are developing rapidly, with program designs in various villages in Indonesia.

Administratively, Mojokerto Regency has a total area of 692.15 km2, consisting of 18 districts and 304 villages. The regency, known as Bumi Mojopahit, is also famous for the cultural sites left by the Majapahit Kingdom. Mojokerto Regency is directly bordered by Lamongan and Gresik Regencies in the north, Pasuruan and Sidoarjo Regencies in the east, and Batu City and Malang City in the south.

Several prominent sub-districts exist in Mojokerto Regency. First, Ngoro District consists of 19 villages and is known as an industrial area where many factories absorb a large number of workers who are members of the Ngoro Industrial Park (NIP). Second, the Pacet District consists of 20 villages with beautiful natural areas because they are located in the highlands and have fertile agricultural and animal husbandry potential. The Pacet area is famous for its natural tourist attractions, which are well known and directly adjacent to Batu City, which equally features its natural tourism area.

Each village has different characteristics and potentials. Natural and human resources are the main factors that increase a village's empowerment capacity. The village has relatively close and harmonious social levels and community relations compared to urban areas, where individuality is quite high. As a social community unit, a village can easily unite under a common vision and mission.

2. Literature review

The energy transition has been widely discussed by Indonesian academics based on their respective fields of expertise. Engineering academics, for example, discuss the forms of renewable energy that can be developed. Geothermal energy is an environmentally friendly energy source with the potential for development in Indonesia. Geothermal energy sources are quite large, and Indonesia has the second largest geothermal reserves in the world. However, research shows that it is still difficult to develop in Indonesia because of the relatively large investment value barriers and risks (Harefa & Harmoko, 2021).

Another study that discusses the energy transition based on its energy field, in addition to geothermal energy, is about motorized vehicles with electric energy. The energy transition of motorized vehicles with electrical energy is based on a self-organization approach, namely an approach that looks at transformative planning in the process of energy transition (Ibad, Antiqasari, Hudalah, & Dirgahayani, 2022). Climate change is also one of the factors affecting the energy transition process, where important policies must be issued as a technical basis for the energy transition process (Poerwantika, Windary, Rasyid, & Santoso, 2022).

Another study discussed operating carbon-neutral tourism, where tourism positively contributes to the energy transition (Ranasinghe et al., 2020). The next study on energy transition through LPG subsidy reform, which is based on this study, shows that LPG subsidies are a form of energy transition policy centered on aid targets. This means that LPG subsidies are provided to ensure access to energy for low-income households. In a study conducted by Toft, Beaton, and Lontoh (2016), the energy transition process was not about how to change the use of non-renewable energy into renewable energy but also about how to provide energy access that is evenly distributed (Toft et al., 2016).

Energy transition studies that examine policy tools that affect the energy transition process have also been conducted widely. The goals and objectives of Government Regulation No. 79 of 2014 concerning national energy policies must be reviewed to achieve energy conservation goals and their impact on the workforce (Rinayuhani, Arisandi, & Sutrisno, 2024). Hanan also sees that the energy transition made by the Indonesian government is only a promise that is difficult to realize because the government is actually increasing the share of coal and natural gas, which are forms of non-renewable energy (Hanan, 2019). Not much different from Hanan, Abdhy Walid, and friends, also see that the national energy mix still relies on coal and other non-renewable energy sources, which has a lethal negative impact on the environment (Siagian, Alghazali, & Alify, 2022).

Strengthening the performance and role of the National Energy Council is one of the factors expected to oversee the renewable energy transition process (ESDM, 2009). Through a set of policies made by the government, the National Energy Council should oversee the process from upstream to downstream regarding the energy transition process (Arsita, Saputro, & Susanto, 2021). The concept of the energy *trilemma*, namely, energy security, energy equity, and environmental sustainability, is also a factor that must be considered when creating a successful energy transition process (Wardhana & Marifatullah, 2020).

Several important entities that are the subject of study in the development of energy transition processes are nuclei and biodiesel. The roles of nuclear energy and biodiesel in the national energy transition process have also been extensively studied. Nuclear energy is considered an entity with sufficient potential to meet long-term energy needs with a fairly high level of security (Prăvălie & Bandoc, 2018). In terms of raw materials, which is quite broad, palm oil is an important renewable energy source with the potential to be developed more rationally (Dharmawan, Sudaryanti, Prameswari, Amalia, & Dermawan, 2018).

Many economists have discussed the global energy transition. Much discussion has been carried out on the impact of the energy transition process, as well as the economic benefits that can be obtained by the Indonesian government. Non-renewable and renewable energy sectors play an important role in influencing a country's monetary and growth rates (Syafriany & Wulansari, 2021). However, the urgency of the carbon tax is seen as a tool capable of supporting the national energy transition process (Harris & Ramadhan, 2022).

Based on the literature above, most energy transition research has been conducted at the macro level. In policy setting, there are many energy transition studies that discuss national energy policy analysis. Alternative energy, geothermal or geothermal energy, electrical energy, nuclear energy, and biodiesel have been discussed as forms of energy transition entities. This is called a green economy (Ul Mustafa, Afzal, & Zahoor, 2020). Many institutional settings have conducted energy transition studies on the role of international cooperation agreements and the institutional strengthening of the National Energy Council. From the several literature studies on energy transition above, no one has seen the role of the government in the village as an important factor in the energy transition process; therefore, this research looks at the village perspective on the energy transition process.

3. Research Methodology

The methodology used in this research is descriptive qualitative; through this method, the researcher hopes to be able to describe more clearly and comprehensively the various perspectives that arise in the village government regarding the energy transition process. Data sources were obtained from literature studies on legislation, the latest news, and examples of cases that exist in Mojokerto Regency. Through these data, the author will build thinking constructs to obtain answers from the search for researchers analyzing the village government's perspective on energy transition.

4. Results and discussion

The strengthening of village institutions as the lowest government unit has been conducted since 2014. Since then, the Indonesian government has provided many training and development opportunities for local governments to become independent organizations (Amegayibor, 2021). This strengthening of villages has been seriously realized by providing Village Fund Allocations (ADD) since 2015, which have been transferred directly through the APBD, amounting to around IDR 600,000,000 (six hundred million rupiah) to IDR 1,000,000,000 (one billion rupiah) per year. Since the disbursement of Village Funds (DD), the central government has aimed to improve all aspects of village community life, including village apparatus resources, rural infrastructure, and village economic resources.

The allocation of funds for villages has slowly but surely led to positive development in Indonesian villages. Apart from the various negative impacts of village fund allocation, which led to the emergence of corrupt practices, villages began to design various programs for village development. Eight years after the implementation of the village strengthening program through the Village Fund, the village has made rapid progress. Many villages have emerged that are starting to develop as tourist villages. This development by village-owned enterprises (BUMDES) contributes to empowerment and independent program villages in Indonesia (Haekase, Nursalam, & Toda, 2020).

In view of the success of strengthening village governance, the government has set the main indicators as a measurement tool. This indicator is called the Development Village Index (IDM), which consists of three main aspects:

1. Social Resilience Index which includes: Health, Education, Social Capital and Settlements
2. Economic Resilience Index which includes: Diversity of community production, regional openness, access to trade center and markets, access to logistics as well as access to credit and banking
3. The Environmental or Ecological Resistance Index includes: Environmental quality, Natural Disasters and Disaster Response

The government has determined that village independence is based on IDM, which consists of the three main indicators mentioned above. Based on data until 2022 in Mojokerto Regency, there are 69 independent villages out of 299 existing ones.

Table 1. Data for Independent Villages in Mojokerto Regency 2022

No	Kecamatan	Jumlah Desa Mandiri
1	Jatirejo	3
2	Gondang	3
3	Pacet	1
4	Trawas	5
5	Ngoro	9
6	Pungging	4
7	Kutorejo	6
8	Mojosari	1
9	Dlanggu	1
10	Bangsal	5
11	Puri	1
12	Trowulan	2
13	Sooko	4
14	Gedeg	5
15	Kemlagi	5
16	Jetis	4
17	Dawarblandong	9
18	Mojoanyar	1

Source : satudatapalapa.mojokertokab.go.id

Mojokerto Regency consists of 18 sub-districts, 5 sub-districts and includes 299 villages with quite diverse characteristics. Based on its territorial mapping, the northern area is seen as more industrial, as indicated by the existence of the Ngoro Industrial Park shoulder blade area. The highlands in the south are represented by the Pacet sub-district with potential highland natural resources, as well as good agriculture and animal husbandry practices. The Trowulan District in the western region has the potential for cultural tourism because of the many relics of the Majapahit Kingdom that are found there.

Independent villages in the Mojokerto District showed a significant increase from year to year. In 2020, there were 22 independent villages, in 2021, there were 45 independent villages, and in 2022, it increased again to 69 independent villages, as shown in Table 4.1. However, from the 69 independent village data, no villages were included in the energy-independent village classification. The indicators used in the independent village assessment of Mojokerto were based on the IDM and SDG's.

If we look at the three main IDM indicators set by the government, energy transition is an indicator of national resilience in the social capital indicator. This is included in the indicator of social capital because the energy transition process requires an analysis of the ability to map sources that can be used as alternative renewable energy sources, such as the type of alternative energy source that you want to develop, technological readiness, and funding that must be prepared.

The energy transition in the IDM indicators set by the government was also included as an indicator of ecological resilience. All forms of renewable energy are derived from renewable natural energy sources, which are very different from fossil energy sources, which are gradually depleting. The concept of energy transition through renewable energy creates continuous energy sustainability while maintaining environmental quality.

The concept of an energy-independent village (DME) is a form of village empowerment. DME is an energy supply program that utilizes local energy potential, both biofuels (BBN) and non-BBN, using technology that can be operated by the local community. Villages that can utilize local energy sources based on New Renewable Energy (EBT) to provide 60% of the village's energy needs are referred to as energy-independent villages.

Based on the 2022 data of the 69 independent villages in the Mojokerto District, there are no villages that can be called energy-independent villages. The independent village in the Mojokerto district is an economically independent village, and apart from being based on the IDM, the Mojokerto district government uses two main indicators in SDG's develop an independent village. The Mojokerto district government uses two main indicators to form an independent village: (1) indicators for reducing poverty and hunger and improving health and the environment and (2) indicators for improving education and friendly villages for women and children.

From the explanation above, it can be seen that the village government's perception of an affordable and sustainable energy transition in accordance with village potential has not yet become the main agenda for villages in the Mojokerto District. The village and district governments of Mojokerto still believe that reducing poverty and hunger can only be realized by increasing traditional economic pillars, such as support for community entrepreneurship. In fact, transitioning to renewable energy will also increase public spending on non-renewable energy.

This perception is also strengthened by the seven development priorities of the Mojokerto District government, based on the 2022 Mojokerto Regency RKPD (Diskominfo, 2023), as shown in the diagram below:

From the above description, it can be seen that there is no energy transition agenda in the Mojokerto district government's development priorities for the next five years. This is not a policy error, considering that various parts of the world, including Indonesia, have just entered a period of normalization due to the Covid-19 pandemic, where many state and regional governments' economic joints have been affected. Thus, the joints of the economy and environmental health are still the main focus of both central and regional governments, as well as the village as the lowest unit of government in the region.

Based on these main policy bases, it is not wrong to form a perception between regional and village governments that they must be mutually sustainable with central government policies in normalizing the pandemic. Therefore, it is not wrong if the village government does not have the same perception of one of the central government's agendas towards the target of a 25% renewable energy transition by 2024. The concept of energy transition is still understood as a transition process that is full of technology and budget, requiring financial assistance. especially in villages.

Although most villages in the Mojokerto Regency do not yet have the same perception of the energy transition process, there has been a renewable energy transition in several villages. In the Pacet District, for example, many dairy farmers have a potential source of new renewable energy from cow dung into renewable energy in the form of biogas. Unfortunately, based on a study conducted by Hardi and Soedarto (2023), the continuity of the dairy farming business in the Pacet sub-district was quite apprehensive because of the lack of support from the government and related agencies (Hardi & Soedarto, 2023).

The use of EBT in the Mojokerto district can also be seen through the use of a micro hydropower plant (PLTMH) in Trawas District, namely, Seloliman Village. Water energy is used to supply electrical energy in the hamlets of Biting and Balekambang, which do not yet have electricity from PLN (Kusuma, 2018). PLTMH is also being developed in Jembul Village, Jatirejo District, which has the potential for rivers to flow throughout the year for NRE utilization (Lesmana, Rohi, & Tumbelaka, 2018). In Sendi Pacet Village, a PLTA energy transition process was also conducted, which was encouraged because of the potential for water flow. The provision of hydropower EBT is supported by the use of turbine energy as a producer of electricity (Faturrochman, Guntara, & Andriawan, 2021).

The use of EBT sources with the potential of Kali Geruh in PLMTH is also being carried out well by the village of Kebontunggul because it synergizes this energy transition process with the tourism potential of the village that has been successfully developed previously, namely, the Mbencirang Valley. Kebunwai Village is observant in being able to combine the beneficiaries of water sources from Kali Geruh into the development unit for the tourism area of the valley village of Mbencirang. Based on the results of the potential ability to provide electricity, it can be used for 436 heads of families (Teguh et al., 2022).

Table 2. Village Renewable Energy Transition in Mojokerto District

No	Kecamatan	Desa	Bentuk EBT	Status
1	Trawas	Seloliman	PLTMH	Berjalan
2	Jatirejo	Jembul	PLMTH	Berpotensi belum berjalan
3	Pacet	Sendi	PLMTH	Berjalan
4	Gondang	Kebuntunggul	PLMTH	Berjalan
5	Pacet	Pacet	Biogas	Berpotensi belum berjalan

Some of the above villages, out of the 299 other villages in the Mojokerto Regency area, were not able to carry out a sustainable energy transition process. Most villages in the Mojokerto Regency area are still bound by the village development model, which focuses on infrastructure development and increasing resource allocation. This is not a wrong thing to do, considering that the village community, in general, is not yet aware (Akaria, 2022) of the crisis of non-renewable energy.

The village community and officials map the potential of the village every year to develop priority scales for village development through the Village Medium-Term Development Plan (RPJMDes). Through these RPJMDes, village development programs are mapped and implemented in accordance with the results of village meetings. However, the formulation of the RPJMDes must not contradict the RPJMD of the Mojokerto Regency government as a form of synergy in regional development. Thus, it can be said that RPJMDes are heavily influenced by the RPJMD of the Mojokerto Regency's government.

The main work program of the Mojokerto District Government from 2021 to 2026 does not prioritize the energy transition program. Currently, the district government's main work programs are addressing stunting, poverty control, inflation control, and strengthening infrastructure. Of the four main programs, it can be seen as a development program that still applies the concepts of developmental progress in the old paradigm. Where energy transition is seen as a stand-alone policy, it has not been seen as part of poverty control and infrastructure strengthening.

The village, as part of the government integrated with the local government, must follow the foundation of the work program set by the regional government. This strengthens the minimal village perspective of the energy transition. Without synergy, the development of the energy transition process remains slow, and without the cooperation of all parties, the village's perspective on the energy transition process will not change significantly. Villages need help with feasibility studies, funding, and a definite policy foundation to play an active role in achieving energy-independent villages.

Energy transition is not an easy thing to do because it requires adequate academic studies and adequate funding, but that does not mean it is impossible to realize it if there is a change in perspective regarding energy transition as a necessity. Awareness of the existence of the energy crisis must be built into one perspective, especially for policymakers, the private sector, and the community as the main users of energy. With a similar perspective on the energy transition process between villages and local governments, the national target of zero emissions by 2050 can be achieved.

5. Conclusion

5.1 Conclusion

The results of this study show that there are traditional perceptions of policymakers in regions and villages, especially regarding the concept of development. Development that is capable of creating self-reliance prioritizes infrastructure progress and the joints of the economy through the active participation of the community as a program driver. This development concept is still the main perspective of most village stakeholders in the Mojokerto Regency for building village independence. Thus, many villages in Mojokerto Regency still see the concept of an energy-independent village as a form of village development that is not a priority, but only as another small need of the village, which is not the main thing to be developed.

5.2 Limitation

The energy transition process requires considerable consideration, including the potential that is owned and can be developed, the economic value assessment of the application of the technology, and the readiness of the community. The limitations of these three factors influence the perception of the village as participating in an active role in the energy transition program by realizing an energy-independent village (DME). The village still prefers to become an economically independent village rather than integrating the energy transition concept as part of the village development program.

5.3 Suggestion

Researchers believe that synergistic cooperation between village policy stakeholders, academics, related agencies, and the community is the main factor driving change towards achieving an energy-independent village. Village perceptions that understand the energy transition process as a program that is far from having economic value for the community, compared to models of physical development and real assistance, must begin to be reduced by providing an understanding that the energy transition will also have an impact that has economic value for the community.

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