

# Potential Development of New Renewable Energy in East Java in Support of Indonesia's Energy Security

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**Abstract:-** East Java is one of the provinces in Indonesia that has many potential renewable energy sources to be developed in order to support Indonesia's energy security. The potential for renewable energy in East Java is very large, so good management is needed. Energy potential as a national vital object in East Java is meant such as Geothermal and Hydroelectric Power Plants (PLTA). Although dependence on the use of fossil energy is still high, the Provincial Government of East Java has entered an era of energy transition, namely the transition from fossil energy to a new renewable energy system. This is because the potential availability of fossil energy is dwindling while people's needs are increasing. Therefore, an alternative is needed to maintain energy security in the availability of energy to meet the needs of the community, namely renewable energy. In addition, the transition to renewable energy is one of the agendas in helping the government to achieve the Net Zero Emission goal because new and renewable energy is categorized as green energy that is environmentally friendly so that it can minimize the threat of greenhouse gas effects and reduce emissions. This research was conducted using a qualitative descriptive method by conducting interviews from research sources and supported by literature sources. With this, it is hoped that the results of this research can be used as guidelines by other local governments in optimizing the potential of renewable energy.

**Keywords:-** Energy Security, Renewable Energy, East Java.

## I. INTRODUCTION

East Java Province is geographically located between 11100 East Longitude – 11404' East Longitude and 70 12' South Latitude – 8048" South Latitude, with an area of 47,963 km<sup>2</sup> which includes two main parts. Namely mainland East Java and the Madura Islands. Administratively, East Java is divided into 29 regencies and 9 cities, with Surabaya as the provincial capital. This makes East Java the province with the largest number of districts/cities in Indonesia. East Java has a strategic position in the industrial sector because it is flanked by two large provinces, namely Central Java and Bali, making it a center for industrial and trade growth (East Java Province, 2022). With this geographical location, the East Java region has great potential in developing energy, both fossil energy, electricity infrastructure, as well as new and renewable energy such as geothermal, solar, water, and so on. From the energy potential in East Java, which is quite large, it can provide 1/3 of the contribution of oil and gas in Indonesia. In addition, East Java Province also exports electricity to

Central Java and Bali which is included in the distribution of the national on-grid network.

One of the strategic steps taken by the East Java Provincial Government in the energy transition to renewable energy is to maintain energy security. Maintaining energy security means that we must also provide protection for the environment, especially those that are a source of energy for the country. Currently, Indonesia is still dominated by consuming fossil energy compared to new renewable energy or commonly known as green energy. The Institute for Essential Services Reform (IESR) said that the composition of our energy mix comes from oil (42.1%), coal (30.3%) and natural gas (21.3%). That means, approximately 93.7% of the energy consumed in this country cannot be renewed (Institute for Essential Services Reform, 2019). In 2018, the use of new national renewable energy only reached 11, 68% which is still far from the target. To achieve the target in 2025 to 2050, the government must continue to explore the potential of new renewable energy and continue to invest in the new renewable energy sector (Setyono, 2019). Therefore, East Java Province is making a transition from fossil energy to new and renewable energy that is more environmentally friendly and whose existence will not run out with the support of good processing so that it can continue to be sustainable.

The energy transition is carried out not only because of the depletion of fossil energy but because of the many negative impacts on the environment caused by fossil energy such as pollution, global warming, greenhouse gas effects, emissions, acid rain, and so on. Fossil energy also has a negative impact on human health. Related to the existence of maintaining environmental sustainability in realizing independence and national energy security in accordance with Government Regulation of the Republic of Indonesia No. 79 of 2014 concerning National Energy Policy CHAPTER 2 Article 6(i) (p. 6). Various climate action efforts to save the earth are carried out, one of which is the use of new and renewable energy as an alternative to fossil fuel energy such as coal, oil and gas.

Listed in the East Java Provincial Development Plan, the emission targets and the mix of renewable energy in their achievements are indicators that must be implemented by the East Java government, especially the Energy and Mineral Resources (ESDM) Office through activities and programs every year such as comprehensive socialization both to institutions and the public. . The socialization was carried out to introduce the existing types of NRE to remote communities due to conditions where natural resources were not supportive. If the remote location has the potential

for natural resources, it will be assisted with electrical construction such as using micro hydro.

**II. RESEARCH METHODS**

The research method used is descriptive analysis with qualitative methods supported by interviews with sources, observations and literature studies from various literatures. Some of the research data used comes from the Domestic Work Lecture (KKDN) conducted by postgraduate students of the Energy Security Study Program at the Defense University of the Republic of Indonesia with the research location in East Java in February 2022.

**III. RESULTS AND DISCUSSION**

Currently, the development of New and Renewable Energy refers to Presidential Decree No. 5 of 2006 (JDIH BPK RI DATABASE REGULATION, 2006) concerning National Energy Policy. The Presidential Decree states that the contribution of EBT in the national primary energy mix in 2025 is 17% with a composition of 5% Biofuels, 5% Geothermal, Biomass, Nuclear, Water, Solar and Wind 5%, and liquefied coal of 2 %. For this reason, the steps that will be taken by the Government are to increase the installed capacity of Micro Hydro Power Plants to 2,846 MW in 2025, 180 MW Biomass installed capacity in 2020, wind installed capacity (PLT Bayu) of 0.97 GW in 2025, solar 0.87 GW in 2024, and 4.2 GW nuclear in 2024. The total investment absorbed in NRE development until 2025 is projected to be 13.

The East Java Provincial Government with its strategic steps carried out the transition to a new renewable energy system with the target of achieving Net Zero Emissions in 2060 where Indonesia joined the Clean Energy Demand Initiative forum. Here are some points that can be done in creating clean energy towards Net Zero Emissions:

- Increased Utilization of New Renewable Energy
- Fossil Energy Reduction
- Electric vehicles in the transportation sector
- Increased use of electricity in households and industry
- Utilization of Carbon Capture and Storage (CCS).

In addition to meeting the achievement of Net Zero Emissions, the East Java Provincial Government has made an energy transition because the potential for fossil energy is dwindling, so to maintain energy security, alternative energy is needed, especially environmentally friendly green energy that minimizes the threat of greenhouse gas effects and emissions. Regarding the potential for new renewable energy in East Java Province, geothermal energy has a very large contribution in increasing electricity supply. The East Java Provincial Government is targeting several Geothermal Power Plants (PLTP) such as in Balawan, Ijen, and Banyuwangi to operate in January 2024 and currently the drilling of the first production well has been completed. From the total existing drilling, the total PLTP will produce 2x55 MW, and when fully operational this plant will produce up to 110 MW (ASIH, 2021). The Head of the Energy Division of the ESDM Office, Oni Setiawan at the

Domestic Work Lecture (KKDN) said that the potential for geothermal energy in East Java is ±1,296.8 Mwe.

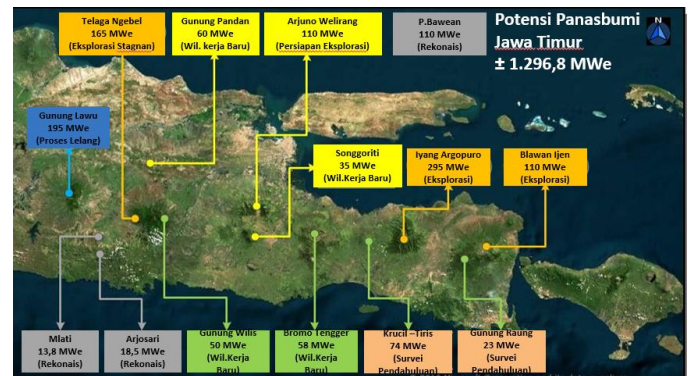


Fig. 1: Geothermal Potential of East Java

Source: ESDM Office of East Java

The growth of NRE power infrastructure to the available potential, based on the table below, shows that PLTA, PLTS, and Biomass develop earlier when compared to other types of renewable New Energy. In Surabaya, there is also a Benowo PLTSa which produces 11 to 12 MW which is the first PLTSa production in Indonesia which has a commercial operation date (COD) with PLN operating continuously. The following is the energy potential that exists in the East Java region in addition to the geothermal energy previously mentioned.

No	Resource Type	Generator	Potency (MW)	Installe d	percen t %
1.	Water	PLTA	1,667	319,16	19.1
2.	Geother mal	PLTP	1.012	0	0
3.	Rubbish/ Biomass	PLTSa/ PLTBm	3.421	28.6	0.83
4.	Sun	PLTS	10,335	8.91	0.086
5.	Wind	PLTB	7.907	0	0
6.	sea	PLTGL	1,200	0	0

Table 1: East Java's New Renewable Energy Potential

Source: ESDM Office of East Java

The above energy resources are assets of the province of East Java that must be maintained and managed properly through proper planning. The current condition of East Java's total electricity consumption is 35,838 GWh, the largest electricity user is the industrial sector reaching 44 percent, then the household sector 37 percent, trade/business 13 percent, and social 6 percent.

The availability of electricity in East Java is currently still obtained from PLTU, PLTGU and PLTA supplies with a total power of 8,839 MW from generators connected to the Java-Madura-Bali (Jamali) electricity network and a peak load of 5,716 MW. The following is a roadmap for the renewable energy mix target of East Java Province in accordance with Regional Regulation Number 6 of 2019 concerning the General Regional Energy Plan (RUED):

Jenis Pembangkit	TARGET (MW) Sesuai RUED									
	2017	2018	2019	2020	2021	2022	2023	2024	2025	
PLTA	275	275	275	275	275	275	275	275	412	
PLT Mini Mikrohidro	0	1	1	5	5	5	5	5	200	
PLT PumpStorage	0	0	0	0	0	0	0	0	1000	
PLT Panas Bumi PLTP	0	0	0	0	110	165	165	165	670	
PLT Biomassa	0	0	0	0	0	150	150	150	800	
PLT Surya PLTS	0	1	2	2	58	58	58	58	950	
PLT Bayu PLTB	0	0	0	0	0	0	0	0	70	
PLT Laut	0	0	0	0	3	3	3	4	4	
PLTSa Sampah Kota	0	0	2	10	10	10	10	10	84	
Total	275	277	288	292	460	666	666	667	4190	

Fig. 2: East Java NRE Mix Target

Source: ESDM Office of East Java

The development of the new renewable energy sector in East Java can be seen in the exploration status of 30 MW of geothermal energy in Blawan - Ijen. In addition, there is an increase in the electrification ratio for the condition of access to electricity which is assisted by electricity connections for the poor and remote areas where there is no electricity network assisted by PLTS, PLTMH, and Biogas. The implementation of the use of new and renewable energy in East Java in 2020 – 2021 can be seen from several programs that have been realized, as follows (DEPARTMENT OF ENERGY AND MINERAL RESOURCES, EAST JAVA PROVINCE, 2022):

- Construction of 22 SHS PLTS units with a total capacity of 2.2 kVA in Gemblung Hamlet, Kendalrejo Village, Durenan District, Trenggalek Regency
- Construction of PLN Rooftop On Grid PLTS in Government Institutions/Institutions Buildings in 36 locations with a total capacity of 1.5 MW
- Installation of Solar Street Lighting (PJU) totaling 2,375 units in 15 Regencies/Cities
- Construction of PLTS Cold Storage for fishing ports in Probolinggo Regency 6600 Watt (6.6 KW) and Sumenep 240,000 Watt (240 KW);
- Conversion Kit (BBM to CNG Conversion) assistance for fishermen as many as 1,109 units in 4 Regencies
- Conversion Kit (BBM to CNG Conversion) assistance for 1,713 units of Farmers in 5 Regencies
- Construction of a Household Gas Network (Jargas) of 20,155 House Connections in 5 District/City Locations
- PLTS development at PT. Barata Indonesia with a capacity of 500 kWp;
- PLTS development at PT. YTL East Java with a capacity of 111 kWp;
- PLTS development by PT. PLN UID East Java in Saubi Village, Sumenep Regency with a capacity of 150kWp and in Sabintan Village, Sumenep Regency with a capacity of 100 kWp;
- Installation of PLTS Rooftop by PT. PLN on 160 customers until September 2020 with a total capacity of 1,442,004 kWp (1,442 MW).
- Construction of PLTS SHS in Bangkalan, Banyuwangi and Bondowoso regencies, a total of 60 units with a total capacity of 6 kWp
- Construction of the Piko Hydro Power Plant in Probolinggo Regency with a capacity of 4 kW;

- Construction of PLTS Rooftop for Islamic Boarding Schools in Jombang Regency with a capacity of 5 kWp.
- Development of 25 units of Cattle Biogas for Households in Trenggalek and Magetan Regencies.
- Detailed Engineering Design (DED) of PLTMH in Desa Pakis, Kec. Panti, Jember Regency 10 KW.
- Exploration of Shallow Gas in Jombang and Mojokerto Regencies To supply 40 residents.
- Construction of PLN Rooftop On Grid PLTS in Government Buildings and Public Facilities in 8 locations with a total capacity of 490 kWp;
- Installation of Solar Powered Public Street Lighting (PJU) of 2,525 units in 21 regencies/cities;
- Conversion Kit (BBM to BGG Conversion) assistance for fishermen as many as 1,878 units in 3 regencies, namely Gresik, Lamongan, Banyuwangi;
- Conversion Kit (BBM to BGG Conversion) assistance for 1,900 units of Farmers in 7 Regencies, namely Bojonegoro, Tuban, Ponorogo, Sidoarjo, Gresik, Lamongan, Blitar;
- Construction of Household Gas Network (Jargas) totaling 68,897 House Connections in 5 Regency/City Locations.
- Construction of a Micro Hydro Power Plant (PLTM) by PT. PLN UID East Java with a capacity of 24.1 MW
- Construction of the Ra'as Hybrid Power Plant (PLTH) with a capacity of 1 MW;
- PLTH construction with a capacity of 2 MW;
- Construction of the Gili I PLTH with a capacity of 1 MW;
- Construction of the Sapudi PLTH with a capacity of 2 MW;
- Construction of the Kangean PLTH with a capacity of 2 MW

Developing new and renewable energy potential in order to support energy security, the East Java provincial government is guided by:

- Presidential Regulation Number 80 of 2019 concerning the Acceleration of Economic Development in the Gresik Region-Bangkalan-Mojokerto-Surabaya-Sidoarjo-Lamongan - Bromo Tengger-Semeru Area and the Wilis and South Cross Areas (JDIH BPK REPUBLIC OF INDONESIA, 2019).
- Stimulation of the use of battery-based electric vehicles.
- Law No. 30 of 2007 concerning Energy.
- Regional Regulation Number 6 of 2019 concerning the General Plan of Regional Energy for the Province of East Java.

energy resistance (*energy security*) is a condition of ensuring the availability of energy, public access to energy at affordable prices in the long term while still paying attention to the protection of the environment. It is described later on the principles of availability, accessibility, affordability, acceptability and sustainability (DEN, 2015). The principle of national energy security 4A+1S is described by the Quintuple Helix model (Sea Colonel (KH) Dr. Ir. Yanif Dwi Kuntjoro, 2021):

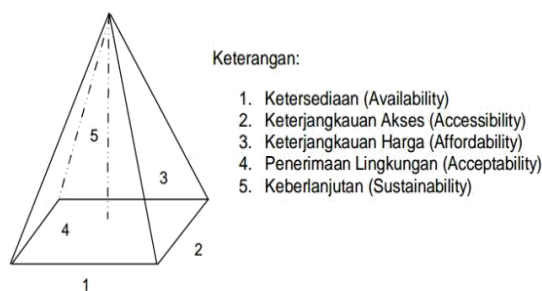


Fig. 3: Quintuple Helix Principle of Energy Resistance

The following is a description of the principle of national energy security 4A+1S:

- *Availability*: guaranteed energy availability
- *Accessibility*: easy access to energy for the community
- *Affordability*: energy that is affordable by the community
- *Acceptability*: when energy fulfills the three principles above, it must be accepted by society implicitly
- *Sustainability*: energy is long term and sustainable by taking into account the environment.

In this case, the East Java Provincial Government is not only guided by energy policy but also guided by the principle of energy security in developing new and renewable energy potential.

#### IV. CONCLUSIONS AND SUGGESTIONS

Based on the research data obtained, it shows that the energy potential in East Java Province is very large. To maintain energy security, good and appropriate management is needed because it will have an impact on the development model and community welfare. New and renewable energy is the future energy that is abundant and continuous and environmentally friendly and is the only alternative energy source to maintain energy security and energy independence. Good and correct management of vital objects in the energy sector is the key to a prosperous, prosperous, just and civilized society.

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