The Model of Renewable Energy Utilization

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ABSTRACT
The purpose of this study is to obtain a renewable energy model to increase economic growth in Indonesia. The method used in this study is a research method with a qualitative approach, through descriptive analysis. To find information about the right renewable energy to improve the Indonesian economy, a focus group discussion was held with key people in the field of renewable energy at the relevant agencies. Based on the results of the analysis, it was found that the development of appropriate renewable energy to improve the Indonesian economy is (1) clean energy, (2) energy that benefits many people, (3) energy from natural resources, (4) energy based on green environment, and (5) energy-based technology.

Keywords: *Renewable Energy, Economic Growth, Clean Energy, Environmental Energy*

JEL Classification: O14, Q32, Q40, Q41

INTRODUCTION
Indonesia is a country with the fourth-largest population in the world. Indonesia will remain the top five in terms of population and the top ten in land area over the next 50 years. In terms of economic capacity, at this time it also illustrates that Indonesia's position is ranked in the top 15 in the world, even becoming the world's top five in 2050 in line with population growth.

If conservatively Indonesia's economic growth is consistent at 5 percent per year over the next 10 years, by 2030 Indonesia's total gross domestic product (GDP) will reach around the US $ 1.8 trillion. That is equivalent to Canada's total GDP in 2018, which is ranked 10th in the world.

The ten countries with the largest GDP in the world in the past 10 years only grew 1-2 percent per year, except for China and India. Now, this is an opportunity to encourage Indonesia's economic growth at least 5 percent per year, so that it can reach a greater number than Canada in 2018 when entering the year 2030 or greater than Japan in 2018 when entering the year 2050.

History proves, post-political and state reforms in 1998, for 20 years the average economic growth of Indonesia was above 5 percent per year. Mathematically, it is expected to grow on average above 6.5 percent per year over the next 30 years, so that it can position itself into the top five.

The question is, how to encourage economic growth so that it can be above 6 percent over the next 30 years? That has been proven by China in the period 1979-2019 with an average growth of above 7 percent per year. One of Indonesia's economic growth can be encouraged by utilizing renewable energy.

Energy is an integral part of increasing economic development. Neoclassical economists argue that the increase in energy consumption reflects an increase in the economy(National Geographic, 2014). (Roberts, Gloy, Joseph, Scott, & Lehmann, 2010) once stated that the main and first principle in energy consumption is the better off you are, the more energy you use.

The region considered to be a region that has good economic prospects is the Asia Pacific because this region has the second-largest economic growth in the world (United Nations Economic and Social Commission for Asia and the Pacific(Loebenstein, 2009). In terms of economics and demographics, the Association of Southeast Asian Nations (ASEAN) in the region with the fastest growth rate, and the level of growth in energy consumption reaches 4% per year, compared to the world which is only 1.8%(IEA, 2016). Therefore Indonesia should have a renewable energy development model to increase economic growth in Indonesia. But in reality, renewable energy in Indonesia, is still not well utilized, namely:

- Indonesia's renewable energy wealth is abundant but the fulfillment of this country's energy, 92% fossil, 8% renewable energy.
- Indonesia must hurry the transition to renewable energy, leaving behind fossil fuels such as oil and coal, which could worsen the climate crisis, damage the environment and also burden the state budget.
- From 34 provinces in Indonesia, until August 2019, only five had a regional energy general plan (RUED). The five provinces are West Java, JavaCentral, West Nusa Tenggara, North Kalimantan, and East Java.
- Solar energy, one of the interesting choices, by calculating the life span of PLTS 20-25 years, consumers only pay Rp400 per kWh. Compare this with the price of PLN electricity reaching Rp1,457 per kWh.

LITERATURE REVIEW

The concept of renewable energy began to be known in the 1970s, as an effort to offset the development of fuel energy nuclear and fossil. The most common definition is an energy source that can be quickly restored naturally, and the process is sustainable. By this definition, nuclear and fossil fuels are not included. By definition, all renewable energy is certainly also sustainable energy, because it is always available in nature in a relatively very long time so no need to worry or anticipation will run out of sources. The bearers of non-nuclear energy do not enter nuclear power as part of sustainable energy because the supply of uranium-235 in nature has a limit, say hundreds of years. However, nuclear activists argue that nuclear energy is included as sustainable if used as fuel in a fast breeder reactor(FBR: Fast Breeder Reactor) because nuclear fuel reserves can "breed" hundreds to thousands of times(Blok et al., 2007).

The reason is this, the nuclear reserves discussed by energy experts in the order of tens or hundreds of years are implicitly calculated with the assumption reactor used is an ordinary reactor (generally BWR or PWR type), which incidentally can only burn U-235. On the one hand, the U-235 content in nature is no more than 0.72%, the remaining approximately

99.28% isU-238.UraniumThis type of U-238 in "ordinary" combustion conditions (used as fuel in ordinary reactors) cannot produce nuclear energy, but when mixed with U-235 and put together into a breeder reactor, together with the consumption/combustion of U- 235, U-238 experienced an arrest reaction 1neutronand changed its form to U-239. Within minutes U-239 decays while removing beta particles and change shape againNP-239. Np-239 also decays while emitting beta particles to become Pu-239. This Pu-239, which although not available in nature but formed as a by-product of burning U-235, can divide and produce energy as U-235. You can imagine if all of the U-238s, which were thousands of times more than the U-235, were successfully changed to Pu-239, how much was the increase in the amount of nuclear fuel. The same thing happened for the atom [thorium-233] which with the reaction of capturing 1 neutron transformed into U-233who has the ability chain reaction(nuclear reaction) (Abad et al., 2017)

That is why certain developed countries are reluctant to abandon nuclear despite risks radioactive he received not lightly. Fast breeder reactors like those of North Korea received strict supervision from the IAEA for being able to produce new fuel Pu-239 which is prone to be misused for weapons of mass destruction.

On the other hand, nuclear opponents tend to use the term "sustainable energy" as a synonym for "renewable energy" to exclude nuclear energy from the discussion of these energy groups.

The main source of renewable energy

Geothermal energy

Geothermal energy comes from radioactive decay in the center earth, which makes the Earth hot from the inside, as well as from the sun's heat which makes the surface heat of the earth. There are three ways to use geothermal energy:

- As a power plant and is used in the form of electricity
- As a source of heat that is utilized directly using pipes to the bowels of the earth
- As heat pump which is pumped directly from the bowels of the earth

Geothermal a format energy or thermal energy that is produced and stored in the earth. Heat energy is the energy that determines the temperature of an object. Geothermal energy comes from energy formed by planets (20%) and radioactive decay from minerals (80%)[1]. Geothermal gradients, which are defined by the difference in temperature between the core of the earth and its surface, controlling conduction which continuously occurs in the form of heat energy from the core to the surface of the earth(Wang, Li, & Alva, 2010).

Earth's core temperature reaches more than 5000 oC. Heat flows by conduction to the rocks around the earth's core. This heat causes the rocks to melt, form magma. Magma circulates heat convection and moves up because magma in the form of molten rocks has a density that is lower than solid rocks. Magma heats the earth's crust and the water that flows in the earth's crust, heating it to 300 oC. This hot water causes high pressure so that the water comes out of the earth's crust

Geothermal energy from the Earth's core is closer to the surface in some regions. Hot steam or underground water can be utilized, brought to the surface, and can be used to generate electricity. Sourcegeothermal power is in some parts that are geologically unstable like Iceland,New Zealand, the United States of America, The Philippines, and Italy. The two most prominent regions so far in the United States are in the dome Yellow stone and in north

California. Ice land generates geothermal power and supplies energy to 66% of all homes in Iceland in 2000, in the form of direct thermal energy and electricity through electricity generation. 86% of houses in Iceland use geothermal as a home heater(Perra, Ward, & Yahoui, 2010).

Solar panels (photovoltaic arrays) on small yachts at sea can charge 12 V to 9 amperes in full and direct sunlight. Since most of the renewable energy derived is "solar energy" the term is a little confusing. But what is meant here is the energy that is collected directly from sunlight(Sun, 2011).

Solar power can be used to:
- Generate electricity using solar cell
- Generate electricity using solar tower
- Heats the building directly
- Heats the building through a heat pump
- Heat food using a solar oven.
- Heats water through a solar water heater

Of course, undoes not provide constant energy for every point on earth, so their use is limited. Solar cells are often used to charge the battery, during the day and the power from the battery is used at night when sunlight is not available.

Wind power
The difference in temperature in the two different places results in air pressure difference, so it produces wind. The wind is the movement of matter (air) and has long been known to be able to move turbines. Wind turbines used to produce kinetic energy and electrical energy. The energy available from the wind is a function of wind speed; when the wind speed increases, the energy output also increases the maximum energy that the turbine can produce[5]. Areas with stronger and constant winds such as off shore and plateaus, usually preferred to be built "wind fields"(Wang et al., 2010).

Water power
Water energy is used because it has mass and can flow. Water has a density of 800 times compared to air. Even the slow movement of water can be converted into other forms of energy. Water turbines are designed to get energy from various types of reservoirs, which are calculated from the amount of water mass, height, to water velocity. Water energy is utilized in forms(Larsen & Astrup, 2011):
- The power plant dam. The biggest one is there a Gorges dam in china.
- Micro-hydro was built to generate electricity up to a scale of 100 kilowatts. Generally used in remote areas that have many water sources.
- *Run-of-the-river* is built by utilizing kinetic energy from water flow without the need for a large water reservoir.

Biomass
Plants usually use photosynthesis to save solar power, air, and CO_2. Biofuel (biofuel) is a fuel obtained from biomass - organisms or products from animal metabolisms, such as manure from cows and so on. It is also a renewable energy source. Usually, biomass is burned to release chemical energy stored in it, except when biofuels are used for fuel cell fuels (e.g.*direct methanol fuel cell and direct methanol fuel cell*).

Biomass can be used directly as fuel or to produce other types of fuels such as biodiesel, bioethanol, or biogas depending on the source. Shaped biomass biodiesel,bioethanol, and biogas can be burned in an internal combustion engine or boilers directly with certain conditions(Abad et al., 2017).

Biomass becomes a renewable energy source if the uptake rate does not exceed its production rate because basically biomass is a material produced by nature in a relatively short time through various biological processes. Various causes of the use of non-renewable biomass have occurred, such as the case roman deforestation, and what is happening now Amazon deforestation. Peatalso biomass which is defined as renewable energy is quite biased because the rate of extraction by humans is not proportional to the rate of growth of the peat layer.

There are three forms of biomass use, namely solid, liquid, and gas[8]. And in general, there are two methods in producing biomass, namely by growing biomass-producing organisms and using waste materials from the processing industry of living things.

Liquid biofuel

Liquid biofuels are usually in the form of bio alcohol such as methanol, ethanol, and biodiesel. Biodiesel can be used in modern diesel vehicles with little or no modification and can be obtained from vegetable waste and animal oils as well as fat. Depending on the potential of each region, corn, sugar beet, cane, and several types of grass cultivated to produce bioethanol. While biodiesel is produced from plants or crops containing oil (palm oil, copra, castor beans, algae) and has gone through various processes such as esterification.

Solid biomass

Direct use is usually in the form of flammable solids, whether firewood or flammable plants. Plants can be specifically cultivated for combustion or can be used for other purposes, such as processed in certain industries and processed waste that can be burned as fuel. Making briquettes biomass also uses solid biomass, where raw materials can be in the form of raw solid pieces or fragments of biomass or that have gone through certain processes such as pyrolysis to increase the percentage of carbon and reduce its water content.

Solid biomass can also be processed in a way gasification to produce gas.

Biogas

Various organic materials, biologically by fermentation, and by physical-chemical gasification, can release flammable gases.

Biogas can easily be produced from various wastes from existing industries, such as production paper, production sugar, animal waste animal husbandry, etc. Various waste streams must be diluted with water and allowed to naturally ferment, producing gas methane. Residues from this fermentation activity are fertilizer which is rich in nitrogen, carbon, and minerals.

The small scale energy source

- Piezoelectric, is an electrical charge that results from the application of mechanical stress to solid objects. This thing converts mechanical energy into electrical energy.
- Automatic clock(Automatic watch, self-winding watch) is a watch that is driven by stored mechanical energy, which is obtained from the user's hand movements. Mechanical energy is stored in the mechanism spring inside it.

- Electrokinetic foundation(electrokinetic road ramp) is a method of producing electrical energy by utilizing the kinetic energy of a car that moves on a runway mounted on the road. A runway has been installed in the supermarket parking lot Sains bury's in Gloucester, Great Britain, where the electricity generated is used to drive the cash register[11].
- Capture electromagnetic radiation that is not utilized and convert it into electrical energy use*rectifying antenna*. This is one method harvest energy(energy harvesting).

METHODOLOGY

The method used in this study is a research method with a qualitative approach, through descriptive analysis. To find information about the development of renewable energy to improve the Indonesian economy.

For types of data such as strengths/weaknesses of internal resources and opportunities/threats of the external environment, it is obtained from primary data. Primary data is taken from key players in the field of renewable energy in related institutions.

For empirical supporting data types of problems, such as data on Indonesia's economic growth in the Ministry of Economy produced, a list of economies needed by the market, and organizational profiles, as well as annual reports.

In collecting data, it is needed a technique to collect data directly with FGD (focus group discussion). Observations were made to obtain preliminary information from existing problems and to obtain field findings that were not in the FGD to enrich the discussion.

RESULTS AND DISCUSSION

Economic growth

(Veblen, 2017)defines economic growth as a long-term increase in a country's ability to provide more and more types of economic goods to its population. This capability grows by technological progress, and the institutional and ideological adjustments needed by the population of the country concerned. This definition has three main components; (1) the economic growth of a nation is seen and the continual increase in the supply of goods, (2) advanced technology is a factor in economic growth that determines the degree of growth in the ability to supply various kinds of goods to the population, and (3) the widespread and efficient use of technology it requires adjustments in the institutional and ideological fields so that the innovations produced by human science can be utilized appropriately.

(Tajerin, 2017)defining economic growth is a change in the level of economic activity that applies from year to year. An economy is said to experience growth if the level of economic activity is higher than what has been achieved in the previous time. The rate of economic growth is measured through the rate of GDP at constant prices.

(Sodik, 2007)defines economic growth as a process of increasing per capita output over a long time. Economic growth includes three aspects; (1) economic growth is an economic process, namely; change from time to time, (2) economic growth is closely related to two important aspects, namely total output and population, and (3) economic growth is said to increase if per capita output increases in the long term.

The characteristics of a process of economic growth are revealed by Kaldor (in Barro & Martin, 1995): (1) total per capita output increases from year to year and tends not to decrease, (2) physical capital per worker increases over time, (3) the rate of return on capital tends to be constant, (4) the ratio of physical capital to output tends to be constant, (5) the role of labor and physical capital to national income tends to be constant and (6) the rate of growth of labor output varies in each country.

Calculating the economic growth of a country can be done by comparing GDP in a certain year (PDBt) with the GDP of the previous year (PDBt-1), as in the following equation(Sowolino, Hadi, Mujahid, & Santosa, 2020) :

$$\text{Economic Growth Rate } (\triangle Y) = (\frac{PD\ ) - (PDBt-1)}{(PDBt\ )} x\ 100\% \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Renewable Energy Development

If it refers to the target of using biodiesel in 2025 by 25% of the need for fuel oil, where the production of biodiesel from oil palm reaches 11,992.55 thousand SBM, then the required palm oil plantation land area is 1.32 million hectares with labor absorption 2, 64 million people, and as many as 5,281 units of biodiesel plants with a workforce absorption of 52,810 people. Based on Table 4 above, it can be seen that the biodiesel industry derived from oil palm is feasible to be produced as a substitute for non-subsidized diesel.

When referring to the target of using bioethanol in 2025 by 25% of the need for fuel oil, where the production of bioethanol from cassava or nipa nira reaches 11,992.55 thousand SBM, then the need for cassava plantations covering 475.89 thousand hectares or 468 hectares of nipa plantations with the employment of 951.78 thousand people for cassava plantations or 936 people for nipa plantations. Meanwhile, the need for a bioethanol plant was 5,288 to 5,301 units with a workforce absorption of 52,880 to 53,010 people. Based on Table 6 above, it can be seen that the bioethanol industry, both derived from cassava and nira nipa, is already feasible to be produced as a substitute for non-subsidized gasoline. Meanwhile, if it refers to the target of using biogas in 2025 by 100% of its potential, then the potential for livestock waste and household waste in Indonesia that can be utilized reaches 5,410,486 tons one year which can produce biogas of 1,715,009.97 thousand m3 per year or equal to 1,063,306 kiloliters (6,302,318 SBM) kerosene per year or the equivalent of 10,959,599 MWh of electricity production one year. This potential has only been utilized in a very small amount of 445 SBM per year for household needs. The number of poor households in Indonesia in 2025 is estimated at 38,290 households. If every two poor households are assisted by the government as much as one biogas installation unit, then the need for biogas installation units that must be built by the government to utilize the potential biogas is 19,145 units with an investment value of Rp 361,

The problem of the oil sector is very basic, which is to help overcome the scarcity of fossil oil in the future, local governments must immediately diversify energy production from renewable energy sources with enormous potential. Therefore, the development of biofuel and biogas infrastructure will help reduce the rate of use of fossil fuels. Utilization of renewable energy as one of the energy diversification programs should be carried out through the Village Energy Independent (DME) approach for areas that are not reached by energy infrastructure to reduce the dependence of rural communities on fuel for daily needs.

The transformation of energy use from fossil energy to bioenergy (biodiesel, bioethanol, and biogas) in Indonesia is carried out in stages. In the initial or short-term (one year) phase, the transfer of the use of diesel oil and gasoline with biodiesel and bioethanol is done at 10% each of the total fossil oil needs in this province, while the transfer of kerosene use with biogas is carried out using 30% of the total biogas potential in this province. In the next stage or medium-term (3-5 years), the transfer of the use of diesel oil and premium gasoline with biodiesel and bioethanol is done each by 15% of the total fossil oil needs in this province, while the transfer of the use of kerosene with biogas is done by utilizing 60% of the total biogas potential in the province. Then, in the long-term stage (more than five years), the transfer of the use of diesel oil and premium gasoline with biodiesel and bioethanol is expected to be done each by 25% of the total fossil oil needs, while the transfer of the use of kerosene with biogas is done by utilizing 100% of the total biogas potential in the province.

If energy use from the industrial and transportation sectors can be saved by 50% from the utilization of biodiesel and bioethanol, the fossil fuel that can be saved is equivalent to 23.99 million BOE. If the household sector and the power generation sector can use biogas at 100% of its potential, then fossil fuel that can be saved is equivalent to 6.30 million SBM. These total savings can reach 30.29 million SBM (63.14% of the total energy needs in 2025 which amounted to 47.97 million SBM). Energy savings from the use of renewable energy which amounted to 63.14% makes Indonesia can be categorized as an energy independent region.

As a comparison, since 2007 West Nusa Tenggara Province has been striving for regional energy independence through Regional Energy Policy based on Governor Decree No. 110/2007 on the Policy of Regional Electricity Sector of West Nusa Tenggara Province. One of the targets in this policy is the realization of a balanced energy mix by 2025. The energy mix that West Nusa Tenggara Province wants to achieve in 2025 is the use of fuel oil of less than 23%, biofuel more than 9% coal more than 28%, renewable energy especially water power and geothermal reached 38%, other renewable energy which includes wind, solar, and biomass reached 2%. The Energy Self Village in West Nusa Tenggara Province was built based on PLTMH, PLTS-SHS, biogas,

Meanwhile, efforts to make regional energy independence in Riau Province have been carried out earlier compared to other provinces. Development of a biodiesel plant in the province has been started since 2003, construction of a hybrid power plant between solar cells and generator sets began in 2008, solar collector for agriculture and fishermen began in 2010, a study of the potential of ocean currents and tidal energy in Pelalawan Regency was carried out in 2011, engineering and development of alternative two-wheeled vehicles began in 2012, and biogenic gas energy mapping in alluvial formations in the Meranti island District was carried out in 2012 (Tengku Dahril, 2012). The Energy Self Village that was built in Riau

Province during 2012 included Indragiri Hilir Regency, Rokan Hilir Regency, Kuantan Singingi Regency, and Rokan Hulu Regency with 194 villages out of a total of 1,643 villages and village office. Renewable energy sources utilized for the development of Energy Independent Village include biomass, PLTS-SHS, PLTMH, PLT-Bayu, and biodiesel(Rastogi, Singh, & Pathak, 2002).

In connection with the development of biofuels in other countries, Brazil has succeeded in producing ethanol from sugar cane since 1984 and replaced almost 42% of gasoline needs. In fact, in the span of 2013/2014, ethanol production reached 27,500 million liters (UNICA, 2016). In Brazil, gasoline used has a mixture of bioethanol with levels of 18% - 27%. Meanwhile, the United States managed to sell biogasoline under the name gasohol with a mixture of 10% bioethanol (from corn raw material) and 90% gasoline. In Finland, biogasoline used has a 5% bioethanol content with an octane number of 98. In Japan, since 2005, 3% of bioethanol has been used as a gasoline mixture. In Thailand gasohol 95 has been sold since 2006. In Korea, The use of biodiesel has been carried out since 2002 and it is estimated that consumption will increase by around 0.5% per year with the raw material used of 77.3% coming from soybeans and the rest coming from waste oil. Meanwhile, the use of bioethanol in Indonesia only began in 2007, whereas much as 10% bioethanol is mixed with premium and named bio premium(Schuitema & de Groot, 2015).

CONCLUSION

Factors that influence the development of renewable energy are Socio-political stability. Community security stability, Law enforcement is indiscriminate and consistent, Opening a broad investment as long as it does not conflict with the constitution, Encouraging efficiency and productivity in all branches of production, both branches run by the private sector and SOEs, Simplifying laws and regulations, Encourage healthy competition, Focus on competencies and what is owned by Indonesia by providing added value and downstream, and Implementing tax policies and import duties at competitive rates. The development of renewable energy that is appropriate to improve the Indonesian economy is (1) clean energy. (2) the energy that benefits many people, (3) energy from natural resources, (4) energy based on green environment, and (5) energy-based technology.

The correlation of the results of this study with Indonesia's Long-Term Development Plan (RPJP) 2005-2025 is found in programs in the energy conservation sector, job creation, poverty alleviation, empowerment of small and medium businesses, and empowerment of inland/border communities. Based on the results of the analysis, it can be concluded that the results of this study are by the programs planned in the Indonesian RPJP Year 2005-2025.

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