



Good Governance in the Policy on Using Solar Cells as Efforts to Reduce Emissions in Indonesia

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Abstract- Climate change due to global warming is a problem for countries globally. This encourages countries to carry out mitigation and adaptation efforts, one of which is switching to renewable energy. A solar Cell is an electricity-generating device that is capable of converting sunlight into electrical power. Of several types of renewable energy, Solar Cells or Photovoltaics require relatively more affordable costs. Countries that have a tropical climate like Indonesia tend to only have two seasons and get enough sunlight. The future global energy transition is projected to reach 90% by 2050. Through normative juridical research, government efforts through regulations and institutional policies to encourage the effective use of solar cells as part of efforts to reduce emissions are actions in good governance. to organize government for the sake of justice and welfare of society in the present and the future.

Keywords- Solar Cell, Good Governance, Emission Reduction

I. INTRODUCTION

The need for energy is a basic need for human life in the technological era and leads to the growth of globalization. Based on projections, Indonesia's energy needs in 2023 will increase by 5.4% or the equivalent of 130 to 137 tons equivalent from the previous year. Projections for increasing energy needs in Indonesia also refer to economic growth factors which have significantly increased, amounting to 5.3% and population growth of 0.9%. In addition, the increase in energy demand is predicted to continue to increase in the following year. so that the need for energy is increasing and is important to support people's lives, especially in Indonesia. On the other hand, energy requirements increase also raises problems, that is that the current availability of energy produced in Indonesia is not yet in favor of providing renewable energy. This is of course the cause of other problems such as increasing carbon emissions from energy sources originating from fossil fuels which will have an impact on climate change.

The policy regarding efforts to produce energy from NRE in 2030 encourages the government to achieve the national NRE target of 34% or an increase of 10.6% from the previous target. On the other hand, the national target in 2025 is 23%. However, in reality, based on a report from the Ministry of Energy and Mineral Resources (MEMR) which assesses that the portion of NRE in 2023 will still be at the level of 12%, or at least the primary energy mix will only increase by 0.1% from 2022. Of course the government's efforts need to be stronger to achieve its target. in 2030.

Inconsistent government policies in efforts to develop renewable energy and promotional efforts are also considered slow, and will hinder the increase in renewable energy development.[1] For example, solar energy, even though it is a government projection and program to reduce emissions to fulfill *the Paris Agreement*, as well as efforts to increase the share of energy to replace fossil energy is still at a minimal stage of development. Apart from that, the development of alternative energy in other energy sources such as wind and water power is considered to hamper the growth of the solar energy market in the period 2021 to 2030 because it reduces the use of solar energy in the NRE mix in Indonesia.

In 2022, Solar Power Plants (PLTS) will experience a decline in energy production, this is due to PLN's policy of issuing restrictions *on on-grid PLTS* which means that people can only install solar panels with a capacity of 10-15% of the installed electric power. This restriction policy is considered to reduce the public's attractiveness in using electrical energy from PLTS, besides that it is also not in line with MEMR Regulation 26 of 2021 on Rooftop PLTS. The Indonesian government needs to make extra efforts to achieve the NRE target of 34% by 2030. This target can be achieved in several ways, one of which is a firm commitment to government policy towards prohibiting the construction of Steam Power Plants again, and gradually eliminating coal power plant. Furthermore, the development of NRE through increasing Solar Cells as an effort to improve the economy can also reduce emissions to achieve Indonesia's *National Determined Contribution* (NDC) which was increased at the COP 27 meeting of *the Paris Agreement*.

The challenge of population distribution in people who can access energy in Indonesia is getting bigger. This is of course because Indonesia has an area that stretches across more than 17,000 islands, so there are still many people who are isolated and cannot be reached by electrical energy. In 2021 Indonesia's electrification rate will reach 99.45%. This figure does not exceed the target of 100% for the year that has been set. The government's plans to increase the use of NRE in rural areas continue to be implemented and the use of mini PV electricity networks as the cheapest alternative to meet electrical energy needs. From this research, we conceptualize how the use of solar cells will be the cheapest alternative and can be done individually or through third parties.

II. LITERATURE REVIEW

A. *New Renewable Energy Trough Solar Cell*

Geographically, The Association of Southeast Asian Nations (ASEAN) has the largest population and has abundant natural resources. As a country crossed by the equator, it has huge energy resource potential, one of which is a constant supply of solar power throughout the year. [2]As a tropical country located on the equator, Indonesia can use it to produce electrical energy using photovoltaic solar panels (Solar PV) at relatively competitive costs.

Renewable energy is defined as energy produced from energy sources that are cleaner, safer, and inexhaustible compared to conventional energy such as fossil energy. This energy comes from wind power, tidal waves, sun, geothermal energy, garbage power plant[3] and biomass. As in institution that manages electrical energy in Indonesia, PT Perusahaan Listrik Negara/PLN (persero) has the responsibility for the management of electricity intended for the needs of the community in order to improve the welfare and prosperity of the people carried out fairly and equitable. So it is necessary to make efforts to provide electricity from upstream to downstream so that all people get access to energy fairly and evenly. PT PLN (persero) is also obliged to develop electricity from both fossil and renewable primary energy sources.

B. *New and Renewable Energy Transition to Meet Energy Needs*

The energy transition is the issue that is attracting the most attention in the era of efforts to reduce emissions to overcome climate change. The current global agenda continues to encourage countries' efforts to switch to renewable energy. Inclusively, PT PLN (Persero) can take advantage of the environmentally friendly energy transition as a new business opportunity either independently or by collaborating with investors from the private sector. Acceleration of the development and implementation of New Renewable Energy (NRE) to achieve a conducive energy transition by prioritizing innovation and efficiency. This effort is realized so that the fulfillment of electrical energy reaches a competitive level (*competitiveness*).

According to the Internastional Renewable Energy Agency (IRENA), 80% of the world's population living in several countries are fossil feul importing countries. Dependence on fossil feuls would negatively impact more than six billion people who are vulnerable to geopolitical crises. In contrast, every country has renewable energy availabilty but the realisation of this potential has not been fully exploited. Thus globally by 2060, to avoid an energy crisis and geopolitical crisis or even the dangers of climate change, as much as 90% of the world's energy must be sourced from renewable energy.

Based on the latest report from the International Renewable Energy Agency (IRENA) in the "Indonesia Energy Transition Outlook", it is estimated that by 2030 energy sourced from solar power will become the backbone of the energy system in Indonesia. It is estimated that energy from solar power accounts for 798 GW of the total 1,000 GW. PV will contribute up to 840 GW of energy from total solar installations. [4]Creating a renewable energy market is a form of developing solutions for optimally distributed NRE. New business models applying significantly to renewable energy will be attractive to consumers and the development of financial models. This will close the gap between electricity generation costs and retail electricity rates. Stimulating private investor participation in mini and off-grid markets through policy and regulatory frameworks will be very important for achieving Indonesia's goal of replacing non-renewable energy sources to switch to NRE. Review of regulations with power wheeling and renewable energy certificate systems as well as new processes for companies to obtain renewable energy, requiring more energy.

III. METHOD

This research uses normative juridical research methods by reviewing and analyzing related laws and regulations, theories, principles and legal principles, that is in Law No. 30 of 2007 on Energy, Law No. 30 of 2009, MEMR Regulation No. 26 of 2021. The basis for policies regarding the use of renewable energy in Indonesia will be implemented based on RUPTL (Rencana Usaha Penyediaan Tenaga Listrik) as part of the PT PLN (Persero)/ Country Electricity Company road map as the institution responsible for managing energy in Indonesia. Based on a good governance system through policies and/or regulations, the use of NRE through Solar Cells is a program for fulfilling electrical energy both globally and to be implemented in Indonesia

IV. RESULT AND DISCUSSION

A. Good Governance in Solar Cell Utilization Policy

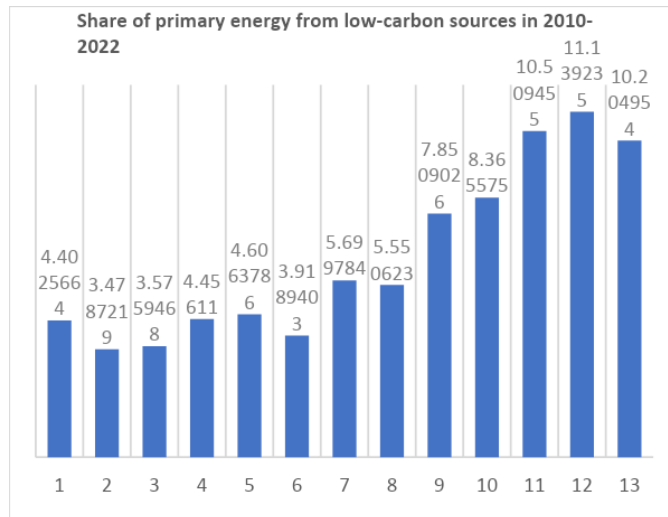
Indonesia's renewable energy sources that can be utilized developed in addition to increasing market share for business and improving the economy, renewable energy sources can also reduce emissions that cause climate change. Dependence on non-renewable energy sources will hinder the government's efforts to reduce emissions because various economic sectors, such as transportation, still use fuel oil. The plans to use electric transportation in Indonesia also still depend on fossil energy sources. The current energy consumption produced in Indonesia shows a high dependence on the use of coal.[5]

Based on data collected by Our World in Data from the Statistical Review of World Energy (2023), energy consumption by Indonesian people is still dominated by coal with a consumption value of 1.2 16.51 TWh. [6]Meanwhile, energy consumption produced from Solar Cells is 0.78 TWh.

The energy transition will involve a variety of planning and strategies, development, investment and time. *Good governance* in the energy sector has an urgency for the sustainability of plans to reduce emissions in each country. The commitment to *net-zero carbon* will be determined by good governance to attract stakeholders and companies to collaborate on the progress of using NRE to make it more competitive and sustainable. If there is strategic impotence, political interests that do not side with the people, and inefficient energy governance, it will affect developing countries towards a catastrophic energy crisis amidst poor environmental conditions due to increasing greenhouse gas emissions.[7]

In the future, the energy sector will become the largest producer of carbon emissions without concrete action to switch to using renewable energy. The government has a role to remove obstacles and strive to expand renewable energy.

Figure 1 Share of primary energy from low-carbon sources in 2010-2022



Source: Our World in Data

Then, efforts to use renewable energy sources show that Indonesia's low carbon data produced from low carbon energy sources in 2022 was achieved at 10.20%, so it did not reach the government's target in 2025 of achieving 25% of total energy sources. Shared responsibility is an effort that can be made to implement collaboration between regional and central governments, energy supply institutions, and third parties for sustainable governance of renewable energy programs. However, of course the main important role is government policy as a road map for implementation and supervision.[8]

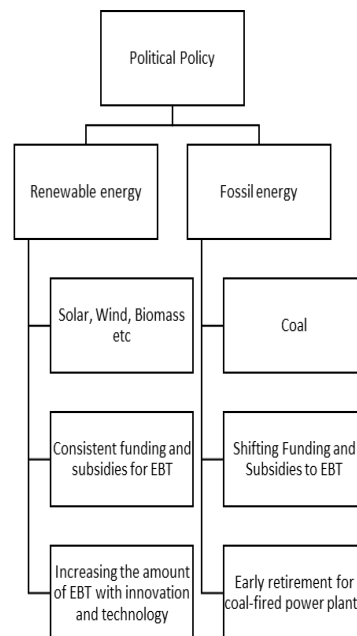
The government's efforts to continue to encourage the energy transition using NRE are by drafting and immediately passing the NRE Bill to support green industry and improve the economy. Apart from that, the NRE

Bill can also help the government's target of achieving *Net Zero Emissions* by 2060 as well as the NDC promise in *the Paris Agreement*. Even though the NRE Bill has not been passed, the government has issued Presidential Decree no. 112 of 2022 on Accelerating the Development of Renewable Electric Energy for the Supply of Electric Power. The aim of establishing this Presidential Decree is to accelerate the mix of renewable energy as part of national energy and the government's efforts to reduce GHG emissions. Apart from that, Presidential Decree No. 112 of 2022 also prohibits the construction of new PLTUs. On the other hand, there is an inconsistency with this Presidential Decree, that PLTUs that have been included in the Electricity Supply Business Plan (RUPLT) before the enactment of the Presidential Decree are permitted provided they fulfill the applicable requirements.

Quoting *the Australian National Audit Office (ANAO)* that in determining public service sector governance, according to ANAO that " *Governance has the goal of achieving results in increasing trust in decisions, actions and the organization*". The government, in its efforts to provide services to the public sector, especially the availability of energy for electricity, needs to implement effective and efficient initiatives, so that these provision efforts do not only focus on 'availability', but also performance and compliance efforts are an inseparable part. This is the same as in the ANAO regarding good governance which generally focuses on two main needs for society, that is: 1) Performance, that is efforts to deliver planned goods, services or programs; 2) Conformity, that is compliance with legal rules, published standards, regulations, as well as honesty, accountability and openness as expected by society.

The use of environmentally friendly energy is part of the increasing urgency for energy transition efforts, considering that in the future there is the potential for greater global energy consumption. This consumption is driven by various community needs, with energy needs such as transportation, household consumption and other daily activities highly dependent on energy.

Figure 2 Chart of Government Policy Efforts to Provide Energy Transition



Political policies will influence the development of renewable energy which is supported by consistent regulations, for example regulations on rooftop solar power which will refer to efforts to support increasing NRE compared to the use of fossil fuels. [9]Political will will be reflected in renewable energy development targets so that it can attract investors to choose green investments for the development of renewable energy in Indonesia that needs to be built.

Based on considerations regarding Indonesia's achievement target for *Nationally Determined Contribution (NDC)*, which rose to 31.8% from the previous 29% with independent efforts, the form of commitment to reduce emissions as a concrete step is by: a) consistent policies to regenerate energy sources and switch to renewable energy, such as Solar Cells; b) harmonization of policies between related institutions such as ESDM and PLN to realize NRE; c) community support in realizing the use of NRE.

B. Government Elaboration with the Country Electricity Company (PLN) Policy in Increasing Solar Cell Utilization

Industrial progress in line with the progress of globalization and technological developments has driven an increase in energy needs. On the other hand, current energy sources are mostly produced from fossil fuels which hurt on environmental pollution and cause health problems in society as well as causing depletion of the ozone layer. Thus, this reason is part of the Country's responsibility to switch to renewable energy by encouraging an integral system through policies in ministries and institutions that handle energy provision for society to become the basis for implementing a conclusive energy transition. [10]Future policies on the application of energy through solar cells using incentive methods, for example with *Feed-in-Tariff* (FIT) as a tariff guarantee. Each country will have differences in the incentive implementation system, such as a period of between 10 and 25 years. Incentives on FIT can also be implemented using market value or fixed value.

The influence of technology on PLTS creates two systems, including: a) *on-Grid / Grid-connected* PLTS , where this system is in the form of a building that will have 2 power sources. First, it comes from the voltage source on the PLN lines. Second, from the PLTS system that is being built. These two resources will be regulated by the *Distributed Borad AC component*. This system is considered the simplest and most cost effective. b) *Off-Grid* PLTS will usually be found in isolated areas and far from the reach of PLN networks. The challenge with this system is that it requires a battery that has a *deep cycle* so that it can store electrical energy when it doesn't get enough sunlight at a certain time.

Regarding the implementation of PLTS in Indonesia, overland Country the importance of supporting high technology in the energy transition period of technology and innovation. One of the goals for developing renewable energy research is to develop new technology using cheaper and environmentally friendly materials that have the best prospects in the future. The demand and need for electricity in Indonesia continues to increase from 2016 to 2023.

Based on Dadang's opinion regarding the obstacles to implementing NRE in Indonesia due to the lack of transparency. Research conducted by *the Corporate Political Engagement Index* (CPEI) Countryrd that coal-fired power plants in Indonesia do not apply the principle of transparency and close access to company activities, especially regarding political issues. Transparency is considered part of good governance efforts *from* all aspects and aims for the welfare of society in general. [11]Global governance also requires transparency or involves international legal elements with more and more negotiations that are compatible with transparency. So that transparency and inclusiveness will become the main pillars of good governance.[12]

Together with the Government, PT PLN (Persero) has a role in determining national energy management to provide safe, environmentally friendly and reliable national energy. as implied in Article 1 paragraph (2) of Law No. 30 of 2007 on Energy. In 2025, Indonesia has a target of using NRE of 23% and 31% in 2050 which is formulated in the National Energy Policy (NEK) as long as economic conditions are met, this is Countryrd in PP No. 79 of 2014 on National Energy Policy.

Based on the Decree of the MEMR No. 188.K/HK.02/MEM.L/2021 on the Ratification of the Business Plan for the Provision of Electricity of PT Country Electric Company (Persero) from 2021 to 2030, the planned electricity generation sourced from NRE is 51, 6% of total electricity generation, and the remainder comes from fossil energy at 48.4%. The potential for PLTS development reaches 207.8 GWp with 0.15 GWp as the realization of its achievements. The region with a reach of 2.1 GWp is in North Sulawesi. Based on RUPTL in 2020, it targeted that 78 MW will be sourced from PLTS with a total NRE target of 933 MW. In the MEMR regulation No. 49 of 2018 which was amended by MEMR regulation No. 13 of 2019 supports the achievement of 23% of NRE projections in 2025.

Apart from elaboration efforts between government institutions, issues regarding climate policy both internationally and nationally currently only focus on the fields of technology and economic incentives. The push with the highest urgency is changing individual behavior as part of the focus on mitigating climate change. In research (Gishlain Dubois, 2019) [13]says that the implications of individual behavior need to be focused on changes in consumption or options on the demand side apart from efforts to emphasize mitigation in technology or other policies offered. Considering lifestyle is also an important part of a target in policy, not just as a voluntary action carried out by individuals. The lifestyle of today's society has had an impact on the atmosphere, biodiversity and geology, and will have an impact on future generations.[14]

Apart from that, the perception of the high costs and maintenance involved in developing *solar cell/photovoltaic energy* means that this island country, which is divided by two equator lines with fairly constant

sunlight throughout the year, only has the fewest solar energy installations of the other G20 member countries. Even though the potential for solar power in Indonesia is greater than the combined electricity generation in the world.

Indonesia is the largest thermal coal exporter in the world and the country's electricity network managed by PT PLN (Persero) currently relies on domestic supplies to power two-thirds of existing power plants. Based on studies from the IMF, on remote islands in Indonesia, smaller power plants are produced to illuminate the area, that is by providing electricity sourced from burning millions of liters of light at a cost of up to 22% per kilowatt per hour or at least this covers 7% of electricity capacity in Indonesia.

C. Encouraging the Business World to Use Solar Cell

During the energy transition period in Indonesia, some issues hindered progress in the development and use of NRE at this time, such as: the production costs of NRE being more expensive than the costs of using coal; lack of electability regarding legal certainty and clarity of existing regulations regarding government programs to switch to renewable energy in reducing Green House Gas emissions; and APBN subsidies allocated for fossil fuels. Behind this issue, based on research (Osman, 2022) renewable energy in solar photovoltaics has decreased from 2010 for of \$0.417 to %0.048/kilowatt-hour in 2021. Photovoltaic technology has experienced [15]development and has business potential. The use of solar power does not involve moving parts, and operating costs are relatively low and maintenance costs are more affordable and can be installed anywhere with other systems.

As with climate change mitigation efforts, of all pathways and efforts to reduce greenhouse gas (GHG) emissions globally, almost 75% of these efforts are in the energy sector which produces Co₂, and the remainder is in AFOLU at 13% and other emissions from all sectors in a non-Co₂ context amounted to 12%. This certainly encourages the importance of decarbonization efforts in the energy sector globally. Projections from *the Intergovernmental Panel on Climate Change (IPCC)* note that achieving efforts to reduce emissions to 1.5°C with a low carbon pathway will cover 97-99% of global warming. Especially in electricity, that is in 2050, 63-85% of primary energy will be dominated by solar power, especially photovoltaic and wind energy which is estimated to contribute 40-80% to all global electrical energy production. This certainly indicates the importance of NRE sources from the solar cell and wind sectors to mitigate climate change and decarbonize efforts in the energy system.

Energy consumption will provide a boost to general economic growth. However, the source of the energy produced also needs to be considered. The environmental impact resulting from energy sources will determine environmental quality. Based on [16]*Worldbank* data regarding the significant increase in global gross domestic product in 2020, it has steadily increased since 2015 to \$81,749.43 billion or a growth value of 2.9% per year. Meanwhile, global energy consumption increased by 8223.6 Mtoe with a growth rate of 2.0%.

At the G20 event, ASEAN countries will also attract more investment in the energy sector in the renewable energy sector. The investment achievement in the NRE sector is only USD 1.6 billion, which is relatively small compared to other G20 countries. Future expansion opportunities for the PLTS market will encourage wider PLTS expansion projects in Indonesia.

V. CONCLUSION

Accelerating the development and upgrading of solar power plants or Solar Cells by 2025 is part of a government program whose urgency depends on the relevant policies and regulators. If the current achievement of 23% is still half as high, then before 2030 Indonesia will need strong efforts to achieve an NDC of 31.8% in the *Paris Agreement*. The energy sector, especially the use of fossil fuels, is the largest contributor to emissions in Indonesia. Thus, RUPTL in 2025 is required to be harmonized with programs to accelerate the use of NRE and policies that will influence the target market due to the high interest in using solar cells with affordable financing methods and systems.

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