Indonesia Nuclear Energy Law and Policy: Overcoming Energy Crisis and Supporting Sustainable Development

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Abstract. In 2023, about 140 villages in the rural area of Papua didn't have electricity. Meanwhile, Indonesia government efforts to maintain SDGs within several projects of energy transition remain significantly increased. The potential of a Nuclear Power Plant to support the electricity production is being considered by the Indonesian government as an option. The research aims to provide an alternate perspective for Indonesian governors and academics on Nuclear (as a clean energy source) Energy Law and Policy to adopt and implement. The research will be analyzed through analytic induction supported by the data and facts while using qualitative techniques from reviewing the credible data resources in virtual documents, journals, and literature. Indonesia regulatory frameworks for nuclear energy as a renewable energy with the Japan Nuclear Energy Law and Technology as compression in the context of geographical comparable characteristics, considering the strength and weakness of nuclear power plants compared to coal energy, including energy transfer to all Indonesian regions, particularly eastern Indonesia. The research will increase the interest of the Indonesian government and academicians to arrange a legal renewable energy law specifically. Whereby supporting the development of energy technology, to fulfill the well-being of Indonesia's citizens and maintaining sustainable development goals.

Keywords: Nuclear Power Plant, Energy Law, SDGs

1 Introduction

As an archipelagic country, Indonesia has more than 17.000 islands, which includes the small and large islands. Papua is one of the large islands located in the East-side of Indonesia, whereas this area still lack of infrastructure and development compared with the other islands. Thus, Indonesia is one of the most populous countries, the data from world population review and world meters shows Indonesia ranks 4th in terms of countries with the largest population about 283,488,000 people[1]. The large population in Indonesia causes an increasing amount of energy demand for daily needs, one of which is electrical energy. However, the problem occurs in Indonesia not only that, but also the distribution of electrical energy because there are too many

remote areas in Indonesia which still uninstall electricity in the villages[2]. Therefore, the rural area of Papua in 2023, with about 140 villages, still live without electricity sources. Not only in Papua, but also in several areas in Indonesia, the society in villages still struggle to meet the requirements of electricity sources. On the other side, the Indonesian government is implementing various regulatory and fiscal incentives to encourage green growth, focusing on electric mobility, carbon markets, and renewable energy in national scope. In September 2022, including emissions reductions from LULUCF -Land Use, Land-Use Change and Forestry-, Nationally Determined Contribution (NDC) now aims for 31.9 % unconditional emissions reduction (up from 29.0 %) and 43.2% reduction with international support (up from 41.0 %) below a business-as-usual scenario by 2030. These are Indonesia's government efforts to maintain SDGs within several projects of energy transition[3].

The Sustainable Development Goals (SDG) define as set of 17 goals put forward by the United Nations (UN) which aim to create a better and sustainable future for everyone. One of the SDG's put forward by the UN is clean and affordable energy, it is energy with environmentally friendly, cheap, and easily accessible energy. Generally, clean energy is renewable energy because it has minimal impact on the environment and can reduce the greenhouse effect and global warming[4].

Due to the Republic Indonesia article about Energy Law in 2008, the regulation and energy law in Indonesia already stated in Act No.30/2007 stipulates that; (1) Chapter 2 Article 3 about the priority of energy access is the availability of domestic energy used to meet domestic energy needs, fulfill foreign exchange, and realize increased access of the poor and/or disadvantaged to energy; (2) Chapter 3 Article 8 about environment and security, namely every energy management activity must prioritize the use of environmentally friendly technology and every energy management activity must fulfill the provisions required by laws and regulations in the field of occupational safety; (3) Chapter 5 Article 20 about energy efficiency is the use of energy carried out by optimizing all potential energy resources, considering technological, social, economic, conservation, and environmental aspects, and prioritizing the fulfillment of community needs.

Fossil fuel-based sources have dominated Indonesia's electricity generation for the past two decades and are expected to remain the main source[5]. Based on the data from energy and economic statistics of Indonesia 2023, coal is the most widely used main energy source in Indonesia with an average of 38.30% in the last 5 years, followed by oil at 31.82%, gas 18.43%, renewable energy 11.43%, hydropower 2.76%, wind 0.07%, geothermal 1.78%, and solar 0.08%[6]. Coal is one of the non-renewable energies and is formed from hundreds of years old plant residues. Almost 36% of the world's energy needs use coal. However, the use of coal can damage ecosystems because of land degradation, and air pollution can occur by the reason that it releases emissions such as CO, NOx, and SO2 gasses into the atmosphere[7].

Nuclear power is one of the solutions to the energy crisis. One of the significant advantages of nuclear energy is its ability to generate electricity without emitting large amounts of greenhouse gasses or air pollutants. Nuclear power plants do not produce carbon dioxide (CO2), sulfur dioxide (SO2), or nitrogen oxides (NOx), which are significant contributors to global warming and air pollution[8]. Indonesia already have

consideration about the large-scale and small-scale proposals on nuclear power development. Through the consideration, a National Nuclear Act was passed in 1997, stated in Act No. 10/1997 about Nuclear Power. However, up until now, the construction and implementation on Nuclear Power Plant remain put on hold, even though the long-term plan and the collaboration with Korea Electric Power Corp. and Korea Hydro & Nuclear Power Co. (KHNP) already signed a memorandum of understanding (MoU) with Indonesia's PT Medco Energi International at a cost of 3 billion US$. Another agreement also has been signed between Indonesia with foreign countries like Russia for construction and China for develop high-temperature gas-cooled reactor (HTR), earlier before KHNP MoU. The final nuclear power plant development phase ended in 2022, when ThorCon signed an agreement with Bureau Veritas, a testing, inspection, and certification organization, for reactor technology qualification and ongoing development. Furthermore, international support for Indonesian plans is already strong, as seen by the existence of those agreements and the IAEA's plan proposal examination[9].

The Indonesian government has committed to implementing an energy transition to reduce the greenhouse effect and achieve Net Zero Emission (NZE) at the G-20 Summit in Bali in 2022, where the government seeks to encourage research and development of new renewable energy (RE) power generation technologies and one of them is nuclear energy. Along with the implementation of Government Regulation in the Law No.2/2022, about Badan Pengawas Tenaga Nuklir (BAPETEN) is committed to issuing a "licensing consultation service" policy which aims to make nuclear business actors consult with BAPETEN regarding the 3S (Safety, Security, Safeguards) aspects before submitting a license application to BAPETEN. One of the business actors interested in investing in building the first nuclear power plant in Indonesia is PT ThorCon Power Indonesia (PT TPI). In December 2022, PT TPI submitted an application to BAPETEN to be able to carry out consulting activities for the construction and operation of the TMSR500 type nuclear power plant and other facilities. This request was welcomed by BAPETEN, and an executive meeting was immediately held regarding the signing of the 3S consultation plan. Based on the results of the review and regulatory framework, BAPETEN provides a view that the TMSR500 (conceptual design) is designed to be able to mitigate the Fukushima accident and other external hazards, as well as typical Indonesian external hazards[10].

As time goes by, the utilization of nuclear energy in Indonesia is increasing, for this reason, BAPETEN conducted a press release for the Nuclear Product Exhibition (PPN) and Nuclear Safety Seminar (SKN) on August 20-21, 2024 where SKN itself was carried out for the preparation of nuclear power plants[11]. Not only that, BAPETEN also held a Radiation Safety Seminar on Medical Exposure on September 4, 2024 for the safety of workers and patients[12], and the 2024 National Nuclear Emergency Response Exercise on September 24-25, 2024 to assess the ability and skills of personnel in dealing with nuclear/radiological accidents[13].

According to an article published by the METI Agency for Natural Resources and Energy, Japan's nuclear energy program has great supply stability with high efficiency and has contributed to increasing resource security. It has low operating expenses and

emits no CO2 while operating, making it environmentally friendly. However, following the Fukushima nuclear tragedy in 2011, the world community has proposed new, stricter standards for nuclear power safety. Furthermore, the Japanese government lost public trust in nuclear energy, compelling it to replace it with other alternative energy sources[10]. Since the disaster, the government has formed an independent organization known as the Nuclear Regulation Authority in 2012. Then, in 2013, new regulatory standards were developed with the most-strict criteria in the world, while also taking into account International Atomic Energy Agency (IAEA) regulatory standards when defining the new standards.

Moreover, Indonesia has troubles in terms of public trust, it can be seen on 26 April 2024 in Jakarta and Pontianak. WALHI (Wahana Lingkungan Hidup Indonesia) or known as Indonesian Forum for the Environment, an Indonesian environmental non-governmental organization, that is part of the Friends of the Earth International (FoEI) network, were rising some issues about almost half of the Semipalatinsk. Astana population suffered from motor nervous system dysfunction (1949-1962), there is no transparency from the government about Nuclear Power Plant Plans, until the suspicion of the hidden scheme on putting individual and/or certain organization advantages[14]. In the government side, Himpunan Masyarakat Nuklir Indonesia (HIMINI) or Indonesian Nuclear Society is organized as an effort to socialize the Nuclear Energy confusion. It is an independent organization that is intended to research and learn more about the nuclear field for the society's welfare and to enlighten the nation (HIMINI Articles of Association Article 3 Verse 2 & 3) [15]

The research will discuss another perspectives related to the legal framework of Nuclear Power Plant implementation in Indonesia, which supports the sustainable development and overcoming energy crisis. By reviewing reliable sources from virtual documents such as international journals, articles, and books. Also, collecting data from the secondary source, will sharpen the discussion and findings from the general to the specific issue. Within the technique of qualitative method by describing the result in the analytic induction process. The analysis of study using the Green Theory from this field of study, further consideration for the Indonesian government to prioritize clean energy and to continue the project on the implementation of nuclear power plants.

2 Method

Qualitative technique is used to analyze most of the content in this research. In qualitative studies, the researcher measures with alternatives to numbers, and measurements are less aspirate research steps. Because the process is inductive, this research is measuring and creating new concepts simultaneously with the process of gathering data from the virtual documents and reviewing it to create the result.

Supported by analytic induction we observe the empirical world and then reflect on what is taking place and think in an increasingly more abstract way to see the issues. It begins with approaching the general topic and some unclear ideas that we later explore and explain into more certain concepts inductively [11].

Researchers collect the data from credible journals, articles and books that align

with the research conventionally by searching using the keywords that needed. Reviewing several documents which has similar topics then decide which one is more fit with the field of study. After finding the most suitable data, reviewing and analyzing another perspective that is different from the previous research and focuses more on the regulation and policy about Nuclear Power Plant implementation in Indonesia. The research analysis using grounded theory on Green Theory in International Relations to shaping the result of this study.

3 Theoretical Framework

The emergence of Green Theory started in 1960s because the rising of the 'tragedy of the commons' contains the idea as self-interested individuals; the human will overuse share resources that available in the earth. In 1970, United Nation has conference discussing about the subject and later in 1980s public policies and green political parties has emerged. Green Theory captures this orientation in political terms of value and agency (Goodin 1992), means what is to be valued, by whom and how to get it. In the terms of environmental issues, green theory which belongs to the critical theory answered the question that emerge about the relations between and among ourselves and others in the context of community and collective decision making. It is also discussed what kind of level of political community to seek a solution. Those questions are answered by the alternative idea about political association based on ecological relationships [12].

Based on ecological view, the criticism on the development and progressive sustainable development practices which known as 'tragedy of the commons' (Hardin 1968), rational choices where it destroys the environmental resources seems tragic due to the condition that there is no change and practicing to prevent it. The scholars argue that these issues could not solve only by the technical means but also need to change the human values. Another scholar, Goodin (1992) stated that the distinguish feature of green theory is its own reference to a coherent moral vision as a 'green theory of value' which operates independently of a theory of practices or political agency [12].

In International Relations, environmentalism-themed scholarship generally already accepting the concept existing framework of political, social and economic structures of world politics. Which these address the relations between human communities, rather than relations with the non-human environment. In the global environmental problems, the traditional IR with the concern of state need require solutions, which it can develop our understanding under the 'global' terms as an alternative organizing principle and perhaps look over the green social movements rather than states itself as a theoretical insight. Due to the interaction among global scale, the political structure is needed either it's a big government, small government or no government with the level or extent of their development. The study case for instance the promotion of centralized global political structure like institution for governing environmental issues (Biermann 2001) or allow a variety of decentralized, even anarchical, interconnected local structure to emerge as circumstances require (Dyer 2014). [12]

4 Literature Review

The Energy Law No. 30 of 2007, which lays out general guidelines for the management of energy resources and a specific legal foundation for national energy management, as well as the government's fundamental goals for the development of the energy mix in the future, serves as the foundation for Indonesia's energy regulation laws. Additionally, it recognizes that energy security is a critical issue for expanding renewable energy sources and decreasing dependency on imported refined oil. This law lays the foundation for regulations controlling the production and conservation of renewable energy and highlights the significance of environmental preservation, energy resilience, and sustainable development in national energy management. Furthermore, the regulation Act No.10/1997 on Nuclear Power has already been established and is encouraging the construction of nuclear power plants in Indonesia in order to help the country achieve its renewable energy goals.

Recent research indicates that Indonesia currently lacks policies to encourage the use of renewable energy domestically. Notwithstanding the obstacles, such as Indonesia's inadequate investment in the renewable energy sectors, the policy also had to support the renewable energy initiative. In the meantime, government stakeholders continue to place a high priority on fossil fuels and other energy sources. Second, unlike Germany, Spain, France, Italy, and the United States, Indonesia has already failed to set aside funds for investments in technology and innovative energy industries following COVID-19 [12]. Third, despite having more aggressive plans to reduce emissions than Organization for Economic Cooperation and Development (OECD) nations, Indonesia still has to strengthen its policymaking to boost renewable energy[13].

According to studies, Indonesia has not prioritized the development of renewable energy and instead relies solely on oil, gas, and coal resources, resulting in a renewable energy contribution of less than 10%. Transitioning energy to a greener approach system presents major hurdles, including the presence of well-established non-renewable energy companies, the need for large capital investment in renewable energy infrastructure, and the risk of a decrease in tax revenue[16].

Another area of study also discovered that Indonesia had already experienced the ups and downs of ideational power renewable energy in the process of rural electrification in the Sumba Iconic Island project. The primary issue is that the Indonesian government has to focus more on the institutional approach to electrification policies in remote rural areas. This includes a deeper comprehension of local ideational dynamics in sustainability projects at the national level. In order to translate national pledges to climate change and sustainable development into workable guidelines for implementation, the researcher suggested local-level legislation[14].

In a prior study, the non-conformance between regulatory capture and public interests was discussed as a conceptual framework for real practice in executing legislation-making. The Indonesian government's failure to prioritize public interests creates contradictions in regulations addressing environmental concerns, which frequently collide with economic interests and operations. The study example of inadequate and continuously delayed coal-fired power facilities illustrates the implications of these phenomena. The goal of the regulation must be to monitor and assess the performance of regulated businesses and organizations, and it must be independent. According to the research, an efficient method is to gradually increase accountability and openness from the very beginning[15].

After the Fukushima incident with the evidence of pro-cons that grew throughout society notably Japanese. These phenomena helped to secure the political discourse surrounding nuclear power and established the groundwork for the implementation of a revised energy policy. The study also examines the combined influence of interest structure and level politicization on the scope of policy change. The manipulation could take place in civil society at a crucial time, such as when the incident occurred[17].

According to different sources of field research, the most effective strategy to attract foreign investment is to establish best-practice policies and incentives and then put them into practice. Second, establish a high-level governing body with responsibilities for renewable energy[18].

5 Result and Discussion

Reflecting on the Fukushima disaster in 2011, where an earthquake measuring 9.0 on the Richter scale was followed by an aftershock tsunami that severely damaged the Fukushima-Daiichi nuclear power station. The catastrophe killed many people and caused the public to lose faith in the government, prompting the government to replace it with alternative energy. The case of Japan's nuclear law has changed shows a result of the role of activists and public interests following the Fukushima incident should serve as a suitable model for adaptation and implementation. These phenomenon shows the relationship between among ourselves and others in the context of community and collective decision making. The activist in Japan to push their government to improve the previous policy on Nuclear Power shows significant role as finding solutions. Due to the group interest and community, local government of Japan has emerged to consider into the local level of decision making. Previous field of study illustrate that in environmental problems, green social movement could be look over deeper to finding the alternative view on the relations between community and global political structure. It still needed to establishing the certain level of political governance in global to extend the development of implementing practice such as establish the nuclear power plant in Indonesia. another alternative is creating variety of decentralized government to combat the issues also could be a way to strengthening the domestic law and policy. Such as collaboration between society to society in global level to emerge the local government making a policy.

The interconnected local structure is successful to solve the problem such as Indonesia's problem on lack of policy and law power. Indonesia still needed the collective decision making supported by the existence of powerful community in the democratic country. In fact, there are several protests from WALHI, support community-support on nuclear power like HIMNI, however their actions could not as powerful as Japan's nuclear activist to create an emergence situation for Indonesian government. It still considers as the lack of human values to care with their environmental issues, which Indonesia cannot solve the technical problem in the practice of implementing the Nuclear Power Plan.The involvement of society in the process of persuading the government to develop a policy is equally critical. The analysis of this case is similar with the ecological view which it's critics about the development and progressive sustainable development practices. Despite Indonesia itself already made a rational choice for trying to run the nuclear power plant program since long time ago,

and several failed project to electricity distribution in rural area. However, the tangible result has not existed to sustain development and prevent the environmental issues. Therefore, the meaning of the solving problem is failed because the roots is not in the technical means, but instead it need change on the human values.

Nuclear energy is one potential answer to Indonesia's energy crisis. It has various advantages, including the ability to generate enormous amounts of energy with a small quantity of fuel while emitting no carbon dioxide (CO2), sulfur dioxide (SO2), or nitrogen oxide (NOx), chemicals that contribute to global warming. As a result, nuclear power plants (PLTN) can be used to shift from fossil fuels to renewable energy, while also addressing one of the SDGs, clean energy. However, nuclear power plants have significant downsides, including environmental issues related to nuclear waste, potential accidents caused by radioactive waste, and potential radiation leakage that endanger public safety.

Even though Indonesia's plan to establish PLTN is supported by the other states like Japan, South Korea, Russia and China. However, it also needs support and balancing of interest groups to persuade the government to create an urgent policy relating to renewable energy, despite the fact that the Energy Law and Nuclear Energy are already in place. Indonesia's electricity sources have shifted toward non-renewable energy since stakeholders ignore the public interests, despite the country's ambition to contribute to the reduction of greenhouse gas emissions.

Based on the requirements for the development and implementation of advanced nuclear energy technologies, four recommendations can be made: (1) Convert fertile materials into fissile materials to ensure nuclear fuel sustainability; (2) Emphasize the widespread use of advanced compact reactors as well as novel applications of modern nuclear energy in order to create an efficient, low-carbon, and adaptable smart energy system. Advanced compact reactors offer excellent safety, low power, multi-purpose capability, and significant flexibility, and they are expected to become a new trend in nuclear energy applications; (3) Enhance basic research and general technology research and development. Nuclear power plants are actually relatively safe, as many countries have employed them. In reality, Japan, a ring of fire country like Indonesia, is developing nuclear power facilities to replace fossil fuels. Although tragedies like the Fukushima tragedy are possible, they can be avoided via tight government laws and advanced technology; (4) Strengthening the partnership within the foreign states and the International Organization to prevent the incident of nuclear damage in society and environment.

6 Conclusion

Indonesia requires support and balance from interest groups to persuade the government to implement urgent renewable energy policies, despite existing Energy Law and Nuclear Energy Laws. Indonesia's electricity sources have switched toward non-renewable energy, yet non-renewable energy, such as fossil fuels, can harm ecosystems and produce pollutants, making Indonesia's objective to reduce greenhouse gas emissions difficult. Nuclear energy can help to solve Indonesia's energy dilemma. Nuclear energy is a renewable and environmentally friendly energy source, so it aligns with the SDGs, which emphasize the use of clean energy as a

source of electricity. Indonesia has made progress in the deployment of nuclear power facilities; however, the absence of a renewable energy law, which is still being incorporated into the energy program, may be an obstacle to implementation. Reflecting on how Japan's nuclear law has changed as a result of activists' and the public's involvement following the 2011 Fukushima disaster, it should serve as a model for adaptation and implementation. The tragedy has demonstrated the importance of rigorous policies and advanced technologies in preventing similar incidents. With stringent laws and advanced technology, it is possible to prevent catastrophes like Fukushima and ensure that nuclear power facilities are safe to operate. As a result, Indonesian government need to strengthening the policy and law relates to the nuclear power helped by the community and activist, increasing the awareness to the human values relates to the environmental issues, and also emerge the government to conduct the policy making on nuclear power.

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