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Utilization of Nuclear Electricity in the Paradigm of Progressive Legal Theory

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Abstract

The purpose of this research is to examine the risks of utilizing nuclear power in terms of emission, footprint, ecosystem, and waste, examine the utilization of nuclear power in supporting the green economy, and examine the format of new and renewable energy law reform in the utilization of nuclear power as new energy in the paradigm of progressive legal theory. The research is motivated by the negative perception of nuclear energy without detailing the potential and advantages of nuclear energy through the application of nuclear power plants. Then, highlighting doubts about the use of nuclear energy in the green economy development agenda. As well as highlighting legal challenges in the framework of nuclear energy regulatory reform in Indonesia contained in the Draft Law on New and Renewable Energy (RUU EBT). By using normative and comparative juridical approach methods, this research finds positive impacts of nuclear energy on the environment and green economic development by taking France as a successful example. To overcome legal problems in RUU EBT, this study recommends the application of progressive legal approach in the formation of legal policy model, as has been applied by the People's Republic of China (PRC) and Norway.

Keywords: *Draft Law on New and Renewable Energy; Green Economy; Nuclear energy; Progressive Legal Theory*

1. INTRODUCTION

Indonesia is working to change the paradigm in the national electricity supply sector, with a sharp focus on environmentally friendly energy quality and increased utilization of renewable energy. PP No. 79/2014 on KEN is the foundation for Indonesia in targeting to achieve 23% of the primary energy mix from new and renewable energy by 2025.[1] In addition, the high demand for electricity in line with economic growth in Indonesia.[2] The direction of Indonesia's economic policy has begun to transform towards a green economy. These two agendas are Indonesia's efforts to maintain economic growth through the fulfillment of demand for environmentally friendly electricity energy sources. The utilization of Nuclear Power Plants (NPP) has the opportunity to be an alternative solution to the provision of environmentally friendly electricity and green economic development.

Nonetheless, the utilization of nuclear power plants has generated opposition. OECD countries take a skeptical view of nuclear power plants, influenced by case studies of the Chernobyl and Fukushima disasters.[3] The Chernobyl tragedy is estimated to release radioactivity about 4x the amount of the two atomic bombs on Hiroshima and Nagasaki.

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[1] "Peraturan Pemerintah Nomor 79 Tahun 2014 Tentang Kebijakan Energi Nasional" (2014), https://peraturan.bpk.go.id/Details/5523/pp-no-79-tahun-2014.

[2] Ap Prastika, "Hubungan A ra Tingkat Konsumsi Energi Listrik Dengan Pertumbuhan Ekonomi Di Indonesia," *Jurnal Ilmu Ekonomi (JIE)* 7, no. 1 (2023): 18–29, https://doi.org/https://doi.org/10.22219/jie.v7i01.25042.

[3] Aleksandra Badora an rzysztof Kud and Marian Wo´zniak, "Nuclear Energy Perception and Ecological Attitudes," *MDPI* 14, no. 4322 (2021), https://doi.org/Energies 2021,https:// doi.org/10.3390/en14144322.

The significant contaminated area covered 100,000 km^2 , causing 273 people to suffer from acute radiation sickness as well as about 1,000 cases of thyroid cancer and about 4,000 cases of other cancers in Europe. In addition, more than 19,000 km^2 of farmland was contaminated with 2,640 km^2 never to be planted and 17,000 km^2 of forests, mainly in the Ukrainian region, infected as a result of a combination of unauthorized manipulation, human error, and design imperfections of the RBMK-type reactors.[4] In the Fukushima tragedy, the use of nuclear power plants in disaster-prone areas was extremely risky. A magnitude 9 earthquake accompanied by a 14-meter tsunami caused a hydrogen gas explosion that triggered the release of radioactive material into the environment due to the partial destruction of the roof of the containment building. Although there were no fatalities, at least 100,000 people were evacuated to avoid the effects of radiation. After the two biggest nuclear tragedies, there have been advances in nuclear power plant safety technology, involving safety system models that do not require human intervention and the application of natural law principles through natural circulation.[5]

Indonesia's legal framework that regulates the utilization of nuclear power is still a polemic. Draft Law on New and Renewable Energy (RUU EBT) has included nuclear material that creates legal dualism with Undang-undang (UU) Nomor 10 Tahun 1997 (UU Ketenaganukliran).[6] This conflict is reflected in the enactment of RUU EBT which will only revoke Article 13 paragraph (4) of Law on Nuclear, while the regulatory materials on the construction, operation, and decommissioning of nuclear reactors, establishment and division of authority of institutions outside Article 13 paragraph (4) of UU Ketenaganukliran will refer to the two UU. This situation is very far from the spirit of progressive law that uses law as a means of delivering humans to justice, welfare, and happiness.[7]

There are three previous studies that are relevant and contribute to this research. First, the research highlights the urgency of developing advanced technology in environmentally friendly nuclear power plants based on the principle of energy management cycle.[8]

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[4] Symeon Naoum and Vasileios Spyropoulos, "The Nuclear Accident at Chernobyl: Immediate and Further Consequences," *Romanian Journal of Military Medicine* CXXIV, no. 2 (2021): 184–90, https://doi.org/http://dx.doi.org/10.55453/rjmm.2021.124.2.9.

[5] Lee Youri Mikhaelia Riyatun, Heddy Krishyana, Ari Handono Ramelan, Agus Supriyanto, Suryanto, Suharyana, Fatia Puspitasari, Drajat Tri Kartono, Purbayakti Kusuma Wijayanto, Irwan Trinnugroho, Sajidan, Agnafan Julian Fortin, *Kajian Akademik Nuklir Sebagai Solusi Dari Energi Ramah Lingkungan Yang Berkelanjutan Untuk Mengejar Indonesia Sejahtera Dan Rendah Karbon Pada Tahun 2050*, ed. Firli Rahmawati Diani Galis Saputri (Surakarta: UNS Press, 2021).

[6] "Undang-Undang (UU) Nomor 10 Tahun 1997 Tentang Ketenaganukliran" (1997), https://peraturan.bpk.go.id/Details/45931.

[7] Satjipto Rahardjo, *Hukum Progresif: Sebuah Sintesa Hukum Indonesia*, Cet. 1 (Yogyakarta: Genta Publishing, 2009).

[8] Lia Wulandari et al., "Analisis Pengaruh Globalisasi Dan Perkembangan Teknologi Nuklir Terhadap Lingkungan Hidup Yang Berkelanjutan (Sustainable Environment)," *Jurnal Bisnis Dan Manajemen West Science* 1, no. 01 (2022): 36–50, https://wnj.westscience-press.com/index.php/jbmws/article/view/81.

However, it has weaknesses related to the presentation of non-renewable data on the development of current NPP technology such as safety quality improvements in reactor design and more environmentally friendly waste treatment, thus making the research lose relevance as technology advances and globalization, in accordance with the aspects discussed in this study.

Second, the research focuses on assessing the positive and negative impacts of nuclear utilization on the environment as well as the political challenges and public acceptance of nuclear faced in the plan for nuclear utilization in Indonesia in 2035. [9] However, the absence of discussion of the regulatory aspect, which is a crucial element in political policy-making, makes its relevance to the focus of this research limited.

Third, research that examines the exclusion of nuclear energy regulatory substance as new energy in RUU EBT through the concept of green legislation. [10] However, there are weaknesses in the form of weak reasons for the exclusion of nuclear energy regulatory substance because it is less supported by objective data on nuclear energy, which is actually an environmentally friendly energy. Therefore, the objectivity and scientificity of this research are very doubtful due to the presentation of inaccurate data.

Based on the above comparison, it shows the state of art of this research and is not a duplication of previous research. The reason for compiling this research is to provide a new perspective regarding the utilization of nuclear as a PLTN in combating climate change and encouraging green economic development, while integrating the progressive legal paradigm in the regulation of the RUU EBT. This research highlights excellence in presenting comprehensive, objective, and comparative data regarding the utilization of PLTN in accordance with the latest technological advances and its impact on green economic development, so that it can become input for policies on the utilization of PLTEBT in Indonesia. Enrichment of analysis through progressive legal theory and EBT regulatory models in other countries can contribute to restructuring RUU EBT as an effort to form progressive law. Therefore, this research has three main objectives, namely examining the risk of utilization of nuclear power in terms of emission, footprint, ecosystem, and waste aspects, examining the utilization of nuclear power in supporting green economy, and examining the format of new and renewable energy law reform in the utilization of nuclear power as new energy in the paradigm of progressive legal theory.

2. METHODS

This research is a normative research with descriptive analytical research specifications, namely obtaining a clear and detailed description of a situation or problem to be analyzed

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[9] Muhammad Fakhrudin et al., "Penerapan Energi Nuklir Sebagai Pembangkit Listrik Indonesia Pada Tahun 2035," *Jurnal Humanis* 3, no. 2 (2023): 910–16, http://openjournal.unpam.ac.id/index.php/SNH/article/view/31036.

[10] Abel Parvez; Reyhana Nabila Ismail; Sifa Alfyyah Asathin; Agus Saputra, "Reformulasi Rancangan Undang-Undang Energi Baru Terbarukan Sebagai Tra[illegible] Menuju Energi Ramah Lingkungan Berbasiskan Green Legislation," *IPMHI Law Journal* 3, no. 1 (2023): 94–112, https://doi.org/https://doi.org/10.15294/ipmhi.v3i1.58069.

in accordance with applicable theories and laws. The approach method used is normative juridical and comparative juridical. Research on the utilization of nuclear power, the principle of environmentally sound economy, progressive legal theory, norms contained in *statutory* regulations (*statute approach*) applicable in Indonesia and EBT-related regulations applicable in other countries, as well as international conventions will be a test tool to examine the utilization of nuclear energy as new energy, the contribution of nuclear power utilization in supporting an environmentally sound economic agenda, and examine the format of legal reform of nuclear power utilization in the perspective of progressive legal theory. Data in the form of document studies derived from secondary data sources (primary, secondary, and tertiary legal materials) will be analyzed in a qualitative juridical manner to analyze theories, laws and regulations, and concepts related to this research.[11]

3. RESULT AND DISCUSSION

3.1 Risk of Nuclear Electricity Utilization in Terms of *Emission, Footprint, Ecosystem,* and *Waste* Aspects

Clean and environmentally friendly energy is generally understood as energy that does not have a negative impact on the ecosystem, which is usually obtained from new and renewable energy sources, one of which is nuclear. Nuclear energy is energy produced by the reaction of atomic nuclei in the form of fusion or fission reactions. In the case of nuclear power plants, the atomic nucleus will undergo a fission reaction and release a very large amount of nuclear energy in the form of heat. The heat is used to boil water and produce steam to rotate turbines to produce electrical energy. In operation, nuclear power plants require a supply of fuel in the form of Uranium (U_{92}) and Thorium (Th_{90}). Indonesia has an estimated 59,000 tons of uranium deposits in Kalimantan and Papua has an even larger amount than Kalimantan.[12] Indonesia's Thorium reserves are also projected to be sufficient to power a nuclear power plant for 1000 years.[13]

Potential radiation from reactor accidents and unsustainable waste management become environmental law issues in the utilization of nuclear energy. Nuclear energy is considered environmentally unfriendly because it produces radiological waste. The pollutant area can be felt as far as 80 km from the reactor terrace. Therefore, Parvez's research requires that the regulation of nuclear material in the EBT Bill must be eliminated, because it does not reflect the spirit of green legislation, namely legislation that supports environmental restoration.[14]

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[11] Jonaedi Efendi and Johnny Ibrahim, *Metode Penelitian Hukum Normatif Dan Empiris*, ed. Endang Wahyudin, Cetakan Ke (Jakarta: Kencana, 2020).

[12] Hasan, *Energi Nuklir: Solusi Energi Listrik Di Indonesia*, Cet. 1 (Bandung: PT Sarana Tutorial Nurani Sejahtera, 2014).

[13] Lukas Joko D[illegible]manto, "Penantian Pembangunan Pembangkit Listrik Tenaga Nuklir Di Indonesia," *Orbith* 12, no. 2 (2016): 59–66, https://doi.org/http://dx.doi.org/10.32497/orbith.v12i2.768.

[14] Saputra, "Reformulasi Rancangan Undang-Undang Energi Baru Terbarukan Sebagai Transisi Menuju Energi Ramah Lingkungan Berbasiskan Green Legislation."

There are four indicators as test variables for environmentally friendly energy. The use of the four indicators is to assess the efficacy of an energy in reducing negative impacts on the environment, namely:

3.1.1 *Emission*

This indicator requires that each power plant with a certain energy source must produce minimal or no GHG emissions. Nuclear energy is one of the energies that produces little GHG emissions compared to other EBT sources. Data from the World Nucelar Association, for every 22 tons of uranium used can avoid emissions of 1,000,000 tons of CO emissions$_2$. Grant Chalmers conducted a comparison of GHG emissions produced by several energy sources presented in the figure below.

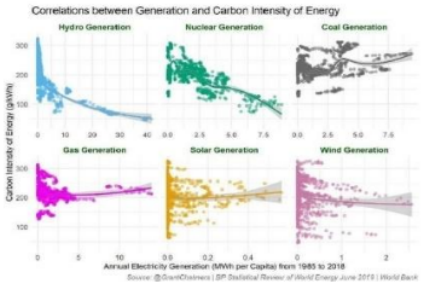

Figure 1. Comparison of GHG emissions from power plants[15]

From Figure 1, the trendline illustration shows that the utilization of nuclear and hydropower plants can reduce the volume of GHG emissions. Emissions produced by nuclear are too small compared to other energy, which is around 3 tons per 1 GWh. In contrast, the use of coal-fired power plants, gas-fired power plants, solar power plants, and wind power plants does not show significant improvements in reducing GHG emissions because each of the GHG emission contributions from these power plants is adrift, namely 820 tons, 490 tons, 5 tons, and 4 tons per 1 GWh. Although solar and wind power plants are considered as renewable energy and have the potential to generate 200 GW and 60 GW of electricity, solar and wind energy sources are intermittent energy, i.e. the limited sustainability and availability of energy sources depends on the natural conditions around the power plant area. Consequently, if solar and wind farms experience limitations in obtaining their energy sources, backup power plants are needed which tend to use fossil

[15] Riyatun, Heddy Krishyana, Ari Handono Ramelan, Agus Supriyanto, Suryanto, Suharyana, Fa[illegible]na Puspitasari, Drajat Tri Kartono, Purbayakti Kusuma Wijayanto, Irwan Trinnugroho, Sajidan, Agnafan Julian Fortin, *Kajian Akademik Nuklir Sebagai Solusi Dari Energi Ramah Lingkungan Yang Berkelanjutan Untuk Mengejar Indonesia Sejahtera Dan Rendah Karbon Pada Tahun 2050*.

power as an alternative, as is the case in Germany today. Meanwhile, nuclear power plants can operate around the clock without being affected by natural conditions..[16]

3.1.2 *Footprint*

Environmentally friendly energy sourced from EBT must also concentrate on the concept of minimalism. This concept allows PLTEBT not to use too much land, so that land use efficiency can be carried out, as well as maintaining the spatial field. The size of land use for a power plant is influenced by the capacity factor and energy density. The capacity factor (CF) in nuclear power plants has a figure of 90% because nuclear power plants can operate 24 hours and are not *intermittent energy* (*energy farming*). Nuclear energy density can also be proven with 1000 grams of ^{235}U can produce around 24 million kW of electricity, while 1000 grams of coal only produces 8 kW of electricity. Figure 2 shows the comparison of land use of nuclear power plant, solar power plant, and wind power plant in producing 1 GW of electricity.

Jenis Pembangkit	Footprint	Faktor Kapasitas (%)	Daya Terpasang (GW)
PLTN	259 - 337	90	1,3
PLTS (PV)	3.755 - 19.425	32 - 47	1,9 - 2,8
PLTBayu	67.340 - 93.240	17 - 28	3,3 - 5,4

Figure 2. Comparison of Land Use between NPP and Solar and Wind Farms[17]

Figure 2 shows that, in generating power, nuclear power plants do not require too much land coverage. When compared to solar and wind farms, in generating considerable power, both also require considerable land to install the plant. Each requires 15 and 131 times the land area of a nuclear power plant.

3.1.3 *Ecosystem*

This indicator requires that the operation of NPPs does not harm ecosystem components such as biotic (living things) and abiotic (non-living things) components. The European Commission reports that the utilization of nuclear power plants does not necessarily eliminate the impact of risks to the ecosystem, but it is also not more dangerous than other CPPs. In the operation of wind power plants, there are ecosystem problems that are quite detrimental, namely noise pollution caused by machines in the form of infrared sound, causing shadow flicker effects, and disturbing human health conditions.[18] In figure 3 shows the negative impact of wind power on the ecosystem.

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[16] Riyatun, Heddy Krishyana, Ari Handono Ramelan, Agus Supriyanto, Suryanto, Suharyana, Fatma Puspitasari, Drajat Tri Kartono, Purbayakti Kusuma Wijayanto, Irwan Trinnugroho, Sajidan, Agnafan Julian Fortin.

[17] Riyatun, Heddy Krishyana, Ari Handono Ramelan, Agus Supriyanto, Suryanto, Suharyana, Fatma Puspitasari, Drajat Tri Kartono, Purbayakti Kusuma Wijayanto, Irwan Trinnugroho, Sajidan, Agnafan Julian Fortin.

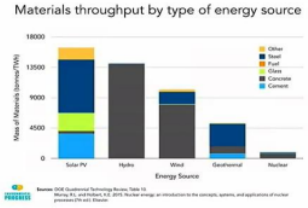
[18] Riyatun, Heddy Krishyana, Ari Handono Ramelan, Agus Supriyanto, Suryanto, Suharyana, Fatma Puspitasari, Drajat Tri Kartono, Purbayakti Kusuma Wijayanto, Irwan Trinnugroho, Sajidan, Agnafan Julian Fortin.

Figure 3. Negative impacts of wind farms on ecosystems[19]

Figure 3 shows that there are six negative impacts of wind farm operations, namely (1) noise and visuals, (2) bird deaths, (3) land erosion and deforestation, (4) lightning from towers, (5) electromagnetic radiation, and (6) human health and psychology. In addition, geothermal power plants can also threaten ecosystems. In a case study of the Mount Amiata geothermal area in Tuscany, there was a link between increased exposure to H_2S and human health. The most consistent findings were found in respiratory diseases.[20]

3.1.4 *Waste*

Waste is a waste product that at a certain time is not wanted and has no economic value in the form of liquid, solid, and gas. Waste contamination of the environment can be prevented by considering the waste management aspects of waste volume, containment, and management. In solar power plants, the manufacturing process of *PV* cells involves the use of hazardous chemicals, including refined recycled materials, sulfuric acid, and phosphine gas. Not only that, the presence of toxic metals such as chromium and cadmium in solar panels also poses a serious risk to human health as well as potentially causing problems in drinking water supply.[21] Figure 4 shows a comparison of the amount of waste generated by the utilization of nuclear power plants and other wind power plants.



[19] Muhammad Shahzad Nazir et al., "Potential Environmental Impacts of Wind Energy Development: A Global Perspective," *Current Opinion in Environmental Science & Health* 13 (2020): 85–90, https://doi.org/10.1016/j.coesh.2020.01.002.

[20] Daniela Nuvolone et al., "Health Effects Associated with Chronic Exposure to Low-Level Hydrogen Sulfide from Geothermoelectric Power Plants. A Residential Cohort Study in the Geothermal Area of Mt. Amiata in Tuscany," *Science of the Total Environment* 659 (2019): 973–82, https://doi.org/10.1016/j.scitotenv.2018.12.363.

[21] Lujia Wang, "The Negative Impacts of Solar Power" (The University of Arizona, 2023), http://hdl.handle.net/10150/632227.

Figure 4. Comparison of the Amount of Waste Generated by the Utilization of NPPs and Other Biogas Plants[22]

Figure 4 illustrates that in 2015, solar power plants generated the largest amount of waste among other renewable energy plants, even exceeding the amount of waste generated by nuclear power plants. This is because about 90% of NPP waste can be recycled into NPP fuel, improving fuel use efficiency and supporting the preservation of nuclear energy sources.[23] Nuclear waste management from NPPs is subject to a mechanism that is strictly regulated and supervised internationally by the IAEA through the Safety Standards Disposal Of Radioactive Waste.

Radioactive waste management is a weakness of the utilization of nuclear power plants. Although the amount of nuclear waste is relatively small, its radioactive nature poses a potential negative risk to the environment if its management does not take into account strict technical aspects. The main problem lies in the availability of final storage for nuclear waste that can no longer be utilized. Ideally, such storage should be underground through the *Deep Geologic Repositories* (DGR) technique, but the construction and selection of suitable sites is an obstacle. Finland became This is an example of a successful user of this technique compared to other countries, including the US, which does not yet have permanent storage for its nuclear waste. Therefore, if Indonesia plans to use nuclear power plants, the readiness of the system from upstream to downstream must be considered, avoiding following the footsteps of countries that face potential risks. In determining the location of DGR in Indonesia, the government may consider utilizing uninhabited areas among the scattered islands in the Indonesian territory. The determination should involve rigorous technical tests as well as careful planning of security and safety systems in the selected areas. The importance of community participation also needs to be considered so that the process of determining the location of DGR does not cause disputes and can avoid negative impacts on the environment and surrounding communities. Gérard Mourou, a physicist who received the 2018 Nobel Prize in Physics, has created *Chirped Pulse Amplification* (CPA) technology, which can accelerate the radioactivity degradation of nuclear waste from a million years to only 30 minutes. This technology is expected to be a solution for safer, more sustainable and efficient nuclear waste management.[24]

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[22] Björn Wealer, Ben; von Hirschhausen, Christian R.; Kemfert, Claudia; Präger, Fabian; Steigerwald, "Ten Years After Fukushima: Nuclear Energy Is Still Dangerous and Unreliable," *Deutsches Institut Für Wirtschaftsforschung (DIW)* 11, no. 7/8 (2021): 53–61, https://doi.org/https://doi.org/10.18723/diw_dwr:2021-7-1.

[23] Viktoria Mannheim Mohamed Alwaeli, 'Investigation into the Current State of Nuclear Energy and Nuclear Waste Management—A State-of-the-Art Review," *Energies* 15, no. 12 (2022): 1–22, https://doi.org/https://doi.org/10.3390/en15124275.

[24] Robby Berman, "Lasers Could Cut Lifespan of Nuclear Waste from 'a Million Years to 30 Minutes,' Says Nobel Laureate," BigThink, 2019, https://bigthink.com/the-present/laser-nuclear-waste/.

Cost considerations in the construction of nuclear power plants become a critical aspect that needs to be considered. The initial investment cost to build a large-capacity nuclear power plant requires significant funds, with an investment cost range of around US$7,700-US$11,000 per kW, or around US$7.7 million-US$11 billion for Generation III/III+ nuclear power plants. For example, the construction of Hinkley Point C-1 NPP in the UK requires US$8.3 billion or Rp128 trillion to produce 1.6 GW of power over a 60-year lifetime. It is important to note that construction costs only account for 73% of the total cost, while the rest is divided into the costs of loan interest, operations, maintenance, fuel, and decommissioning.[25] Thus, although the cost of building a nuclear power plant is higher than that of solar and wind power plants to generate 1 GW of electricity, at IDR 15 trillion and IDR 9 trillion for a 25-year lifetime, the advantage of nuclear power plants in providing cheap electricity in the long run is an important consideration. This also indicates that the potential negative impact on the environment and the possible additional costs and operations of solar and wind farms are not worth the long-term advantages of nuclear power plants.[26]

3.2 Utilization of Nuclear Electricity in Support of Green Economy

The green economy emphasizes the integration of improving human welfare and social justice with the need to reduce the impact of environmental degradation risks and ecological deficits.[27] The implementation of a green economy is reflected through economic growth that is supplied by investments in reducing emissions and environmental pollution and stimulating the effective use of energy and resources and preventing damage to biodiversity and ecosystems.[28] The concept of green economy in Indonesia is found in the UUD 1945 Article 33 paragraph (4), which places the principle of environmental insight in the implementation of the national economy.[29] One form of implementing the green economy is the utilization of EBT in the power generation sector. However, the full implementation of the green economy concept in Indonesia still faces challenges, because most of Indonesia's power plants still utilize fossil energy sources that are not environmentally friendly, at least 18,615.63 MW of 43,688.48 MW are generated by coal-fired power plants.[30] Given that the price of electricity from renewable energy is too

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[25] B. Wealer et al., "Investing into Third Generation Nuclear Power Plants - Review of Recent Trends and Analysis of Future Investments Using Monte Carlo Simulation," *Renewable and Sustainable Energy Reviews* 143, no. September 2020 (2021), https://doi.org/10.1016/j.rser.2021.110836.

[26] International Renewable and Energy Agency, "Renewable Power Generation Costs In 2021," 2021.

[27] Lucretia Dogaru, "Green Economy and Green Growth — Opportunities for Sustainable Development," in *14th International Conference on Interdisciplinarity in Engineering* (Târgu Mures: MDPI, 2021), 22–24, https://doi.org/10.3390/proceedings2020063070.

[28] Dainis Lazdans Olga Lavrinenko, Svetlana Ignatjeva, Alina Ohotina, Oleg Rybalkin, "The Role of Green Economy in Sustainable Development (Case Study: The EU States)," *Entrepreneurship And Sustainability Center* 6, no. 3 (2019): 1113–26, https://doi.org/https://doi.org/10.9770/jesi.2019.6.3(4).

[29] "Undang-Undang Dasar Negara Republik Indonesia 1945" (n.d.), https://www.dpr.go.id/jdih/uu1945.

[30] PLN, "Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) PT PLN (Persero) 2021-2030.," *PT PLN* (Jakarta, 2021), https://web.pln.co.id/statics/uploads/2021/10/ruptl-2021-2030.pdf.

expensive and the Indonesian government has not fully intervened in economic factors such as subsidies, investment, incentives, financing instruments, and other factors that can affect electricity prices.[31]

The utilization of nuclear power can be the best solution as an environmentally friendly and cheap source of renewable energy. Nuclear power plant is a fairly cheap electricity provider. *Extra costs* generated by nuclear power plants are also cheap compared to solar power plants, coal-fired power plants, and gas-fired power plants, which amount to 9 cents US dollars. The initial construction of nuclear power plants requires high *costs* and investment, but in long-term use, nuclear power plant electricity is among the cheapest, with a BPP of US$ 6-7 cents per kWh.[32]

France is one of the most successful countries in utilizing nuclear energy. As much as 70.6% of France's electrification comes from the utilization of nuclear energy. France operates nuclear reactors with a total power output of 61,370 MWe.[33] In 2018, France was the third largest contributor of GHG emissions in the EU with 444,823 Gg CO_2 eq with a reduction of 18.9%, in contrast to Asian countries that do not show a downward trend in GHG emissions.[34] France is also the 36th country according to electricity price data, with a figure of 0.21 US Dollars/kWh, in contrast to other European countries such as Italy which ranks first with an electricity price of 0.56 US Dollars/kWh.[35] Since Paris announced plans to utilize nuclear as a source of electrical energy in 1974 due to the world oil turmoil at that time until 2022, French GDP tends to move in positive numbers and increase. [36] This means that the nuclear power plant infrastructure indirectly helps to have a positive impact on the French economy. This is one example of the successful application of the green economy concept, which is a harmonization between efforts to grow the national economy and ensure the quality of the environment to remain sustainable.

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[31] Yunuk Febriananingsih, "Tata Kelola Energi Terbarukan Di Sektor Ketenaglistrikan Dalam Kerangka Pembangunan Hukum Nasional," *Majalah Hukum Nasional* 49, no. 2 (2019): 29–56, https://doi.org/https://doi.org/10.33331/mhn.v49i2.31.

[32] Andri Yanto, "Sosialisasi Transisi Energi Dan Pemanfaatan Nuklir Dalam Bauran Energi Indonesia Di Politeknik Manufaktur Bangka Belitung," *Jurnal Pengabdian Hukum "Besaoh"* 02, no. 01 (2022): 20–38, https://doi.org/https://doi.org/10.33019/besaoh.v2i01.3768.

[33] Dogan Keles Florian Zimmerman State or Market: Investments in New Nuclear Power Plants in France and Their Domestic and Cross-Border Effects," *Energy Policy* 173 (2023), https://doi.org/https://doi.org/10.1016/j.enpol.2022.113403.

[34] Paulina Mielcarek-Boche'nska and Wojciech Rze´znik Greenhouse Gas Emissions from Agriculture in EU Countries — State and Perspectives," *Atmosphere* 12, no. 1396 (2021): 1–18, https://doi.org/https://doi.org/10.3390/atmos12111396.

[35] "Electricity Prices," GlobalPetrolPrices.com, 2023, https://www.globalpetrolprices.com/electricity_prices/.

[36] "France GDP Growth Rate 1961-2023," Macrotrends, 2023, https://www.macrotrends.net/countries/FRA/france/gdp-growth-rate#:~:text=France gdp growth rate for,a 0.02%25 decline from 2018.

3.3 Format of New and Renewable Energy Law Reform in the Utilization of Nuclear Electricity as New Energy in the Paradigm of Progressive Legal Theory

3.3.1 Progressive Legal Theory

The legal positivism paradigm views law as a final scheme, law based on sovereign authority, glorification of written law, strict separation between law and morals, and the exclusion of external factors, especially the role of humans in the dynamics of the legal system. The advantage of this paradigm is the assurance of legal certainty through a value called written law. This was later adopted by Indonesia through the *civil law* legal system. However, Rahardjo views that this paradigm has not been efficient in solving legal problems in Indonesia. For this reason, Rahardjo offers progressive legal theory as an alternative. The progressive legal theory proposed by Rahardjo not only responds to, but also opposes the positivist and realistic approaches. This theory emerges with the main purpose of asserting that law should not only be a formal entity or instrument, but should also exist to fulfill human interests. Within this framework, progressive law recognizes and emphasizes that the existence of law should aim to provide benefits to society and individuals, going beyond traditional conceptions that may ignore the human dimension in the legal system. Thus, Rahardjo's views reflect an aspiration to shift the legal paradigm to a more humane and progressive one.[37]

Through the formula "law is for people, not the other way around," the consequence is that the law does not only serve its own interests, but also aims to provide welfare for people.[38] Therefore, whenever there is a problem in and with the law, reviewing and improving the law is the solution, not forcing humans to conform to the absoluteness of the law.[39] Furthermore, progressive law rejects the concept of a static and final law. Instead, it emphasizes dynamics and continuous process as the essence of law (*law as a process, law in the making*). The parameters of legal perfection, according to this view, lie in its ability to accommodate the factors of justice, welfare, and concern for the people.[40]

3.3.2 Problematics of the Draft Law on New and Renewable Energy (RUU EBT)

RUU EBT still leaves problems in its material aspects, particularly in Articles 7 to 12 that regulate new energy sources from nuclear, which have actually been comprehensively regulated through Law on Nuclear. Such condition is exacerbated by the formulation of Article 58 paragraph (2) of RUU EBT, which states that the enactment of RUU EBT will

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[37] Derita Prapti Rahayu Sulaiman, "Pembangunan Hukum Indonesia Dalam Konsep Hukum Progresif," *HERMENEUTIKA : Jurnal Ilmu Hukum* 2, no. 1 (2018): 128–39, https://doi.org/10.33603/hermeneutika.v2i1.1124.

[38] Noor Rahmad and Wildan Hafis, "Hukum Progresif Dan Relevansinya Pada Penalaran Hukum Di Indonesia," *El-Ahli : Jurnal Hukum Keluarga Islam* 1, no. 2 (2021): 34–50, https://doi.org/10.56874/el-ahli.v1i2.133.

[39] M. Zulfa Aulia, "Hukum Progresif Dari Satjipto Rahardjo," *Undang: Jurnal Hukum* 1, no. 1 (2018): 159–85, https://doi.org/10.22437/ujh.1.1.159-185.

[40] Rahardjo, *Hukum Progresif: Sebuah Sintesa Hukum Indonesia*.

only revoke the enactment of Article 13 paragraph (4) of UU Ketenaganukliran. The concrete impact of the inconsistency between RUU EBT and UU Ketenaganukliran may lead to dualism of legal arrangement and dispute between authorities. For example, according to Article 7 paragraph (3) of RUU EBT, construction, operation, and decommissioning of nuclear power plant shall be carried out by special state-owned enterprise. Meanwhile, the Law on Nuclear Power in Article 13 paragraphs (1) and (3) regulates the division of authority to carry out construction, operation, and decommissioning of two different types of reactors, namely non-commercial carried out by the Implementing Agency and commercial carried out by BUMN, cooperatives, and/or Private Entities. As a result, there are conflicts of authority between institutions in carrying out the construction, operation, and decommissioning of nuclear reactors. These problems can cause stagnation of the Indonesian government's plan to build a nuclear power plant, uncertainty law, and could disrupt the flow of investment funds that Indonesia needs to build nuclear power plants.[41]

Unlike the case in other aspects of EBT energy regulation in RUU EBT, which is given more discretion in its regulation. The evidence is that the regulation is transferred to existing laws and regulations or through the formulation of Government Regulation (PP). For example, Article 6 paragraph (2) of RUU EBT authorizes Government Regulation to further regulate other types of new energy sources. Meanwhile, arrangements related to geothermal renewable energy sources in Article 6 paragraph (2) of RUU EBT authorize Government Regulation to further regulate other types of new energy sources.
27 paragraph (1) of RUU EBT states that it will be subject to the provisions of existing laws and regulations.[42]

3.3.3 Regulatory Models for Nuclear and Renewable Energy Sources in China and Norway

The People's Republic of China (PRC) and Indonesia share a common goal of reducing GHG emissions. China, through its vision, is committed to achieving its NDC target of more than 65% by 2030, compared to 2005 levels.[43] The PRC has an agenda to combat global warming with a nuclear utilization strategy and is positioning itself as a country that is intensive in the construction of nuclear power plants to meet 18% of domestic electricity needs from a total capacity of 400 GW by 2060.[44] China has an installed capacity of 136

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[41] Jaja Ahmad Jayus, "Konsep Sistem Hukum Investasi Dalam Menjamin Adanya Kepastian Hukum," *Litigasi* 16, no. 2 (2016): 2906–38, https://doi.org/10.23969/litigasi.v16i2.38.

[42] "Rancangan Undang-Undang Tentang Energi Baru Terbarukan" (2021), https://pushep.or.id/wp-content/uploads/2021/04/DRAF-RUU-EBT-25-Januari-2021.pdf.

[43] Gørild M. Heggelund, "China's Climate and Energy Policy: At a Turning Point?," *Int Environ Agreements* 21 (2021): 9–23, https://doi.org/https://doi.org/10.1007/s10784-021-09528-5.

[44] Mark Ho et al., "A Review on the Development of Nuclear Power Reactors," *Energy Procedia* 160, no. 2018 (2019): 459–66, https://doi.org/10.1016/j.egypro.2019.02.193.

GW, accounting for more than 50% of the world's total installed capacity for solar and wind power.[45] This achievement reinforces China's status as the world's fastest-growing nuclear power producer and strengthens its position as a world leader in renewable energy through its mega solar and wind projects. [46] To oversee these projects, Beijing has prepared three legal instruments, namely Electric Power Law of the People's Republic of China, Renewable Energy Law of the People's Republic of China, Nuclear Safety Law of the People's Republic of China.

With a focus on statutory analysis, the PRC applies a model of separation of substance. *Article* 5 *paragraph* (2) of the Electric Power Law of the People's Republic of China reflects the PRC's legal policy direction in utilizing renewable energy sources and clean energy to meet domestic electricity.[47] Along with that, the Renewable Energy Law of the People's Republic of China regulates the governance of renewable energy sources, including promotion, investment, education, and research, as well as the industrialization of renewable power plants from upstream to downstream.[48] Meanwhile, the Nuclear Safety Law of the People's Republic of China is directed to regulate construction techniques and safety in the utilization of nuclear as a nuclear power plant, while supporting sustainable socio-economic development. Thus, the legislations of the three regulations reflect harmony, efficiency, connectivity, and clear non-conflict.[49]

Norway's EBT regulatory model also has similarities with the PRC. Norway formulated the Climate Change Act, Energy Act, Electricity Certificate Act, Watercourse Regulation Act, Waterfall Rights Act, and The Offshore Energy Act. The Climate Change Act regulates Norway's strategic efforts in addressing climate change by setting a 40% reduction in GHG emissions by 2050. The management of renewable energy sources is focused through laws that specifically regulate the technical aspects of these renewable energy sources, as formulated in the Watercourse Regulation Act, Waterfall Rights Act, and The Offshore Energy Act. Meanwhile, in regulating the conversion, transmission, trading, and distribution of electricity in its more effective and efficient utilization, Norway

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[45] Yuanyuan Duan Jingze Yang, Zhen Yang, "Capacity Optimization and Feasibility Assessment of Solar-Wind Hybrid Renewable Energy Systems in China," *Journal of Cleaner Production* 368 (2022): 133–39, https://doi.org/https://doi.org/10.1016/j.jclepro.2022.133139.

[46] Bing Sun, Yixin Yu, and Chao Qin, "Should China Focus on the Distributed Development of Wind and Solar Photovoltaic Power Generation ? A Comparative Study," *Applied Energy* 185, no. 1 (2016): 421–39, https://doi.org/10.1016/j.apenergy.2016.11.004.

[47] "Electric Power Law of the People's Republic of China" (n.d.), http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/12/content_1383731.htm#.

[48] "Renewable Energy Law of the People's Republic of China" (n.d.), http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/13/content_1384096.htm.

[49] "Nuclear Safety Law of the People's Republic of China," n.d., https://www.oecd-nea.org/law/legislation/2017_china_nuclear_safety_law.pdf.

legislates the Energy Act. As a result, each law has its own legislative purpose and complements each other.[50]

3.3.4 Format of Renewal of RUU EBT in the Paradigm of Progressive Legal Theory

The format of renewal of RUU EBT in the perspective of progressive legal theory must be able to pay attention to responsive and participatory values. Responsive value is reflected in the legislative objective of RUU EBT, which is an integral legal ideal with the dynamics and direction of legal politics in utilizing EBT as a strategic natural resource for the greatest prosperity of the people. Urgency of emphasis on the political direction of law in RUU EBT is focused on the transition of primary energy from fossil fuels to EBT in all aspects of life. To support this plan, it is necessary to formulate a measurable energy transition program and roadmap that must be elaborated in detail by RUU EBT. Thus, arrangements regarding EBT can become more comprehensive and in-depth, ensuring that each policy produced has a measurable measure in accordance with the purpose of the respective legislation.

Fulfillment of participatory value is shown through contribution of Implementing Agency and Business Entity as well as community as *stakeholders* that need to be involved in formulating RUU EBT. The contribution of the Implementing Agency in charge of carrying out the utilization of nuclear power and the Business Entity as a partner of the Implementing Agency can be carried out through input on the direction of national strategic arrangements and policies on nuclear utilization, division of authority in the construction, operation, and decommissioning of nuclear power plants and collaborative efforts in the utilization of nuclear power plants in Indonesia. The public can contribute through input related to the evaluation of government policies in encouraging the consumption of electricity based on PLTEBT. The high investment and price of electricity from PLTEBT make this policy irrelevant and at risk of failure due to not paying attention to the unequal socio-economic conditions in the community. Therefore, RUU EBT needs to be focused on the development of CPP infrastructure that is oriented towards community-based economics. This involves regulations related to licensing, subsidies, investment, incentives, financing instruments, and other factors that can affect electricity prices. Community involvement and local wisdom values are also important in the development of NPPs to ensure safety and sustainability of the surrounding environment. The community must be considered as the main subject in the stages of the NPP development process. As a result, the legislative process of RUU EBT can become a legal

[50] Saputra, "Reformulasi Rancangan Undang-Undang Energi Baru Terbarukan Sebagai Transisi Menuju Energi Ramah Lingkungan Berbasiskan Green Legislation."

policy that is in accordance with the actual needs of the community and significantly improves economic welfare.[51]

Alternatively, the regulatory model for the utilization of electrical energy from EBT sources in the PRC and Norway can be used as a concrete example of the implementation of progressive legal theory in the formation of laws and regulations. The model of separation of UU material can be adopted in Indonesia by placing RUU EBT as a *lex generalis* or commonly referred to as an umbrella law, while legislation regarding EBT energy sources can be formed as a *lex specialis*.[52] Then, pre-existing regulations will still apply if they are relevant to the context of EBT. Thus, the continuity and interrelationship between legislations on EBT can form a set of rules to oversee the development of EBT ecosystems, especially in the utilization of nuclear power plants that are oriented towards welfare and human development goals.

4. CONCLUSION

The utilization of nuclear electric energy is considered the optimal solution to reduce GHG emissions. Despite facing the challenges of high initial investment costs and the expansion of sustainable waste management mechanisms, tests of *emission, footprint, ecosystem,* and *waste* variables show that nuclear energy has superior results compared to other EBT sources. In the context of building a green economy, the utilization of nuclear power plants is considered as a solution to provide cheap and environmentally friendly electricity. The success of France, which fulfills its national electricity needs through nuclear power plants, is an example of success in reducing GHG emissions and promoting a green economy. On the other hand, in an effort to criticize the legal system in Indonesia, Satjipto Rahardjo proposed progressive legal theory as an alternative to overcome the limitations of a system bound by modern legal traditions. However, the implementation of this theory, such as in RUU EBT in Indonesia, faces obstacles as it may create legal dualism. Therefore, the format of renewal of RUU EBT in the perspective of progressive legal theory must be able to pay attention to responsive and participatory values. In addition, the model of regulating electrical energy from EBT sources in the PRC and Norway can be used as an example in formulating EBT legislation in Indonesia, by placing RUU EBT as an "*umbrella act*" or "*lex generalis*" and Law on EBT sources as "*lex specialis*" to achieve continuity and interrelationship between laws and regulations on EBT in order to form a set of rules to oversee the development of EBT ecosystems, especially in the utilization of nuclear power plants oriented towards welfare and human development goals.

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[51] Ilham Dwi Rafiqi, "Pembaruan Politik Hukum Pembentukan Perundang-Undangan Di Bidang Pengelolaan Sumber Daya Alam Perspektif Hukum Progresif Politics," *Bina Hukum Lingkungan* 2, no. 1 (2021): 1–5, https://doi.org/10.24970/bhl.v5i2.163.

[52] Saputra, "Reformulasi Rancangan Undang-Undang Energi Baru Terbarukan Sebagai Transisi Menuju Energi Ramah Lingkungan Berbasiskan Green Legislation."

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