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ACCOUNTABILITY OF COAL-FIRED POWER PLANTS BASED ON THE POLLUTER PAY PRINCIPLE THROUGH CARBON TAX

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Abstract

The Polluter Pays Principle (PPP) is a fundamental basis in Indonesian environmental law, requiring polluters to be responsible for the costs of environmental restoration. Although regulated in various regulations, the implementation of PPP in Coal-Fired Power Plants (CFPPs) in Indonesia still faces many challenges, including dependence on fossil energy, lack of law enforcement, and supervision issues. This research aims to analyse the application of PPP in the context of carbon tax on CFPPs and its impact on pollution in Jakarta, as well as to formulate the obligations of CFPPs in environmental preservation. This research method uses a normative approach with a statute approach and conceptual analysis to examine legal norms related to CFPPs, renewable energy, and carbon tax. The results show that although a carbon tax has been implemented as a form of PPP, the costs collected are still far from sufficient to finance the clean energy transition and address the impacts of CFPP pollution. Regulatory strengthening is needed through the Climate Change Management Bill, improved pollution control technology, strict supervision, and increased human resource capacity to ensure CFPPs are fully responsible for their environmental impacts.

1. INTRODUCTION

Indonesia is a country with a population of 284,438,800 people.[1] With a large population, there is a need to provide access to electricity to meet the daily needs of the community. However, to meet these needs, the government uses Steam Power Plants, which produce 5 million tons of CO2 or 14% of national carbon emissions. To tackle the significant increase in greenhouse gas (GHG) emissions, the Indonesian Government has committed to increasing the GHG emission target from 29 percent (business as usual) to 41 percent (with international scheme) by 2030 based on the Enhanced Nationally Determined Contribution (ENDC).[2] Currently, the Government and stakeholders in Indonesia are striving to mitigate climate change based on Pillar II of the Golden Indonesia 2045 Vision, one of which is through energy transition to clean and renewable energy (RET). In this energy transition target, it is stated that the Government is committed to increasing the proportion of RET to 30 percent of total national energy consumption by 2050, from 7 percent currently.[3] However, how can the government's commitment align with the expenditure of money on new and renewable energy (EBT) projects, given that the cost required for the clean energy transition by 2050 could reach 25 billion US Dollars. In its implementation, there was a promised public funding of 10 billion US dollars from JETP, but only a small portion was actually allocated for the early cessation of coal-fired power plants (PLTU), one of which is the early retirement or phased out of PLTU Cirebon 1. Problems also arose from delays related to PLN's electricity purchase issues with Independent Power Plants (IPP).[4]

This retirement is also a manifestation of Presidential Regulation No. 112 of 2022.[5] The general provisions of Law No. 32 of 2009 concerning Environmental Protection and Management (Environmental Law) explain that environmental disputes can be resolved through administrative, criminal, or civil legal channels. Through court channels, compensation and restoration of the marine environment can be demanded based on Article

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[1] Galih, Bayu. 2025. "Jumlah Penduduk Indonesia 2025." *KOMPAS.Com*. Kompas.com. March 4. https://www.kompas.com/cekfakta/read/2025/03/04/100100582/jumlah-penduduk-indonesia-2025.

[2] Gabriela, Michelle, and S. Dian Andryanto. 2025. "Kemenperin Wajibkan Pelaku Industri Manufaktur Laporkan Data Emisi Ke SIINas." *Tempo*. Tempo. March 30. https://www.tempo.co/ekonomi/kemenperin-wajibkan-pelaku-industri-manufaktur-laporkan-data-emisi-ke-siinas-1225923/.

[3] Peraturan Pemerintah No. 79 Tahun 2014 tentang Kebijakan Energi Nasional (GR 79/2014) which targets the contribution of new and renewable energy to the national primary energy mix of 23% by 2025 and an increased target to 31% by 2050

[4] Institute for Essential Services Reform (IESR) https://iesr.or.id/wp-content/uploads/2024/03/Indonesia-Energy-Transition-Outlook-2023.pdf

[5] Peraturan Presiden No. 112 Tahun 2022 tentang Percepatan Pengembangan Energi Terbarukan untuk Penyediaan Tenaga Listrik (PR 112/2022) Phased cessation of coal-fired power plant operations, ban on new coal-fired power plant construction (with certain exceptions), and the obligation of the Minister of Energy and Mineral Resources to prepare an energy transition roadmap.

87 in conjunction with Article 88 of the Environmental Law. However, in Indonesia, environmental law enforcement is still relatively slow in its resolution, with administrative sanctions for perpetrators of environmental damage in the form of written warnings, government coercion, suspension of environmental permits, and revocation of environmental permits, as regulated in Article 76 of Law 32/2009. Criminalization is also regulated in Article 97 to Article 120 of the Environmental Law. Of course, many environmental problems remain unresolved. Although many laws and regulations govern the environment, their implementation is still very lacking, especially the implementation of the polluter pays principle.[6]

The Polluter Pays Principle (PPP) is a fundamental principle in Indonesian environmental law that requires polluters to be responsible for the costs of environmental restoration damaged by their activities. This principle is an important basis for encouraging the accountability of parties causing pollution, in this case, coal-fired power plants (PLTU).

PLTUs themselves are generators of carbon emissions and hazardous and toxic waste (fly ash, bottom ash, and liquid waste) and are obligated to be responsible for the pollution they cause. PLTU managers have a legal obligation to pay carbon taxes according to the amount of emissions produced, manage hazardous and toxic waste in accordance with legal provisions, carry out environmental restoration if pollution occurs, and pay compensation to affected communities.

PLTUs are also subject to carbon tax as stated in Article 13 of the Law 7/2021 on Harmonization of Tax Regulations , which mentions that the Indonesian Government will impose a carbon tax on every carbon emission produced from both production and consumption activities. Therefore, every company that uses fossil fuels and thus generates carbon emissions, and/or every consumer (community) who uses fossil fuels for all their needs and thus generates carbon emissions, will be subject to a carbon tax. This carbon tax will be due when consumers purchase goods containing carbon and/or at the end of the calendar year for producers who generate carbon emissions with a cap and tax system.[7] Cap and tax itself means that power plants that produce emissions above the Maximum Limit must buy from power plants that produce emissions below the Maximum Limit and perform offsets. In addition, if a power plant produces emissions above the Maximum Limit but

[6] Christallago, Morita, Yossi Niken Respati, and Rizky Karo-Karo. 2020. "Pelaksanaan Polluter Pays Principle Pada Perusahaan Pertambangan Dalam Pemulihan Pencemaran Laut [The Implementation of the Polluter Pays Principle for Mining Companies in Marine Pollution Recovery]." *Law Review*. Accessed April 19. https://ojs.uph.edu/index.php/LR/article/view/2492.

[7] Arifin,A, and Siagian A.W. 2023. "Quo Vadis Ketahanan Iklim: Analisis Kebijakan Pajak Karbon Sebagai Pertambahan Pendapatan Indonesia"

cannot buy and offset all excess emissions, the remaining emissions will be taxed.[8] The implementation of the carbon tax is one of Indonesia's efforts to address climate change, a global initiative. Indonesia ranks 8th as the world's largest emitter. Indonesia stated its commitment in the Paris Agreement in 2015, pledging to reduce greenhouse gas emissions by 29% unconditionally and 41% with international assistance.[9] A carbon tax is also a manifestation of the polluter pays principle, requiring parties that generate carbon emissions to pay for the negative impacts caused to the environment. This principle is in line with Article 87 paragraph (1) of Environmental Law, which obliges business owners responsible for environmental pollution to pay compensation. A carbon tax is a form of internalization of environmental costs as referred to in Principle 16 of the 1992 Rio de Janeiro Declaration.[10]

The introduction of a carbon tax in Indonesia is a progressive step in line with the spirit of progressive law by Satjipto Rahardjo in an effort to address global climate change. This tax aims to encourage companies and individuals to reduce greenhouse gas emissions by providing economic incentives. But is this carbon tax sufficient to fund clean air? In 2022, coal-fired power plants (PLTU) were a major contributor to high pollution in Jakarta. IESR explained that there are about 8 PLTU surrounding Jakarta, such as to the east of Jakarta (PLTU Suralaya, PLTU Lontar, PLTU Banten) and to the west (PLTU Cirebon 1 and 2, PLTU Batang, PLTU Tanjung Jati).[11]

Coal burned in Coal-Fired Power Plants (PLTU) emits a number of pollutants such as NOx and SO2, major contributors to the formation of acid rain and PM2.5 pollution. Scientific and medical communities have revealed the health hazards of fine particles (PM2.5) from these air emissions. Coal-fired power plants also emit dangerous and deadly chemicals such as mercury and arsenic, as well as waste in the form of fly ash and bottom ash, which can contain heavy metals and hazardous chemicals.[12] The burning of coal in coal-fired power plants also generates GHG emissions from several pollutants such as NOx

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[8] J. Shadiq, I. Rosyadi and Y. P. Adianto, "Could Economic Dispatch and Unit Commitment with Emission Constraints Reduce Power System Costs? A Case Study on Java-Madura-Bali Power System," *2023 4th International Conference on High Voltage Engineering and Power Systems (ICHVEPS)*, Denpasar Bali, Indonesia, 2023, pp. 788-792, doi: 10.1109/ICHVEPS58902.2023.10257426.

[9] Undang-Undang No. 16 Tahun 2016 tentang Persetujuan Paris atas Konvensi Kerangka Kerja Perserikatan Bangsa-Bangsa mengenai Perubahan Iklim (Act of 16/2016)

[10] *Rio de Janeiro conventions include environmental instruments such as Strategic Environmental Assessments (KLHS), and regulations regarding KLHS are stipulated in Articles 15-18 of Law 32/2009.*

[11] Hasjanah, Kurniawati. 2024. "Menangani Polusi Udara Di Jakarta: Peran Intervensi PLTU Menuju Pensiun Dini." *IESR*. March 6. https://iesr.or.id/menangani-polusi-udara-di-jakarta-peran-intervensi-pltu-menuju-pensiun-dini/.

[12] Husna, Wardatul, Sudarningsih Sudarningsih, and Totok Wianto. 2025. "Identifikasi Mineral Magnetik Abu Terbang (Fly Ash) Dan Abu Dasar (Bottom Ash) Sisa Pembakaran Batubara Pltu Asam-Asam." *Jurnal Fisika Flux: Jurnal Ilmiah Fisika FMIPA Universitas Lambung Mangkurat*. Accessed April 21. https://ppjp.ulm.ac.id/journal/index.php/f/article/view/2305.

and SO2, which are major contributors to acid rain formation and PM2.5 pollution. Coal-fired power plants also emit dangerous and deadly chemicals such as mercury and arsenic.[13] This paper addresses two research questions: (1) How is the obligation of coal-fired power plants regulated concerning environmental preservation? and (2) How is the Polluter Pays Principle applied to carbon taxes on coal-fired power plants, and how is it implemented regarding pollution affecting Jakarta.

2. RESEARCH METHODOLOGY

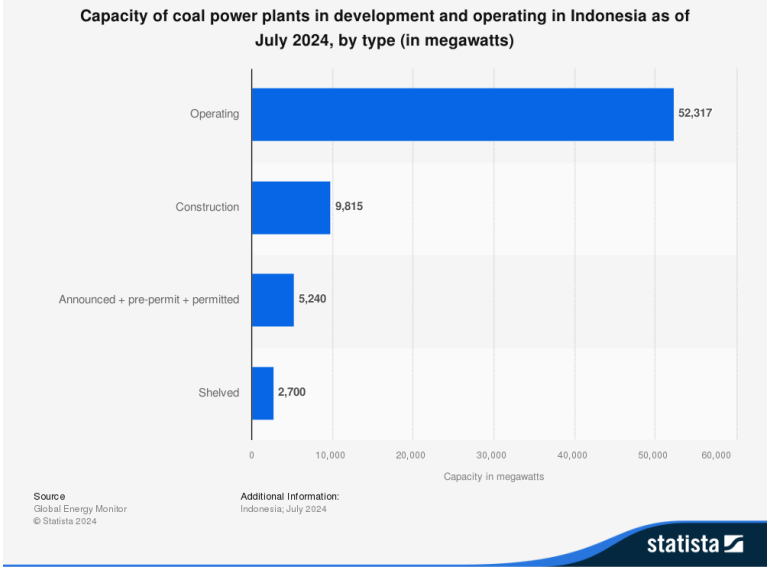
This research uses a normative approach with a statute approach and conceptual analysis to analyze the regulation of the polluter pays principle (PPP) in carbon tax. This approach examines existing norms in legal regulations related to coal-fired power plants (PLTU), renewable energy, and carbon tax, and identifies regulatory gaps that need to be addressed.

Furthermore, the study assesses the regulation of the PPP and draws comparisons with Indonesia's energy law. This comprehensive evaluation aims to understand the PPP's implications for bolstering energy and environmental law enforcement.

3. ANALYSIS AND DISCUSSION

3.1 Legal Framework and Regulatory Obligations of Coal-Fired Power Plants (PLTU)

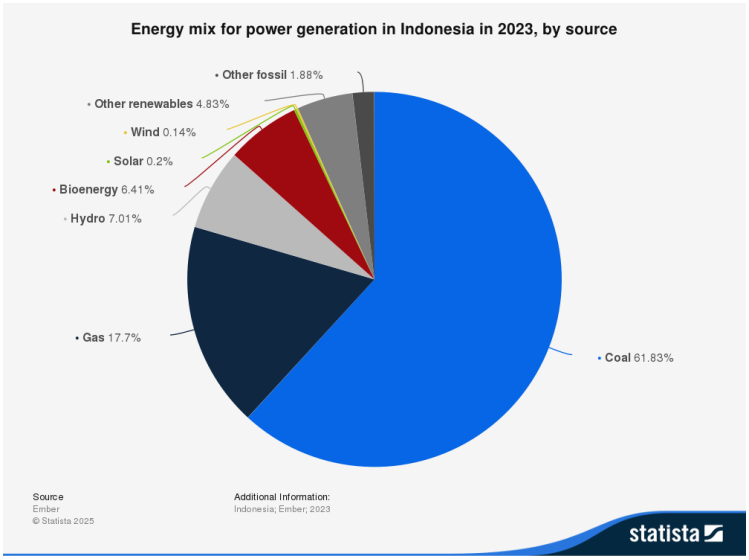
Coal-fired Power Plant (PLTU) is one of the largest sources of electricity in Indonesia, especially on the Java-Bali transmission grid, from PLTU Paiton, Suralaya, Batang, Serang, and Cirebon.[14]



[13] Greenpeace Indonesia, "Kita, Batubara, & Polusi Udara", https://www.greenpeace.org/static/planet4-indonesia-stateless/2019/02/605d05ed-605d05ed-kita- batubara-dan-polusi-udara.pdf.
[14] GoodStats. 2025. "6 PLTU Terbesar Di Indonesia: Letak Dan Kapasitasnya." *GoodStats*. Accessed April 28. https://goodstats.id/article/6-pltu-terbesar-di-indonesia-letak-dan-kapasitasnya-8XGFc.

Picture 1.1 Coal-fired power plant planning in Indonesia as of July 2024 Source: Statista

In 2024, the Government has planned the continued development of coal-fired power plants with a capacity of up to 5,240 MW. The capacity of coal-fired power plants is 52,317 MW, with 9,815 MW under construction, concentrated outside Java-Bali.



Picture 1.2 Electric Energy Mix in Indonesia per 2023 by source. Source: Statista

In 2021, coal-fired power plants (PLTUs) generated 325,035 metric tons of carbon dioxide. Given this substantial amount, the Ministry of Environment and Forestry (KLHK) holds primary authority in overseeing the implementation of the Polluter Pays Principle (PPP) in Indonesia, particularly concerning air pollution from PLTUs. This oversight involves emission monitoring, conducted both routinely and based on PLTU reports. The monitoring process includes:

1. Routine and in-depth air emission monitoring using technologies like the Continuous Emission Monitoring System (CEMS).
2. Issuance of environmental permits that obligate PLTUs to prepare an Environmental Impact Analysis (AMDAL) and comply with applicable emission standards.
3. Direct inspections and audits by KLHK or related institutions to ensure regulatory compliance.

Furthermore, oversight is also carried out by the Regional Environmental Agencies (BLHD) at the provincial and municipal levels. BLHDs are tasked with monitoring and assessing environmental quality in their respective regions, including air pollution originating from PLTUs. This is regulated by Law No. 23 of 2014 concerning Regional Government, which grants regional governments the authority to manage and protect the

environment in their territories, including supervising activities that can cause air pollution. Additionally, Minister of Environment and Forestry Regulation No. P.15/Menlhk/Setjen/Kum.1/4/2019 concerning Emission Quality Standards provides guidelines for the emission quality standards that PLTUs must meet, which are overseen by regional governments. The monitoring process involves observing air quality around PLTUs through field testing and air sampling, and inspecting emission reports submitted by PLTUs to ensure that generated emissions do not exceed specified thresholds. PLTU-generated air pollution not only impacts human health but also extensively damages the environment. Sulfur dioxide (SO2) gas released into the air can react with water vapor in the atmosphere, forming acid rain. This acid rain can harm soil, plants, and water bodies, as well as reduce soil fertility. Acid rain can also contaminate water sources, which is dangerous for aquatic ecosystems and threatens the lives of organisms dependent on freshwater. Furthermore, greenhouse gas emissions such as carbon dioxide (CO2) produced by PLTU also contribute to global climate change. CO2 released into the atmosphere causes the greenhouse effect, which contributes to global warming. Global warming can lead to an increase in the Earth's average temperature, melting polar ice, and extreme weather pattern changes, such as prolonged droughts and floods.

One of the impacts felt is Jakarta's pollution. A study by the Centre for Research on Energy and Clean Air (CREA) shows that PLTUs around Jakarta also significantly contribute to the poor air quality of the capital, even though they are not included in the emission calculations within city limits. Geographical position and wind direction also play a role in the spread of pollutants from PLTUs around Jakarta, while various power plants such as PLTGU Muara Karang and PLTU Suralaya claim to have met the emission standards set by the government.[15] Although, through the Ministry of Environment and Forestry (KLHK), it tends to emphasize that motorized vehicles are the main contributor to air pollution, with a contribution of 44% from fuel use and 96.36% of carbon monoxide emissions.[16]

Within Law No.40 concerning Limited Liability Companies (UU PT), the obligation of Corporate Social and Environmental Responsibility (TJSL) is mandated. This responsibility is defined as the company's commitment to participate in sustainable economic development to improve the quality of life and the environment, benefiting the

[15] CNN Indonesia"Kajian Pakar: Emisi PLTU Ikut Sumbang Polusi Ke Jakarta." 2023. *Nasional*. August 15. https://www.cnnindonesia.com/nasional/20230815131551-20-986291/kajian-pakar-emisi-pltu-ikut-sumbang-polusi-ke-jakarta

[16] CNBC Indonesia. 2025. "Terungkap! Ini Fakta Penyumbang Terbesar Polusi Udara Jakarta." *CNBC Indonesia*. Accessed April 28. https://www.cnbcindonesia.com/news/20230822092516-4-464937/terungkap-ini-fakta-penyumbang-terbesar-polusi-udara-jakarta.

company itself, the local community, and society at large.[17] Furthermore, it is regulated in Government Regulation Number 47 of 2012 concerning Corporate Social and Environmental Responsibility (PP 47/2012), specifically in Article 2, that every company as a legal subject has social and environmental responsibility.[18]

The Polluter Pays Principle is regulated under Article 87 paragraph (1) of the Environmental Protection and Management Law (UU PPLH), which stipulates that every business responsible for environmental pollution must pay compensation and/or undertake specific actions. This article obliges the party causing pollution to be accountable for their actions. In practice, strict liability can be imposed, meaning business actors whose activities cause significant environmental impact can be held absolutely liable without needing proof of fault.

This is relevant to air pollution in Jakarta, which is caused by coal-fired power plants (PLTU) such as PLTU Muara Karang, PLTU Suralaya, and other PLTUs.[19] Coal-fired power plants release millions of tons of pollution every year. These power plants pollute the air with toxic pollutants, including mercury, lead, arsenic, cadmium, and fine but toxic particulates, which penetrate people's lungs. Air pollution is also a silent killer, causing 3 million premature deaths worldwide, leading to an increased risk of lung cancer, stroke, heart disease, and respiratory diseases.[20]

In addition, the Environmental Protection and Management Law (UU PPLH) also stipulates three approaches to accountability, namely as follows:

1) Criminal

   Based on Article 118 of the UU PPLH, individuals who order or lead criminal acts of pollution may face aggravated imprisonment and fines, increased by one-third. Article 119 of the UU PPLH regulates that criminal sanctions can be imposed on business entities represented by authorized management, whether corporations recognized as legal subjects of criminal law (Article 1 point 32). Further regulation of criminal acts is stipulated through Articles 98-115 of the UU PPLH. Environmental criminal acts are formulated as material criminal acts that require

[17] Pasal 1 butir (3) Undang-Undang Nomor 40 Tentang Perseroan Terbatas
[18] Sanarta,K (N.d.). Kewajiban CSR Perusahaan dalam Peraturan Perundang-Undangan Retrieved from https://rcs.hukumonline.com/insights/kewajiban-csr-perusahaan
[19] Purwaramdhona, Ananda Bintang, and Dwi Arjanto. 2023. "Polusi Udara Jakarta: Deretan PLTU Di Sekitar DKI Jakarta Yang Beradius 100 Kilometer." *Tempo*. Tempo. August 29. https://www.tempo.co/lingkungan/polusi-udara-jakarta-deretan-pltu-di-sekitar-dki-jakarta-yang-beradius-100-kilometer-150428.
[20] Prasetyo, Aji. 2025. "Dampak Dan Akibat Hukum Bagi Pelaku Pencemaran Udara." *Hukumonline.Com*. Accessed April 28. https://www.hukumonline.com/stories/article/lt6249375ba021d/dampak-dan-akibat-hukum-bagi-pelaku-pencemaran-udara.

proof of consequences in the form of environmental pollution or damage.

2) Civil

   This includes the obligation to pay compensation to the injured party and the obligation to take specific actions, such as installing or repairing waste treatment units, restoring environmental functions, and eliminating the causes of pollution. Compensation may also take the form of financial remuneration, restoring the situation to its original state prior to the damage, or demanding compliance with and enforcement of regulations.

3) Administrative

   Administrative enforcement involves ensuring the level of compliance through monitoring the adherence to requirements in statutory regulations. In this regard, the Provincial Government of DKI Jakarta is authorized to coordinate and implement environmental pollution control, including air pollution. The DKI Jakarta Provincial Government can also establish a task force for air pollution control to address sources of pollution, including coal-fired power plants (PLTU).

If a PLTU violates emission limits or fails to comply with environmental obligations, the government can impose administrative sanctions in the form of fines or even temporary closure of the PLTU's operations. These sanctions are applied to encourage compliance with environmental regulations. Law No. 32 of 2009 concerning Environmental Protection and Management, Articles 98-101, regulates administrative sanctions that can be imposed on business actors, including PLTU, who violate environmental management provisions. Government Regulation No. 27 of 2012 concerning Environmental Permits provides a legal basis for imposing sanctions on activities that do not comply with the provisions of the granted environmental permits. The law enforcement process includes written warnings or fines for PLTU that do not comply with emission quality standards, and temporary closure or cessation of PLTU operations if the pollution caused endangers public health or the environment.

Based on Permen ESDM No. 16 of 2022, the polluter pay principle is implemented through:

1) The establishment of the Upper Limit of Greenhouse Gas Emissions Technical Approval (PTBAE-PU) for each power plant unit, as regulated in Article 10 of Permen ESDM 16/2022.
2) The obligation of coal-fired power plant (PLTU) business actors to conduct Carbon Trading after obtaining PTBAE-PU, in accordance with Article 10 paragraph (5) of

Permen ESDM 16/2022.

3) The gradual reduction of PTBAE-PU allocation after 2023, based on Article 12 of Permen ESDM 16/2022.

Furthermore, Presidential Regulation 112/2022 stipulates:

1) The gradual cessation of PLTU operations.
2) The prohibition of new PLTU construction with certain exceptions.
3) The obligation to prepare an energy transition roadmap that addresses the reduction of PLTU GHG emissions.

From an Economic Aspect, the Polluter Pay Principle entails:

1) Internalization of Environmental Costs: PLTU business actors exceeding emission limits must purchase carbon units from parties with a surplus. This system compels PLTUs to internalize the costs of the pollution they generate.
2) Incentives for Emission Reduction: PLTUs with carbon trading transactions resulting in less than 85% will receive a PTBAE-PU allocation of 85% in the following year (Article 12 paragraph 2). A surplus PTBAE-PU can be traded in the following year, with a validity period of no more than 2 years (Article 13 paragraphs 3-4).
3) Environmental Attributes or Carbon Economic Value: Regulated in Article 17 of Permen ESDM No. 5 of 2025, which acknowledges the economic value of emission reductions.

In its implementation, several issues and challenges arise, such as insufficient pollution control technology. A lack of effective law enforcement and oversight presents another significant challenge, as many coal-fired power plants (PLTUs) violate emission standards without facing adequate sanctions. This situation is exacerbated by inadequate supervision from relevant institutions and corrupt practices within the permitting process. Furthermore, limited human resources (HR) and governmental oversight capacity worsen these conditions, as supervisory officers often lack the necessary expertise or capacity to effectively monitor emissions and environmental impacts generated by PLTUs.

Remediation can be carried out based on Article 53 paragraph (2) of the Environmental Protection and Management Law, which includes providing warning information to the public regarding environmental pollution and/or damage, isolating pollution and/or environmental damage, halting sources of pollution and/or environmental damage, and other

methods consistent with the advancement of science and technology.

Currently, remediation can be achieved through reforestation or greening efforts and technological approaches like Carbon Capture Utilization and Storage (CCUS). CCUS is an innovative climate mitigation technology that involves capturing CO2 emissions from sources such as fossil fuel power plants and industrial processes, then reusing or safely storing them.[21] CCUS captures CO2 emitted from industrial facilities, which can be compressed and transported by ship, truck, or pipeline to onshore or offshore storage. In addition to storage, captured emission gases can also be reprocessed to create products or services (utilization). Thus, CCUS has the ability to extract CO2 from the atmosphere, thereby offsetting emissions that are released or difficult to mitigate by other means.[22] Indonesia also initiated the development of CCUS implementation by issuing a CCUS project, reviewed by ExxonMobil and Pertamina, with a potential area, namely the Asri Basin Project in the West Java sea region.[23] As well as, the development of CCUS Vorwata with a capacity of around 25 million tons of CO2 to the Vorwata reservoir to reduce carbon emissions and provide additional production through enhanced gas recovery.[24]

3.2 Responsibility of Coal-Fired Power Plants in Environmental Restoration Based on the Polluter Pays Principle

Completion of environmental issues can involve filing environmental lawsuits through legal channels, either in court or through mediation. This serves as a form of law enforcement that grants the public the right to receive compensation or environmental restoration, as stipulated in Law No. 32 of 2009 concerning Environmental Protection and Management. Article 87 of this Law provides the public with the right to legally sue perpetrators who damage the environment. Supreme Court Regulation No. 1 of 2010 concerning Guidelines for the Resolution of Environmental Disputes (Peraturan Mahkamah Agung No. 1 Tahun 2010 tentang Pedoman Penyelesaian Sengketa Lingkungan Hidup) and the Letter of the Junior Attorney General for General Crimes Number B-60/e/ejp/01/2002 concerning Technical Judicial Guidelines for Handling Environmental Crime Cases. (dan

[21] Yan J, Zhang Z. Carbon Capture, Utilization and Storage (CCUS). Appl Energy. 2019 Feb 1;235:1289-99. Available from: https://doi.org/10.1016/j.apenergy.2018.11.019. p. 1289.
[22] IEA. Carbon Capture, Utilisation and Storage - Energy System. Available from: https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage. (accessed March 14, 2024).
[23] Pertamina. (2023, November 13). Perkuat Komitmen Menuju Net Zero Emission, PHE Tandatangani Kerja Sama Carbon Capture dengan ExxonMobil [Strengthening Commitment to Net Zero Emission, PHE Signs Carbon Capture Collaboration with ExxonMobil]. Retrieved from https://www.pertamina.com/id/news-room/news-release/perkuat-komitmen-menuju-net-zero-emission-phe-tandatangani-kerja-sama-carbon-capture-dengan-exxonmobil
[24] bp. (2021, August 30). SKK Migas approved Plan of Development for Ubadari Field and Vorwata CCUS at Tangguh LNG Project. Retrieved from https://www.bp.com/en_id/indonesia/home/news/press-releases/skk-migas-approved-plan-of-development-for-ubadari-field-and-vorwata-ccus.htmlhttps://www.kompas.id/baca/ekonomi/2023/08/01/perusahaan-bisa-monetisasi-karbon-kredit-dalam-ccsccus?open_from=Search_Result_Page

Surat Jaksa Agung Muda Tindak Pidana Umum Nomor B-60/e/ejp/01/2002 tentang Pedoman Teknis Yustisial Penanganan Perkara Tindak Pidana Lingkungan Hidup). These regulations provide guidance to courts in resolving environmental disputes involving the public and companies such as coal-fired power plants. Therefore, this principle needs to be strengthened with further regulations in the Bill on Climate Change Management (RUU Perubahan Iklim), which is currently in the National Legislation Program, in efforts for adaptation, mitigation, and funding.[25]

Carbon tax itself is a form of Pigouvian Tax, which is a tax levied on each unit of output from a polluting source in an amount proportionate to the marginal damage it causes by incorporating it into efficient output.[26] Therefore, the Carbon Tax itself is included in the Polluter Pays Principle, based on Presidential Regulation No. 98 of 2021 concerning Carbon Economic Value in the effort to control GHG emissions. The Carbon Tax itself, with a carbon price of 2.1 USD/ton, will generate additional national revenue of approximately 241 Billion Rupiah, with a distribution of 73%, 15%, 7%, 3%, 2%, and 1% from Java, Sumatra, Kalimantan, Bali-Nusa Tenggara, and Maluku-Papua, respectively, out of a total emission of 181,200,000 CO2/year.[27]

With 241 billion Rupiah reflecting the amount polluters pay for their pollution, it is also necessary to strengthen funding outside of national sources and other forms of accountability beyond CSR and ESG, which can be done in areas at the discretion of each local government. Based on IESR's calculations alone in the study *Deep Decarbonization of Indonesia's Energy System,* it is stated that the cost to transform Indonesia's energy system to achieve emission-free status by 2050 reaches USD 25 billion per year until 2030, and will increase sharply thereafter to USD 60 trillion per year. As in Jakarta and throughout Indonesia, further accountability is needed in developing a smoke-free environment while reducing the impact of coal-fired power plant smoke.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

[25] Pandu, Pradipta. 2024. "Masuk Prolegnas Prioritas, RUU Pengelolaan Perubahan Iklim Perlu Terus Dikawal." *Kompas.Id*. PT Kompas Media Nusantara. November 22. https://www.kompas.id/artikel/masuk-prolegnas-prioritas-ruu-pengelolaan-perubahan-iklim-perlu-terus-dikawal.

[26] Rosen, dalam Selvi, Notika Rahmi, dan Idar Rachmatulloh, "Urgensi Penerapan Pajak Karbon di Indonesia", Jurnal Reformasi Administrasi Vol 7 No. 1, (Maret 2020), hal. 29

[27] Kamil, Ahmad Syafiq, Lindri Setyaningrum, Ade Chandra Lesmana, Suharsono Putri Megawati, Syandi Negara, Heni Susiati, and Dwi Anggoro Yohanes. "Regional Impact Analysis of Carbon Tax Implementation on Indonesia's Coal Power Plant with Interregional Input-Output Method." *International Journal of Energy Economics and Policy* 13, no. 3 (2023): 149-57, https://www.proquest.com/scholarly-journals/regional-impact-analysis-carbon-tax/docview/2814874339/se-2

To enhance the implementation of the Polluter Pays Principle in coal-fired power plants (PLTU) in Indonesia, several crucial steps are necessary. Firstly, regulatory strengthening through the Climate Change Management Bill is needed to serve as the legal umbrella for Presidential Regulation 112/2022. Secondly, advancements in pollution control technology are vital, including the development and application of more efficient and environmentally friendly emission control technologies. This also involves the construction of more New Renewable Energy (NRE)-based power plants. The government can provide funding, incentives, or subsidies for companies transitioning to clean energy and supporting PLTU Co-firing options for the next 15 years. Co-firing methods include direct mixing of biomass with coal in the combustion chamber, separate biomass preparation from coal, or biomass gasification. Currently, Indonesia utilizes direct co-firing with biomass at the Pelabuhan Ratu PLTU. Carbon Capture Utilization and Storage (CCUS) technology also needs to be implemented.

4.2 Recommendations

Furthermore, stricter oversight and law enforcement are essential to ensure PLTU compliance with emission standards. Intensive field monitoring with Continuous Emission Monitoring Systems (CEMS) will help detect violations effectively. Enhancing the human resource capacity at the Directorate General of New Renewable Energy and Energy Conservation and relevant agencies within the Ministry of Energy and Mineral Resources is also crucial for optimizing oversight and law enforcement. Public education and awareness regarding the impact of air pollution on health and the environment also need to be improved. These measures are expected to encourage PLTU to be more responsible, contribute to environmental preservation, improve air quality, and positively impact public health and environmental sustainability.

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