



A LEGAL FRAMEWORK FOR A LOW-CARBON HEALTHCARE SECTOR IN INDONESIA

Donna Okthalia Setiabudhi

Universitas Sam Ratulangi, Manado, Indonesia

donna_setiabudi@unsrat.ac.id

Ahsan Yunus

Universitas Hasanuddin, Makassar, Indonesia

ahsanyunus@unhas.ac.id

Josepus Jullie Pinori

Universitas Sam Ratulangi, Manado, Indonesia

josepusp@unsrat.ac.id

Natalia Lana Lengkong

Universitas Sam Ratulangi, Manado, Indonesia

nl_lengkong@unsrat.ac.id

ARTICLE INFO

Keywords:

Constitution; Emission Standard; Enhanced NDC; Hospital; Net Zero.

ABSTRACT

Grounded in Article 28H of the Constitution and the Paris Agreement, Indonesia has established ambitious environmental and healthcare frameworks. However, a critical legal gap persists due to fragmented instruments that fail to constitute an integrated, binding legal architecture for regulating healthcare greenhouse gas emissions. This article addresses this void by examining the regulatory gaps hindering emission control and proposing an enforceable low-carbon legal design. Utilizing a normative juridical method, this study demonstrates that norm fragmentation rather than regulatory absence constitutes the primary impediment. Currently, energy conservation, hospital governance, medical waste, and climate policies operate disjointly, lacking mandatory measurement, reporting, verification, and reduction mechanisms. Consequently, this paper prescribes a stratified legal framework: national hospitals act as carbon accounting pilots, provincial hospitals serve as regional coordination hubs, and municipal hospitals implement minimum standards backed by fiscal and technical assistance. This tiered regulatory blueprint effectively transforms low-carbon healthcare into a measurable, enforceable, and constitutionally grounded obligation, offering profound implications for decarbonization in developing nations.

A. INTRODUCTION

The constitution of Indonesia, specifically Article 28 H, ensures that every citizen is entitled to a healthy environment and access to healthcare services.¹ This principle aligns with the global health agenda, which now emphasizes not only access but also the provision of high-quality, environmentally friendly healthcare services.² The Sustainable Development Goals (SDGs), for instance, specifically advocate for universal health coverage that includes quality essential services in target 3.8. This emphasis is essential, given a World Health Organization (WHO) report indicating that substandard care results in between 5.74 to 8.47 million fatalities annually worldwide.³

Sustainability is widely acknowledged as an essential component of great healthcare; major authorities assert that health services must address the needs of current patients while safeguarding future generations.⁴ The healthcare sector generates around 5% of worldwide CO₂ emissions.⁵ As a respond to the conflict, WHO now encourages hospitals to optimize resources, enhance energy efficiency, and responsibly manage waste to safeguard public health.⁶ As a nation vulnerable to climate change, ranking 14th on the 2021 Global Climate Risk Index, these issues are already a focus in Indonesia. Recent initiatives, including a Green Climate Fund project in partnership with the Indonesian Ministry of Health, WHO, and the United Nations Development Programme (UNDP), seek to establish climate-resilient, low-carbon health systems.⁷ These international and national movements reflect a growing societal demand for health care that is both high-quality and sustainable, considerate of our environment.

Indonesia's formal policies are exceptionally ambitious and demonstrate a profound commitment to environmental stewardship. The government has

¹ Butt Simon, and Prayekti Murharjanti, "The constitutional right to a healthy environment in Indonesia," *Journal of Environmental Law* 33, no. 1 (2021): 33.

² National Academies of Sciences, Medicine, Medicine Division, Board on Health Care Services, Board on Global Health, and Committee on Improving the Quality of Health Care Globally, "Crossing the global quality chasm: improving health care worldwide," (2018).

³ Donna Okthalia, Setiabudhi, Ahsan Yunus, Irwansyah Irwansyah, and Andi Rifky, "The Role of Land Management Paradigm Towards Certainty and Justice." *Bestuur* 11, no. 1 (2023): 43.

⁴ Mortimer Frances, Jennifer Isherwood, Alexander Wilkinson, and Emma Vaux, "Sustainability in quality improvement: redefining value," *Future healthcare journal* 5, no. 2 (2018): 88.

⁵ Countdown Lancet, "The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels," *The Lancet* 400, no. 10363 (2022): 1619.

⁶ Fadda Jazla, "Green healthcare system: Main features in supporting sustainability of healthcare system. A review," In *Green Buildings and Renewable Energy: Med Green Forum 2019-Part of World Renewable Energy Congress and Network*, Cham: Springer International Publishing, 2019, 113.

⁷ UNDP, "Indonesia Takes Bold, Transformative Step to Build a Climate-Resilient Health System," *Undp*, April 29, 2024. <https://www.undp.org/indonesia/press-releases/indonesia-takes-bold-transformative-step-build-climate-resilient-health-system>. Accessed on May 23, 2026.

made substantial progress by ratifying the Paris Agreement via Law Number 16 of 2016 on the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change (Law 16/2016), committing to a 29% reduction in greenhouse gas emissions by 2030, with the potential to reach 41% with international assistance. In its Enhanced Nationally Determined Contribution (NDC), the third iteration of the NDC, Indonesia is elevating its ambitions by augmenting its unconditional emission reduction target to 31.89% and its conditional aim to 43.20% by 2030.⁸

Various national rules endorse these pledges by promoting efficiency and pollution management. Government Regulation Number 33 of 2023 concerning Energy Conservation (PP 33/2023) requires substantial energy consumers, such as hospitals, to perform energy audits and execute conservation strategies. Law Number 18 of 2008 concerning Waste Management encourages all waste generators to reduce and manage waste safely. Subsequently, Minister of Health Regulation Number 18 of 2020 about the Management of Medical Waste in Region-Based Health Service Facilities (Permenkes 18/2020) offers region-specific directives for hospitals on the management of hazardous medical waste. Moreover, Government Regulation Number 22 of 2021 on the Administration of Environmental Protection and Management (PP 22/2021) empowers the Ministry of Environment to establish pollutant thresholds for diverse sources, including air emissions. In 2018, the Ministry of Health promulgated rules for eco-friendly hospitals, setting forth criteria for energy conservation and sanitation.

In light of these emerging challenges, the Indonesian Ministry of Health has taken positive steps by issuing tailored guidance for specific sectors. Back in 2018, they released the environmentally friendly hospital (eco-friendly hospital) guidelines, which set forth thoughtful design and operational standards aimed at saving energy and safeguarding our essential sanitation and air quality even though it lacks a mandatory assessment.⁹ Together, these international commitments and national regulations create a robust framework focused on energy efficiency, environmental health, and waste management within Indonesia's healthcare services. However, it's important to note that, despite this comprehensive legal framework, the healthcare sector has been slow to adopt these regulations.

⁸ Lomi Abraham, Meita Rumbayan, Kazuaki Iwamura, Noel Regis Estoperez, Udom Lewlomphaisarl, Erkata Yandri, Muhammad Zahoor, and Ivar Zekker, "Model design of an architectural grid-connected photovoltaic system," In *Proceedings of the Estonian Academy of Sciences*, vol. 71, no. 4, (2022): 326, Teaduste Akadeemia Kirjastus (Estonian Academy Publishers), 2022.

⁹ Sutanto, Eka Intan Kumala Putri, Bambang Pramudya, and Suyud Warno Utomo, "Atribut Penilaian Keberlanjutan Pengelolaan Lingkungan Rumah Sakit Menuju Green Hospital di Indonesia," *Jurnal Kesehatan Lingkungan Indonesia* 19, no. 1 (2020): 61.

A significant issue is the absence of specific emission standards for health facilities and its assessment protocol, and the existing air quality laws lack enforceable policies that would encourage hospitals to monitor or reduce their greenhouse gas emissions actively.¹⁰ Take, for example, that by 2022, only a number of hospitals across the country had put in rooftop solar panels, even though there are national goals for increasing solar use and a solution for energy audit analysis.¹¹ Unfortunately, there aren't many financial incentives available; hospitals often have to stretch their budgets or turn to commercial loans to fund efficiency or renewable projects. Also, there haven't been any special tax breaks or subsidies for clean energy in the healthcare sector. This lack of support has real-world effects: for instance, in 2021, only 27% of Indonesian health facilities were able to meet basic waste management standards, highlighting ongoing challenges with sanitation infrastructure and hazardous waste treatment.¹² In short, without firm emission limits for the sector and dedicated green energy incentives for hospitals, it's tough to make meaningful progress on sustainability policies, which hampers Indonesia's regulatory goals.

This research adopts a normative juridical approach to examine the relationship between constitutional environmental obligations, climate governance, and hospital regulation in Indonesia.¹³ While previous studies independently analyze healthcare efficiency or waste management, a significant regulatory gap remains regarding the integrated emission governance of health institutions. To resolve this academic neglect, this study formulates two distinct research questions: (1) What structural regulatory gaps prevent Indonesia's climate, environmental health, and hospital governance frameworks from effectively regulating greenhouse gas emissions produced by the healthcare sector? and (2) How should Indonesia construct an enforceable legal design for a low-carbon healthcare sector stratified across national, provincial, and municipal/regency hospitals?"

This discrepancy raises critical questions about whether these national policies can be truly effective nationwide. While previous studies have looked

¹⁰ Jacqueline Cottrell, Anja Rosenberg, Kai Schlegelmilch, Verena Streitferdt, Budi Haryanto, Aditya Mahalana, Ahmad Safrudin, and Maya Virdayanti, "Fiscal policies to address air pollution from road transport in cities and improve health: Insights from country experiences and lessons for Indonesia," (2019): 89.

¹¹ Husein, Mubarak and Wisnu Ananda Priyatama. "Solar cell-wind turbine hybrid generation as a solution of the energy audit analysis at hospital." In *2018 International Seminar on Research of Information Technology and Intelligent Systems (ISRITI)*, pp. 544-549. IEEE, 2018..

¹² Indah Deviyanti, "A Journey to Improve the Healthcare WASH and Waste Management Information System in Indonesia," *World Health Organization*, 2023. from <https://www.who.int/indonesia/news/detail/18-07-2023-a-journey-to-improve-the-healthcare-wash-and-waste-management-information-system-in-indonesia>. Accessed on April 24, 2026.

¹³ P. Ishwara Bhat, "Idea and Methods of Legal Research," *Idea and Methods of Legal Research*, 2020.

at aspects like hospital energy efficiency¹⁴ or medical waste management independently¹⁵, our work stands out by weaving these elements together under the key ideas of quality and environmental responsibility. We show that, without emission standards specific to health facilities or customized financial incentives, even the best-intentioned policies, like those in the Paris Agreement commitments which you can see reflected in Indonesia's NDC and eco-friendly hospital guidelines tend to remain mostly aspirational. Importantly, we not only highlight the implementation gap in detail but also put forward an innovative policy framework focused on binding emission limits and targeted green-finance strategies. This framework provides practical roadmaps for policymakers, hospital administrators, and development partners. To support this goal, our analysis will include a review of existing laws and regulations, as well as case studies showcasing green policy implementations across several hospitals. Ultimately, this research seeks to offer comprehensive policy recommendations, covering everything from emission measurement standards to incentive mechanisms and medical waste systems, all as part of Indonesia's journey toward a low-carbon and sustainable health sector within a global framework.

B. RESEARCH METHODS

This study adopt a normative juridicial approach. Normative research constitutes an intellectual endeavor aimed at identifying legal norms that serve as the foundation for justifying a particular legal phenomenon. In essence, normative juridicial research concentrates on the examination and analysis of data or materials that refer to legal norms codified within statutory regulations. This study utilizes statutory and conceptual approaches, specifically examining primary legal materials to detect norm fragmentation, including Article 28H of the 1945 Constitution, Law Number 16 of 2016, Law Number 17 of 2023 on Health, Government Regulation (PP) Number 33 of 2023 on Energy Conservation, and Minister of Health Regulation (Permenkes) Number 18 of 2020. The legal analysis follows three systemic steps to ensure replicability: (1) horizontal synchronization to detect contradictions among environmental and health sectors; (2) teleological interpretation to map constitutional health rights onto climate mandates; and (3) prescriptive legal design to construct the proposed tiered regulatory model. The data utilized in

¹⁴ Indah, Fitriani, Senot Sangadji, and S. A. Kristiawan, "Energy efficiency evaluation of hospital building office," In *Journal of Physics: Conference Series*, vol. 795, no. 1, IOP Publishing, 2017, 12067.

¹⁵ N, Fitria., E. Damanhuri, and I. R. S. Salami. "Evaluation of hospital infectious waste management (HIWM) implementation based on applicable regulations in Bandung." In *IOP Conference Series: Earth and Environmental Science*, vol. 483, no. 1, IOP Publishing, 2020, 12026.

this study are obtained from various written sources, including books, scholarly journal articles, seminar proceedings, academic manuscripts, legal dictionaries, legal encyclopedias, as well as other relevant legal materials.

C. DISCUSSION

1. Legal Gaps in Indonesia's Regulation of Greenhouse Gas Emissions from the Healthcare Sector

Indonesia's aspiration to create a low-carbon healthcare industry must be evaluated in light of the constitutional, international, and statutory frameworks that now define the interplay between health, environment, and climate governance. The Indonesian Constitution acknowledges the right to a healthy environment as an integral component of the comprehensive constitutional safeguarding of human welfare.¹⁶ Within the realm of healthcare, this constitutional assurance possesses a twofold significance. The State is mandated to guarantee access to sufficient healthcare services. On the other hand, healthcare services themselves must not be organized in a manner that undermines environmental quality and public health. This dual obligation is central to the legal problem formulated in the introduction: whether Indonesia's existing legal framework is capable of effectively regulating greenhouse gas emissions produced by the healthcare sector.¹⁷¹⁸

Indonesia has accepted the Paris Agreement at the international climate commitment level through Law Number 16 of 2016 and has submitted its Enhanced Nationally Determined Contribution. The Enhanced NDC elevates Indonesia's emission reduction objective to 31.89% unconditionally and 43.20% conditionally by 2030. However, the mitigation framework of the NDC is predominantly structured around traditional sectors, including energy, waste, industrial processes and product utilisation, agricultural, and forestry and other land use.¹⁹ Healthcare sector is not yet expressly constructed as an independent mitigation sector, even though hospitals and other health facilities are energy-intensive institutions that produce medical waste, consume large quantities of water and electricity, rely on complex supply chains, and generate

¹⁶ Butt Simon, and Prayekti Murharjanti, "The constitutional right to a healthy environment in Indonesia," *Journal of Environmental Law* 33, no. 1 (2021): 33.

¹⁷ Mirow Juliane, Julien Venne, and Angela Brand, "Green health: how to decarbonise global healthcare systems," *Sustainable Earth Reviews* 7, no. 1 (2024): 28.

¹⁸ Keil Mattis, "The greenhouse gas emissions of a German hospital-A case study of an easy-to-use approach based on financial data," *Cleaner Environmental Systems* 11 (2023): 100140.

¹⁹ Republic of Indonesia, Enhanced Nationally Determined Contribution Republic of Indonesia (2022) https://unfccc.int/sites/default/files/NDC/202209/23.09.2022_Enhanced%20NDC%20Indonesia.pdf. Accessed on May 23, 2026.

both direct and indirect emissions.²⁰²¹ This omission creates a legal blind spot: healthcare is treated mainly as a sector vulnerable to climate change, but not yet as a sector legally responsible for emission reduction.

This gap is significant because global literature increasingly demonstrates that healthcare systems are not environmentally neutral. According to Health Care Without Harm and Arup, 4.4% of the world's net greenhouse gas emissions come from the healthcare industry.²² Similarly, by monitoring the health effects and opportunities of the global response to the Paris Agreement, the Lancet Countdown has repeatedly highlighted the need of coordinating climate action with public health protection.²³ These findings are relevant to Indonesia because they challenge the traditional assumption that healthcare facilities should only be regulated as providers of medical services. From a low-carbon legal perspective, hospitals should also be treated as regulated institutions whose operational model affects environmental quality and climate obligations. This view is consistent with recent scholarship arguing that environmental sustainability should be incorporated into the quality framework of health systems because healthcare itself can generate greenhouse gases, pharmaceutical waste, and other environmental pollutants.²⁴

Indonesia has already established several regulatory instruments that may serve as entry points for low-carbon healthcare governance. The existing energy conservation framework provides a normative basis for energy data management, guidance, supervision, incentives, disincentives, and conservation measures, all of which could support emission reduction in healthcare facilities.²⁵ This regulation is important because energy efficiency is one of the most immediate pathways for reducing emissions from hospitals,

²⁰ Braithwaite Jeffrey, Carolyn L. Smith, Elle Leask, Shalini Wijekulasuriya, Kalissa Brooke-Cowden, Georgia Fisher, Romika Patel et al., "Strategies and tactics to reduce the impact of healthcare on climate change: systematic review," *Bmj* 387 (2024).

²¹ Jianheng, Zhou, and Bo Wu, "Incentive contract design for reducing carbon emissions in the supply chain under asymmetric information," *Managerial and Decision Economics* 45, no. 7 (2024): 4904.

²² Health Care Without Harm and Arup, Health Care's Climate Footprint: How the Health Sector Contributes to the Global Climate Crisis and Opportunities for Action (2019). *Global Noharm* 2019, From <https://global.noharm.org/focus/climate/health-care-climate-footprint-report>. Accessed on April 23, 2026.

²³ Lancet, Countdown. "The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels." *The Lancet* 400, no. 10363 (2022): 1619-1654.

²⁴ Padget Michael, Michael A. Peters, Matthias Brunn, Dionne Kringos, and Margaret E. Kruk, "Health systems and environmental sustainability: updating frameworks for a new era," *bmj* 385 (2024).

²⁵ UNEP Law and Environment Assistance Platform, "Government Regulation No. 33 of 2023 concerning Energy Conservation," *Leap* *Unep*, 2023, From <https://leap.unep.org/en/countries/id/national-legislation/government-regulation-no-33-2023-concerning-energy-conservation>. Accessed on April 23, 2026

especially given the energy-intensive nature of hospital operations and the growing literature on energy monitoring and technological upgrading in healthcare facilities.²⁶ However, it remains a general energy regulation. It does not impose healthcare-specific carbon obligations, hospital emission ceilings, mandatory carbon footprint assessment, or sectoral reporting duties for health facilities. Thus, a hospital may adhere to basic energy conservation standards without a legal need to quantify or mitigate its greenhouse gas emissions within a healthcare decarbonisation framework.²⁷

Table 1. Fragmentation of Indonesia's Legal Framework on Low-Carbon Healthcare

Legal Instrument	Regulatory Focus	Relevance to Low-Carbon Healthcare	Legal Gap
Article 28H of the 1945 Constitution of the Republic of Indonesia	Constitutional right to health and a good and healthy environment	Provides the constitutional foundation for integrating healthcare quality and environmental protection	Does not provide operational standards for reducing emissions from healthcare facilities
Law Number 16 of 2016 on the Ratification of the Paris Agreement	International climate commitment and national emission reduction obligation	Establishes Indonesia's obligation to contribute to global climate mitigation	Does not specifically identify the healthcare sector as a regulated mitigation sector
Enhanced Nationally Determined Contribution	National emission reduction targets and mitigation sectors	Sets Indonesia's emission reduction targets and sectoral mitigation direction	Healthcare is not expressly positioned as an independent mitigation sector despite its emission footprint
Government Regulation Number 98 of 2021 on Carbon Economic Value	Carbon pricing, carbon trading, emission offset, and climate registry	Provides a legal basis for carbon governance and emission accountability	Healthcare facilities are not yet specifically integrated into carbon trading, carbon reporting, or sectoral emission accounting
Government Regulation Number 33 of	Energy conservation, efficiency, incentives,	Can support energy efficiency in hospitals as energy-intensive facilities	Does not impose healthcare-specific emission limits, carbon audits, or

²⁶ Psillaki Maria, Nikolaos Apostolopoulos, Ilias Makris, Panagiotis Liargovas, Sotiris Apostolopoulos, Panos Dimitrakopoulos, and George Sklias, "Hospitals' energy efficiency in the perspective of saving resources and providing quality services through technological options: a systematic literature review," *Energies* 16, no. 2 (2023): 755.

²⁷ Dolcini Michele, Francesca Ferrè, Andrea Brambilla, and Stefano Capolongo, "Integrating environmental sustainability into hospitals performance management systems: a scoping review," *BMC Health Services Research* 25, no. 1 (2025): 764.

2023 on Energy Conservation	disincentives, data, guidance, and supervision		hospital decarbonization targets
Government Regulation Number 47 of 2021 on Hospital Governance	Hospital classification, obligations, accreditation, guidance, supervision, and sanctions	Provides the institutional framework for regulating hospital duties and accreditation	Carbon reduction, renewable energy use, and sustainable procurement are not yet explicit hospital obligations or accreditation indicators
Minister of Health Regulation Number 18 of 2020 on Region-Based Medical Waste Management	Medical waste management for healthcare facilities	Regulates one of the most important environmental impacts of healthcare facilities	Medical waste governance is not yet systematically connected to greenhouse gas reduction and low-carbon healthcare targets
National Action Plan on Climate Change Mitigation and Adaptation in the Health Sector 2025–2030 by the Ministry of Health	Mitigation and adaptation of climate change within the healthcare sector	Shows policy movement toward integrating climate issues into health governance	Still requires translation into binding legal duties, MRV, financing mechanisms, and enforceable standards

Table 1 demonstrates that Indonesia's legal framework on low-carbon healthcare is not entirely absent, but fragmented. Constitutional norms, international climate commitments, energy conservation rules, hospital governance, medical waste regulation, and health-sector climate planning already exist. However, these instruments do not yet form an integrated legal framework that specifically requires healthcare facilities to measure, report, and reduce greenhouse gas emissions. The central legal gap therefore lies in the absence of binding sector-specific obligations for hospitals as emission-producing institutions.²⁸

A comparable weakness also emerges in hospital governance. The existing regulatory arrangement has already addressed hospital classification,

²⁸ World Health Organization, *Measuring Greenhouse Gas Emissions in Health Systems* (Geneva: WHO, 2025), <https://www.who.int/publications/i/item/9789240118423>. Accessed on May 24, 2026. See too, World Health Organization, *Target Setting for Low Carbon Sustainable Health Systems* (Geneva: WHO, 2024), <https://www.who.int/publications/i/item/9789240094468>. Accessed on May 24, 2026.

institutional duties, accreditation, supervision, guidance, and administrative sanctions. It requires hospitals to undergo periodic accreditation at least once every three years. However, the current hospital governance framework does not explicitly incorporate carbon reduction, renewable energy transition, sustainable procurement, or medical waste decarbonization into hospital obligations or accreditation standards. This omission is increasingly problematic because contemporary hospital governance and accreditation models have begun to recognize environmental sustainability as an element of healthcare quality, organizational performance, and institutional accountability.²⁹ As a result, hospital quality in Indonesia is still largely understood through the lens of service, safety, infrastructure, and institutional compliance, rather than through an integrated model of quality healthcare and environmental sustainability.

Medical waste governance further reflects this fragmentation. The existing region-based approach provides an important regulatory basis for managing medical waste, which remains one of the most significant environmental consequences of healthcare facilities. This regulation is relevant because medical waste is a prominent environmental consequence of healthcare institutions. Nevertheless, the regulation primarily frames medical waste as a health-environmental and hazardous waste issue, not as part of a broader healthcare emission reduction strategy. The choice of waste treatment technology, the transportation of infectious waste, the segregation of medical waste, and the use of incineration or non-burn technologies all have climate implications.³⁰ Without connecting medical waste governance to carbon accounting and emission reduction, Indonesia's legal framework remains incomplete.³¹

The 2025–2030 national climate action plan for the health sector marks an important step toward integrating climate mitigation and adaptation into healthcare governance. It indicates that the health sector is beginning to be placed within Indonesia's climate agenda.³² However, as a policy instrument, the plan still requires translation into binding legal obligations. Without

²⁹ Luca Piubello, Orsini, Stefano Landi, Chiara Leardini, and Gianluca Veronesi. "Towards greener hospitals: The effect of green organisational practices on climate change mitigation performance," *Journal of Cleaner Production* 462 (2024): 142720.

³⁰ Mazzei Hernan, G., and Stefania Specchia, "Latest insights on technologies for the treatment of solid medical waste: A review," *Journal of Environmental Chemical Engineering* 11, no. 2 (2023): 109309.

³¹ Muhammad, Ismail, Xiao Zhongdong, Abdul Waheed, Shahid Mahmood, El-Sayed M. El-Sayed, Amel Ali Alhussan, Marwa M. Eid, and Doaa Sami Khafaga. "Decarbonization pathways in medical waste management through circular economy strategies to advance UN-SDGs," *Scientific Reports* 15, no. 1 (2025): 42499.

³² Republic of Indonesia, Minister of Health Decree No. HK.01.07/MENKES/777/2025 on the National Action Plan for Climate Change Mitigation and Adaptation in the Health Sector 2025–2030.

enforceable standards, mandatory reporting, financing mechanisms, and institutional accountability, the plan risks functioning as a strategic policy document rather than an operational legal framework. This is particularly important because international guidance on low-carbon and climate-resilient health systems emphasizes the need for target-setting, emission tracking, financing, monitoring, and accountability mechanisms to convert climate-health commitments into measurable institutional action.³³ This is precisely the gap identified in the introduction: Indonesia has an ambitious environmental and health-related legal framework, but its implementation in the healthcare sector remains insufficiently sector-specific and enforceable.

A limited comparison with Germany helps clarify the type of legal development Indonesia requires. However, Germany provides a useful comparative reference because recent hospital-based studies have begun to measure healthcare emissions through Scope 1, Scope 2, and Scope 3 accounting. A recent study on a German university hospital found that Scope 3 emissions constituted the largest share of hospital emissions, reaching 71%, while Scope 2 accounted for 26% and Scope 1 for 3%.^{34,35} This finding demonstrates that hospital decarbonization cannot be limited to on-site fuel consumption or electricity use. It must also address procurement, pharmaceuticals, medical devices, food systems, waste, transport, and other indirect supply-chain emissions.

The German experience therefore provides one important lesson for Indonesia: a low-carbon healthcare framework must begin with reliable emission measurement.³⁶ Without carbon accounting, the State cannot establish realistic baselines, determine sector-specific reduction targets, monitor compliance, or design appropriate incentives.³⁷ Indonesia's current framework contains climate commitments, energy conservation rules, hospital governance standards, and medical waste regulations, but these instruments have not yet been integrated into a single healthcare-specific emission

³³ Iris Martine, Blom, Fawzia N. Rasheed, Hardeep Singh, Matthew J. Eckelman, Meghnath Dhimal, Martin Hensher, Renzo R. Guinto et al., "Evaluating progress and accountability for achieving COP26 Health Programme international ambitions for sustainable, low-carbon, resilient health-care systems," *The Lancet Planetary Health* 8, no. 10 (2024): e778.

³⁴ Quitmann Claudia, Leonard Terres, Andy Maun, Rainer Sauerborn, Emma Reynolds, Till Bärnighausen, Alina Herrmann, and Bernd Franke, "Assessing greenhouse gas emissions in hospitals: the development of an open-access calculator and its application to a German case-study," *Cleaner Environmental Systems* 16 (2025): 100262.

³⁵ Muriel, Lauschke, Sebastian Ebertshäuser, and Rafael Horn, "Supporting the mainstreamed implementation of life cycle assessment: In the context of the established German building funding system," *Bauphysik* 46, no. 6 (2024): 36.

³⁶ Bücheler Gerolf, "Reform of the German Buildings Energy Act (Gebäudeenergiegesetz, GEG)," www.biogas.org, 2023.

³⁷ World Health Organization, *Measuring Greenhouse Gas Emissions in Health Systems* (Geneva: WHO, 2025).

governance model. The legal gap is therefore not the absence of environmental norms, but the absence of a binding legal architecture that treats hospitals as active mitigation actors rather than mere passive service providers. Critically, from a constitutional law perspective, this fragmentation stems from institutional pathologies, where the Ministry of Health focuses strictly on clinical compliance while the Ministry of Environment and Forestry oversees climate registries, leaving hospital carbon accounting trapped in a regulatory vacuum.³⁸

Accordingly, the first legal problem is answered as follows: Indonesia's climate, environmental health, and hospital governance frameworks remain fragmented because they do not yet impose specific obligations on healthcare facilities to measure, report, and reduce greenhouse gas emissions. This gap weakens the constitutional promise of a healthy environment and limits the ability of the healthcare sector to contribute meaningfully to Indonesia's low-carbon development pathway

2. Constructing an Enforceable Legal Framework for Low-Carbon Healthcare Across National, Provincial, and Municipal Hospitals

The second legal problem concerns how Indonesia should construct an enforceable legal framework for a low-carbon healthcare sector. Such a framework must not treat all hospitals as institutionally identical. Although Indonesian hospital law recognizes formal classifications based on hospital type and service capacity, a low-carbon healthcare framework should also distinguish hospitals according to governmental authority and institutional function: national hospitals, provincial hospitals, and municipal or regency hospitals.³⁹ This distinction does not replace the formal legal classification of hospitals. Rather, it provides a governance model for allocating carbon-related obligations based on capacity, financing, referral function, and supervisory authority.⁴⁰

This model is fundamentally based on the World Health Organization's operational framework for climate-resilient and low-carbon health systems. WHO emphasizes that health systems must both withstand climate risks and reduce their own greenhouse gas emissions.⁴¹ This dual approach is particularly relevant for Indonesia. As a climate-vulnerable archipelagic State,

³⁸ Quitmann Claudia, Leonard Terres, Andy Maun, Rainer Sauerborn, Emma Reynolds, Till Bärnighausen, Alina Herrmann, and Bernd Franke, "Assessing greenhouse gas emissions in hospitals: the development of an open-access calculator and its application to a German case-study," *Cleaner Environmental Systems* 16 (2025): 100262.

³⁹ Republic of Indonesia, Government Regulation Number 47 of 2021 on the Implementation of the Hospital Sector.

⁴⁰ Republic of Indonesia, Minister of Health Regulation Number 16 of 2024 on the Referral System for Individual Health Services.

⁴¹ World Health Organization, Operational Framework for Building Climate Resilient and Low Carbon Health Systems (Geneva: World Health Organization, 2023).

Indonesia must strengthen the resilience of healthcare facilities against climate-related disasters, disease pattern changes, heat stress, and infrastructure disruption. At the same time, healthcare facilities must reduce their own contribution to the climate crisis. Therefore, Indonesian law should no longer separate healthcare quality from environmental sustainability. Low-carbon performance should become part of the legal meaning of safe, responsible, and constitutionally compliant healthcare governance.⁴²

For national hospitals, the legal framework should establish a higher and more immediate level of obligation. National hospitals should become pilot institutions for healthcare carbon governance. They should be required to conduct annual carbon footprint assessments, beginning with Scope 1 and Scope 2 emissions and gradually expanding to major Scope 3 categories such as procurement, pharmaceuticals, food, waste, and transportation.⁴³ These hospitals should also be required to submit verified emission data to a national reporting platform, preferably integrated with Indonesia's climate registry system. Their role should not merely be compliance-based, but also developmental: national hospitals can generate emission baselines, test technical standards, and provide models for provincial and municipal hospitals.⁴⁴

Provincial hospitals should function as regional implementation hubs. Minister of Health Regulation Number 16 of 2024 on the Referral System for Individual Health Services regulates referral governance, integrated referral systems, recording and reporting, and the responsibilities of central and regional governments. This regulatory structure can be used to support a differentiated low-carbon framework. Provincial hospitals are strategically positioned between central government policy and local healthcare delivery. Therefore, their obligations should include internal emission reporting, regional coordination, technical assistance for lower-level hospitals, and integration of healthcare decarbonization into provincial climate and health action plans.⁴⁵

⁴² Padget Michael, Michael A. Peters, Matthias Brunn, Dionne Kringos, and Margaret E. Kruk. "Health systems and environmental sustainability: updating frameworks for a new era," *Bmj* 385 (2024).

⁴³ International Hospital Federation, "Getting Started: Carbon Footprinting in Hospitals," From <https://ihf-fih.org/what-we-do/geneva-sustainability-centre/sustainability-guides/getting-started-carbon-footprinting-in-hospitals/>. Accessed on May 6, 2026.

⁴⁴ Quitmann Claudia, Leonard Terres, Andy Maun, Rainer Sauerborn, Emma Reynolds, Till Bärnighausen, Alina Herrmann, and Bernd Franke. "Assessing greenhouse gas emissions in hospitals: the development of an open-access calculator and its application to a German case-study," *Cleaner Environmental Systems* 16 (2025): 100262.

⁴⁵ UNDP Indonesia, "Indonesia Takes Bold, Transformative Step to Build a Climate-Resilient Health System," *Undp*, April 29, 2024, <https://www.undp.org/indonesia/press-releases/indonesia-takes-bold-transformative-step-build-climate-resilient-health-system>. Accessed on May 6, 2026.

Municipal and regency hospitals require a different regulatory approach. Many local hospitals face fiscal, technological, and human-resource limitations. Imposing complex carbon accounting duties immediately on all local hospitals could produce formal compliance without substantive implementation. Therefore, the legal framework should begin with minimum low-carbon standards. These may include basic energy audits, electricity and water efficiency measures, medical waste segregation, non-burn waste treatment where feasible, environmental reporting, and gradual adoption of renewable energy.⁴⁶ These obligations should be supported by fiscal transfers, technical assistance from provincial governments, and targeted green financing from the central government.⁴⁷

A low-carbon healthcare legal framework should contain at least seven core instruments. First, Indonesia should establish sector-specific emission standards or staged emission reduction targets for hospitals. These standards should be differentiated according to hospital level, size, service capacity, and ownership. Second, hospitals should be required to conduct periodic carbon footprint assessments. For national and provincial hospitals, this requirement should be mandatory from the initial phase. For municipal and regency hospitals, it may be introduced gradually through simplified reporting templates.⁴⁸

Third, Indonesia should create a healthcare-specific monitoring, reporting, and verification mechanism. This mechanism is essential because climate governance depends on credible data. Without MRV, emission reduction targets remain aspirational and cannot be legally enforced.⁴⁹

⁵⁰Fourth, green hospital standards should be strengthened from voluntary guidance into binding regulatory indicators. These indicators may be integrated into hospital accreditation, licensing renewal, and administrative

⁴⁶ Health Systems Insight, *Indonesia Facility Financing Profile*. 2025. Retrieved on April 24, 2026, From https://healthsystemsinsight.org/wp-content/uploads/2025/12/finance-factsheet-Indonesia_final.pdf. Accessed on May 6, 2026.

⁴⁷ Asian Development Bank, *Sustainable and Low-Carbon Health Systems: Health Care Climate Action High-Level Principle #2*, ADB Sustainable Development Working Paper Series No. 109 (Manila: Asian Development Bank, 2025). <https://www.adb.org/sites/default/files/publication/1065291/sdwp-109-sustainable-low-carbon-health-systems.pdf>. Accessed on May 6, 2026.

⁴⁸ Environmental Protection Department, *Guide to Low Carbon Healthcare Facilities: Practical Guide on Carbon Audit and Management* (Hong Kong: Environmental Protection Department, 2021). https://cnsd.gov.hk/wp-content/uploads/2024/01/EPD_CA_Guidebook_Healthcare_Eng.pdf. Accessed on May 6, 2026.

⁴⁹ Chung Hiu Ching, Wanxin Li, and Christine Loh, "Professionalism: bridging the missing link between environmental MRV and carbon neutrality," *Data & Policy* 6 (2024): e40.

⁵⁰ Tang Renhu, Wei Guo, Machtelt Oudenes, Peng Li, Jun Wang, Jin Tang, Le Wang, and HaiJun Wang, "Key challenges for the establishment of the monitoring, reporting and verification (MRV) system in China's national carbon emissions trading market," *Climate Policy* 18, no. sup1 (2018): 106.

supervision.⁵¹ Fifth, the State should provide fiscal incentives, including renewable energy subsidies, tax incentives, concessional loans, and special allocation funds for energy efficiency and sustainable medical waste infrastructure.⁵²

Sixth, the framework should clarify the division of authority between central, provincial, and municipal governments. The central government should set national standards, provide financing architecture, and manage emission data. Provincial governments should coordinate regional implementation and provide technical supervision. Municipal and regency governments should ensure that local hospitals comply with minimum standards and receive sufficient budgetary support.⁵³ Seventh, administrative sanctions should be designed progressively. The purpose should not be punitive in the first instance, but corrective: written warnings, mandatory improvement plans, technical supervision, financing conditions, and, where necessary, restrictions connected to licensing or accreditation.⁵⁴

This differentiated model is consistent with Indonesia's constitutional structure. The right to health and the right to a healthy environment cannot be fulfilled separately. A hospital that provides medical treatment while contributing to avoidable environmental degradation creates a normative contradiction within the constitutional order. The State's obligation is therefore not limited to building hospitals and expanding access to services.⁵⁵ It must also ensure that healthcare services are delivered through environmentally responsible institutions. In this sense, low-carbon healthcare is not merely a climate policy preference; it is part of the constitutional duty to protect present and future public health.⁵⁶

The proposed framework also aligns with the article's central thesis in the abstract and introduction: Indonesia does not suffer from a total absence of environmental regulation, but from a policy-implementation and sectoral-regulation gap. Existing laws already provide fragments of the required

⁵¹ Joint Commission International, "Healthcare Sustainability," <https://www.jointcommission.org/en/certification/healthcare-sustainability>. Accessed on May 6, 2026.

⁵² David Rueda-Rojas, "Green hospitals: maximizing health and climate benefits globally," *Science of The Total Environment* 982 (2025): 179692.

⁵³ Asia Pacific Observatory on Health Systems and Policies, The Republic of Indonesia Health System Review, *Health Systems in Transition* 7, no. 1 (2017). <https://iris.who.int/items/6d65bc05-179f-4875-9a8c-60d5df4911a2>. Accessed on May 6, 2026.

⁵⁴ Braithwaite Jeffrey, Carolyn L. Smith, Elle Leask, Shalini Wijekulasuriya, Kalissa Brooke-Cowden, Georgia Fisher, Romika Patel et al., "Strategies and tactics to reduce the impact of healthcare on climate change: systematic review," *Bmj* 387 (2024).

⁵⁵ Butt Simon and Prayekti Murharjanti, "The constitutional right to a healthy environment in Indonesia," *Journal of Environmental Law* 33, no. 1 (2021): 33-56.

⁵⁶ Padget Michael, Michael A. Peters, Matthias Brunn, Dionne Kringos, and Margaret E. Kruk, "Health systems and environmental sustainability: updating frameworks for a new era," *Bmj* 385 (2024).

framework climate commitments, energy conservation, hospital governance, environmental health, and medical waste rules. What is missing is legal integration. A low-carbon healthcare law or regulation should integrate these fragments into one enforceable system that makes hospitals legally accountable for their environmental footprint.⁵⁷

Accordingly, the second legal problem is answered by proposing a differentiated and enforceable legal framework for national, provincial, and municipal or regency hospitals. National hospitals should lead carbon measurement and technical standard-setting; provincial hospitals should coordinate regional implementation; and municipal or regency hospitals should comply with minimum low-carbon standards supported by fiscal and technical assistance. Through this model, Indonesia can transform low-carbon healthcare from an aspirational policy discourse into a measurable, enforceable, and constitutionally grounded legal obligation.

D. Conclusion

This article concludes that Indonesia's effort to build a low-carbon healthcare sector remains constrained by a fragmented legal framework. Although the Constitution, the Paris Agreement, the Enhanced NDC, energy conservation rules, hospital governance regulations, and medical waste policies already provide important normative foundations, they do not yet operate as an integrated legal architecture for controlling greenhouse gas emissions from healthcare facilities. The central legal gap is therefore not the absence of regulation, but the absence of binding sector-specific obligations requiring hospitals to measure, report, verify, and reduce their carbon footprint. As a result, hospitals remain insufficiently positioned as mitigation actors, despite their energy-intensive operations, medical waste production, and reliance on carbon-heavy supply chains.

To close this gap, Indonesia must construct an enforceable legal framework for a low-carbon healthcare sector across national, provincial, and municipal or regency hospitals. National hospitals should become pilot institutions for carbon accounting and emission reporting; provincial hospitals should serve as regional coordination hubs; and municipal or regency hospitals should be supported through minimum low-carbon standards, fiscal assistance, and technical guidance. Such a framework should integrate emission standards, healthcare-specific MRV, green hospital accreditation, renewable energy incentives, and stronger medical waste governance. In this way, low-carbon healthcare would no longer remain an aspirational policy, but become a measurable, enforceable, and constitutionally grounded legal

⁵⁷ Monica Di Gregorio, and Moira Moeliono, "Climate governance and decentralization in Indonesia," (2023): 198.

obligation. This study provides a significant theoretical contribution to constitutional health law by operationalizing environmental health rights within medical infrastructure. However, a key limitation is its strictly doctrinal and normative nature, which excludes empirical assessments of local governments' fiscal readiness. Future research should pursue socio-legal inquiries into municipal compliance. Empirically, it is highly recommended that the Ministry of Health immediately integrates basic carbon accounting and MRV indicators into the mandatory national hospital accreditation instruments to ensure immediate compliance.

ACKNOWLEDGEMENT

The Principal author acknowledges the financial and institutional support provided by the Institute for Research and Community Service, Sam Ratulangi University (LPPM Universitas Sam Ratulangi), under the Research Contract Letter No. 924/UN12.27/LT/2025.

BIBLIOGRAPHY

Journals:

- Blom, Iris Martine, Fawzia N. Rasheed, Hardeep Singh, Matthew J. Eckelman, Meghnath Dhimal, Martin Hensher, Renzo R. Guinto et al. "Evaluating progress and accountability for achieving COP26 Health Programme international ambitions for sustainable, low-carbon, resilient health-care systems." *The Lancet Planetary Health* 8, no. 10 (2024): e778-e789.
- Braithwaite, Jeffrey,Carolynn L. Smith, Elle Leask, Shalini Wijekulasuriya, Kalissa Brooke-Cowden, Georgia Fisher, Romika Patel et al. "Strategies and tactics to reduce the impact of healthcare on climate change: systematic review." *bmj* 387 (2024).
- Butt, Simon, and Prayekti Murharjanti. "The constitutional right to a healthy environment in Indonesia." *Journal of Environmental Law* 33, no. 1 (2021): 33-56.
- Chung, Hiu Ching, Wanxin Li, and Christine Loh. "Professionalism: bridging the missing link between environmental MRV and carbon neutrality." *Data & Policy* 6 (2024): e40.
- Countdown, Lancet. "The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels." *The Lancet* 400, no. 10363 (2022): 1619-1654.
- Di Gregorio, Monica, and Moira Moeliono. "Climate governance and decentralization in Indonesia." (2023): 198-217.
- Dolcini, Michele, Francesca Ferrè, Andrea Brambilla, and Stefano Capolongo. "Integrating environmental sustainability into hospitals performance

- management systems: a scoping review." *BMC health services research* 25, no. 1 (2025): 764.
- Fadda, Jazla. "Green healthcare system: Main features in supporting sustainability of healthcare system. A review." In *Green Buildings and Renewable Energy: Med Green Forum 2019-Part of World Renewable Energy Congress and Network*, pp. 113-128. Cham: Springer International Publishing, 2019.
- Fitria, N., E. Damanhuri, and I. R. S. Salami. "Evaluation of hospital infectious waste management (HIWM) implementation based on applicable regulations in Bandung." In *IOP Conference Series: Earth and Environmental Science*, vol. 483, no. 1, p. 012026. IOP Publishing, 2020.
- Fitriani, Indah, Senot Sangadji, and S. A. Kristiawan. "Energy efficiency evaluation of hospital building office." In *Journal of Physics: Conference Series*, vol. 795, no. 1, p. 012067. IOP Publishing, 2017.
- Ismail, Muhammad, Xiao Zhongdong, Abdul Waheed, Shahid Mahmood, El-Sayed M. El-Sayed, Amel Ali Alhussan, Marwa M. Eid, and Doaa Sami Khafaga. "Decarbonization pathways in medical waste management through circular economy strategies to advance UN-SDGs." *Scientific Reports* 15, no. 1 (2025): 42499.
- Keil, Mattis. "The greenhouse gas emissions of a German hospital-A case study of an easy-to-use approach based on financial data." *Cleaner Environmental Systems* 11 (2023): 100140.
- Lauschke, Muriel, Sebastian Ebertshäuser, and Rafael Horn. "Supporting the mainstreamed implementation of life cycle assessment: In the context of the established German building funding system." *Bauphysik* 46, no. 6 (2024): 368-373.
- Lomi, Abraham, Meita Rumbayan, Yasuke Nakanishi, Kazuaki Iwamura, Noel Regis Estoperez, Udom Lewlomphaisarl, Erkata Yandri, Muhammad Zahoor, dan Ivar Zekker. "Model Design of an Architectural Grid-Connected Photovoltaic System." *Proceedings of the Estonian Academy of Sciences* 71, no. 4 (2022): 326–335.
- Mazzei, Hernan G., and Stefania Specchia. "Latest insights on technologies for the treatment of solid medical waste: A review." *Journal of Environmental Chemical Engineering* 11, no. 2 (2023): 109309.
- Mirow, Juliane, Julien Venne, and Angela Brand. "Green health: how to decarbonise global healthcare systems." *Sustainable Earth Reviews* 7, no. 1 (2024): 28-38.
- Mortimer, Frances, Jennifer Isherwood, Alexander Wilkinson, and Emma Vaux. "Sustainability in quality improvement: redefining value." *Future healthcare journal* 5, no. 2 (2018): 88-93.

- Mubarok, Husein, dan Wisnu Ananda Priyatama. "Solar Cell-Wind Turbine Hybrid Generation as a Solution of the Energy Audit Analysis at Hospital." *2018 International Seminar on Research of Information Technology and Intelligent Systems, ISRITI 2018*, 2018, 544–49.
- Orsini, Luca Piubello, Stefano Landi, Chiara Leardini, and Gianluca Veronesi. "Towards greener hospitals: The effect of green organisational practices on climate change mitigation performance." *Journal of Cleaner Production* 462 (2024): 142720.
- Padget, Michael, Michael A. Peters, Matthias Brunn, Dionne Kringos, and Margaret E. Kruk. "Health systems and environmental sustainability: updating frameworks for a new era." *Bmj* 385 (2024).
- Psillaki, Maria, Nikolaos Apostolopoulos, Ilias Makris, Panagiotis Liargovas, Sotiris Apostolopoulos, Panos Dimitrakopoulos, and George Sklias. "Hospitals' energy efficiency in the perspective of saving resources and providing quality services through technological options: a systematic literature review." *Energies* 16, no. 2 (2023): 755.
- Quitmann, Claudia, Leonard Terres, Andy Maun, Rainer Sauerborn, Emma Reynolds, Till Bärnighausen, Alina Herrmann, and Bernd Franke. "Assessing greenhouse gas emissions in hospitals: the development of an open-access calculator and its application to a German case-study." *Cleaner Environmental Systems* 16 (2025): 100262.
- Rojas-Rueda, David. "Green hospitals: maximizing health and climate benefits globally." *Science of The Total Environment* 982 (2025): 179692.
- Setiabudhi, Donna Okthalia, Ahsan Yunus, Irwansyah Irwansyah, and Andi Rifky. "The Role of Land Management Paradigm Towards Certainty and Justice." *Bestuur* 11, no. 1 (2023): 43-60.
- Sutanto, Sutanto, Eka Intan Kumala Putri, Bambang Pramudya, and Suyud Warno Utomo. "Atribut Penilaian Keberlanjutan Pengelolaan Lingkungan Rumah Sakit Menuju Green Hospital di Indonesia." *Jurnal Kesehatan Lingkungan Indonesia* 19, no. 1 (2020): 51-61.
- Tang, Renhu, Wei Guo, Machtelt Oudenes, Peng Li, Jun Wang, Jin Tang, Le Wang, and HaiJun Wang. "Key challenges for the establishment of the monitoring, reporting and verification (MRV) system in China's national carbon emissions trading market." *Climate Policy* 18, no. sup1 (2018): 106-121.
- Zhou, Jianheng, and Bo Wu. "Incentive contract design for reducing carbon emissions in the supply chain under asymmetric information." *Managerial and Decision Economics* 45, no. 7 (2024): 4904-4918.

Books:

Bhat, P. Ishwara. *Idea and Methods of Legal Research*. 2020.

Cottrell, Jacqueline, Anja Rosenberg, Kai Schlegelmilch, Verena Streitferdt, Budi Haryanto, Aditya Mahalana, Ahmad Safrudin, and Maya Virdayanti. "Fiscal policies to address air pollution from road transport in cities and improve health: Insights from country experiences and lessons for Indonesia." (2019).

National Academies of Sciences, Medicine, Medicine Division, Board on Health Care Services, Board on Global Health, and Committee on Improving the Quality of Health Care Globally. "Crossing the global quality chasm: improving health care worldwide." (2018).

Websites:

Asia Pacific Observatory on Health Systems and Policies, The Republic of Indonesia Health System Review, Health Systems in Transition 7, no. 1 (2017). <https://iris.who.int/items/6d65bc05-179f-4875-9a8c-60d5df4911a2>. Accessed on May 25, 2026.

Asian Development Bank, Sustainable and Low-Carbon Health Systems: Health Care Climate Action High-Level Principle #2, ADB Sustainable Development Working Paper Series No. 109 (Manila: Asian Development Bank, 2025). <https://www.adb.org/sites/default/files/publication/1065291/sdwp-109-sustainable-low-carbon-health-systems.pdf>. Accessed on May 25, 2026.

Bücheler, Gerolf. "Reform of the German Buildings Energy Act (Gebäudeenergiegesetz, GEG)." www.biogas.org, 2023. Accessed on May 25, 2026.

Deviyanti, Indah. "A Journey to Improve the Healthcare WASH and Waste Management Information System in Indonesia." World Health Organization, 2023. <https://www.who.int/indonesia/news/detail/18-07-2023-a-journey-to-improve-the-healthcare-wash-and-waste-management-information-system-in-indonesia>. Accessed on May 25, 2026.

Environmental Protection Department, Guide to Low Carbon Healthcare Facilities: Practical Guide on Carbon Audit and Management (Hong Kong: Environmental Protection Department, 2021). https://cnsd.gov.hk/wp-content/uploads/2024/01/EPD_CA_Guidebook_Healthcare_Eng.pdf. Accessed on May 25, 2026.

Health Care Without Harm and Arup, Health Care's Climate Footprint: How the Health Sector Contributes to the Global Climate Crisis and Opportunities for Action (2019). <https://global.noharm.org/focus/climate/health-care-climate-footprint-report>. Accessed on May 25, 2026.

Health Systems Insight. Indonesia Facility Financing Profile. 2025. https://healthsystemsinsight.org/wp-content/uploads/2025/12/finance-factsheet-Indonesia_final.pdf. Accessed on May 25, 2026.

Joint Commission International, "Healthcare Sustainability." <https://www.jointcommission.org/en/certification/healthcare-sustainability>. Accessed on May 25, 2026.

UNEP Law and Environment Assistance Platform, "Government Regulation No. 33 of 2023 concerning Energy Conservation". <https://leap.unep.org/en/countries/id/national-legislation/government-regulation-no-33-2023-concerning-energy-conservation>. Accessed on May 25, 2026.

World Health Organization, *Measuring Greenhouse Gas Emissions in Health Systems* (Geneva: WHO, 2025), <https://www.who.int/publications/i/item/9789240118423>. Accessed on May 25, 2026.

World Health Organization, Target Setting for Low Carbon Sustainable Health Systems (Geneva: WHO, 2024). <https://www.who.int/publications/i/item/9789240094468>. Accessed on May 25, 2026.

Regulation:

Republic of Indonesia, Enhanced Nationally Determined Contribution Republic of Indonesia (2022).

Republic of Indonesia, Government Regulation Number 47 of 2021 on the Implementation of the Hospital Sector.

Republic of Indonesia, Minister of Health Decree No. HK.01.07/MENKES/777/2025 on the National Action Plan for Climate Change Mitigation and Adaptation in the Health Sector 2025–2030.

Republic of Indonesia, Minister of Health Regulation Number 16 of 2024 on the Referral System for Individual Health Services.

UNDP, "Indonesia Takes Bold, Transformative Step to Build a Climate-Resilient Health System," Undp, 2024.04.29, 2024.