Renewable Energy Certificate as a Mitigation Strategy for Sustainable AI Data Centers Concept in Indonesia

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Abstract. AI data centers are a vital necessity that is inevitable in the era of AI development, which is growing very rapidly today, even though the aspects of technological development and environmental preservation are two sides that often cannot go hand in hand if not accompanied by a commitment to ecological conservation. The integration of Renewable Energy Certificates (RECs) into the management of AI data centers in Indonesia is a progressive idea but not easy to implement because it clashes with climate crisis issues, especially related to the use of clean drinking water that is used massively by data center operator companies everywhere, including in Indonesia, so that it has the potential to cause a clean water crisis if not balanced with the strengthening of government policies that involve the environment. A comparative study of the concept of sustainable AI data center management applied to Australia. This study recommends REC as a mandatory certification that AI data center operators must possess before being permitted to invest in AI data centers in Indonesia. The REC requirement mechanism includes the ability or commitment to provide energy sources other than clean water, which technological readiness or cooperation contract documents can prove.

1 Introduction

The competition of various countries to develop the Artificial Intelligence (AI) sector has been actively responded by the Indonesian Government, among others, marked by the steps of the Ministry of Investment and Downstreaming/BKPM which facilitated the investment of the first Quantum AI Data Center in Asia through the signing of a strategic partnership between Worldview Beyond Limited, a Silicon Valley-based technology company with Tunas Prima Industrial Estate. This data center will be built in the Tunas Prima area as a green industrial area located in Batam and Bintan, Riau Islands, along with other data centers, as part of the national technology reliability strategy. [1] This location is suspected of having implemented renewable energy-based infrastructure, such as solar panels and independent water treatment facilities, so as to minimize the potential for environmental damage around the industrial area. However, there are still data centers located in other regions sporadically, such as Equinix's JK1, with an investment of 1.2 trillion rupiah in

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Jakarta. This data center provides access to the local ecosystem for cloud services, networks, and internet exchange. Fortunately, Equinix has upheld the principle of sustainability with technologies such as Cooling Array and liquid cooling for efficient heat management, including for AI workloads, with an average energy use efficiency (PUE) of 1.41 at full load. It operates according to the global standard A1A from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).[2]

The Indonesian government has also generally simplified regulations and the OSS system and provided various fiscal incentives such as tax holidays and super tax deductions.[3] This facility can be used for research and human resource development, as well as for exemption from import duties on equipment. This demonstrates the Government's commitment to supporting data center investment, which is considered a pro-technology transfer policy. Unfortunately, the challenge in establishing AI data centers lies not in financing but in operational aspects. AI data centers are required to use backup cooling systems, room temperature and humidity control devices, air distribution lines and overheating protection to avoid the risk of permanent hardware damage, which are also equipped with early detection technology systems for fire threats, for example the VESDA system and gas-based extinguishing systems such as the FM200 and Novec 1230 systems that do not damage active devices.[4] Unfortunately, the specifications of sophisticated AI data centers, which have a much larger kWh capacity than regular data centers, also require much greater energy for their management. The energy source for the cooling and management technology supporting data centers is still primarily food-grade water, threatening a clean water crisis in areas surrounding data center installations. Management of water resources in Indonesia even must be based on constitutional provisions.[5] Therefore, mitigation efforts to prevent environmental damage implemented before an AI data center is established in an area will be more effective than efforts to mitigate environmental damage after the AI data center has been built. One preventative measure is strengthening regulations to encourage AI data center operators to be genuinely committed to maintaining environmental quality around their industrial areas by ensuring the ability to own or provide sustainable cooling and operational technology for AI data centers. This commitment can be integrated into the concept of issuing Renewable Energy Certificates (hereinafter referred to as RECs) as an investment requirement.

This research will discuss how the REC concept applies to managing sustainable data center investments in Indonesia. It will also compare it with the Australian Government's strategy for mitigating the risk of a clean water crisis in establishing AI data centers in their country. Globally, including in Indonesia and Australia, data centers have emerged as one of the most water-intensive critical infrastructures because their cooling requirements disrupt urban water systems, contributing to the climate crisis. An integrated resource planning solution is needed to ensure the efficient distribution of energy capacity related to AI data centers while ensuring sustainable water management.

2 Methods

This legal research analyzes the concept of renewable energy certificate (REC) in the management of sustainable data center investments in Indonesia by focusing on examining the idea of sustainable energy in AI data center investments that are different from non-AI data centers to be then able to produce an analysis of the concept of renewable energy certification to be integrated into the licensing procedures for AI data center investments in Indonesia in order to support sustainable investments that are able to balance between technological development and environmental protection, especially guaranteeing the availability of clean water in the AI data center area in Indonesia which is projected to be established centrally in Bintan (Sumatra). In addition to using a legislative approach and a conceptual approach, this study also uses a comparative approach with regulations related to AI data centers in Australia, considering that the phenomenon of the impact of the clean water crisis on the construction of AI data centers has spread to various countries as a global issue. The consideration of using Australia as a comparative country is because Australia is projected to become the center of AI data centers for the Southeast Asia and Australia regions. Data center regulation in Australia focuses on energy efficiency, with a new requirement for all data centers hosting federal workloads to achieve a minimum 5-star NABERS rating including WUE (Water Usage Effectiveness), in addition to having to comply with the Privacy Act 1988 and the Security of Critical Infrastructure Act (SOCI), which designates data centers as a critical infrastructure asset subject to national security requirements. Indonesia, through Government Regulation Number 28 of 2025 concerning the Implementation of Risk-Based Business Licensing, still has new challenges in being able to integrate REC requirements in supporting the concept of sustainable AI data centers in Indonesia.

3 Results and Discussion

3.1 Comparison of Tier Specification on AI Data Center

Tier is a classification system that categorizes the level of reliability and availability of a data center. There are four levels of data centers, namely Tier I, Tier II, Tier III, and Tier IV, each with different technical specifications, redundancy capacity, and tolerance to disruption. Indonesia should be proud because the status of data center management capabilities in Indonesia has reached Tier IV; however, its impact on sustainable environmental management still needs to be studied more deeply. The details of the differences in specifications from Tier I to Tier IV are as follows, if presented in table form.[5]

Table 1. Comparison of Tier Specifications

Tier	Type	Spesification
I	Basic Capacity	- No redundant components - Only one power and cooling distribution path - Suitable for small businesses with low uptime requirements - Annual downtime 28,8 hours
II	Redundant Capacity Components	- Has redundant components (generally N+1) - Single distribution path - Annual downtime 22,7 hours - Suitable for medium-sized organizations with semi-critical services
III	Concurrently Maintainable	- Fault redundant - Power outage protection of 72 hours - Has dual distribution lines for power and cooling - Maintenance can be performed without stopping operations - Suitable for financial institutions, healthcare, and technology companies with high uptime requirements

IV	Fault Tolerant	- Full redundancy (2N) on all critical systems, Capable of handling component failures without disrupting service - Failure-tolerant design as an essential part - Automatic response system in the event of component distribution failure - Power outage protection 96 hours - The most appropriate type for vast amounts of user/customer data in a single company consisting of parent-subsidiary companies.

However, not all AI data centers and non-AI data centers claiming Tier III or IV status actually have official certification from the Uptime Institute. These certifications include Tier Certification of Design Documents (TCDD), Tier Certification of Constructed Facility (TCCF), and Tier Certification of Operational Sustainability (TCOS). Verification of tier certification is essential for assessing compliance with international standards. However, this tier eligibility certification has a different context from renewable energy certification, which will be discussed further in the next sub-chapter. However, it is still a supporting unit for completeness.

3.2 Renewable Energy Concepts in AI Data Center

Indonesia's digital transformation has driven rapid growth in the need for data storage and computing power. Sustainable AI data centers offer a solution that connects technological advancements with ecological sustainability. As a vital part of Indonesia's digital ecosystem, the transition to environmentally friendly data centers promises a more sustainable future for the nation. AI data centers are designed to support big data, including the ability to store, access, and process the massive amounts of data required by AI models. They are also often integrated with the cloud to support distributed, large-scale computing.[6] While non-AI data centers handle low-density data, AI-specific data centers can significantly increase power requirements, requiring stricter security management and mitigation.[7] These data centers feature advanced computing, networking, storage architecture, and cooling capabilities efficiently.[8] These demands are a significant factor in the massive need for companies that own or manage AI data centers to provide adequate cooling facilities with power requirements of up to 150 kWh.

Australia is experiencing a similar situation, with a data center boom being built on vague water plans. Authorities in Sydney approved the construction of data centers without requiring measurable intentions to reduce water use, raising concerns that the sector's rapid growth would put residents in competition for water resources. The New South Wales state government is the region with the highest data center growth. In 2021, several AI data center applications were approved, including those from Microsoft (MSFT.O), Amazon (AMZN.O), and Blackstone's AirTrunk (BX.N). These centers will generate massive construction costs while simultaneously using gigaliters of fresh water per year.[9] The investment application at the time only outlined a plan for managing energy sources other than fresh water for cooling the AI data center, without identifying the project in measurable terms or providing further targets. Data center in Sydney could consume up to a quarter of Sydney's total clean drinkable water by 2035, according to Sydney Water's report, Sydney Desalination Plant 2025. Finally, Sydney's drinking water supply is currently limited to one desalination plant and reduce supply. Sydney itself has been hit by drought and bushfires, so even without a data center, it is vulnerable to an imbalance between supply and demand.[10] Therefore, Australia has now developed energy storage, pumped hydro, and thermal energy storage options for the 2030 projection.[11] The goal is to give Australia the opportunity to create policies that align data center expansion with more efficient energy and network management without sacrificing capabilities, which is also supported by the implementation of several documents proving its capability.

3.3 Renewable Energy Certificate (REC) as a Requirement to Mitigate the Clean Water Crisis Issues

As a responsible company, AI data center managers must strive to minimize their carbon footprint, particularly due to the use of resources to support AI implementation. REC is a supportive solution for implementing the sustainable data center concept was designed to sustainable practices. This document focuses on evidence of carbon emission reduction, resource conservation, and the integration of renewable energy sources. By adopting these measures, sustainable data centers not only improve operational efficiency but also support sustainability goals globally through the use of renewable sources, such as solar, wind, and geothermal, which enhances its sustainability reputation and meets the demands of investors focused on ESG (Environmental, Social, and Governance).

REC is an energy procurement option that states the carrier owns one megawatt-hour (MWh) of zero-carbon electricity that an energy source has generated.[7] Several specific forms of RECs include solar renewable energy certificates (SRECs) specifically for solar energy or similar energy as Guarantees of Origin (GO), and international renewable energy certificates (I-RECs). RECs differ from carbon certificates. Carbon certificates can be applied to Scope 1 or 2. In contrast, RECs are only applied to Scope 2 emission calculations because it can’t directly reduce emissions. RECs are currently applied to industries that have a direct impact on the environment, as a complement to Greenhouse Gas Emission Reduction Certificates (SPE-GRK) and Dedicated Sources (DS). For example, PT Energy Management Indonesia (Persero) (PT EMI) signed an REC purchase agreement with PT Indonesia BTR New Energy Material (BTR). RECs treated as securities similar to carbon certificates, although their emission coverage and intended use differently. A massive REC purchase agreement also implemented in Coca-Cola and PT PLN purchasing electricity agreement from renewable energy sources.

RECs play a crucial role in incentivizing renewable energy investment, reducing fossil fuels and mitigating climate change to achieve national energy conversion targets as declared at the COP26 UNFCCC Glasgow international forum. The REC certificate is proof that renewable energy usage has been allocated according to the MWH figures in the sustainable digital certification document and supports environmental sustainability goals in Indonesia. The REC certificate may only be awarded to companies that support and promote clean energy programs in Indonesia, and is a form of collaboration with the Clean Energy Investment Accelerator (CEIA) Indonesia. The certificate is internationally recognized and meets the RE-100 Best Practice Guidelines and the Carbon Disclosure Project (CDP) Standard.[12] The integration of RECs as a condition for investment in establishing an AI data center in Indonesia will not only be beneficial as a climate and clean water crisis mitigation strategy, it also provide financial stimulus for REC holders because of their function as securities on the ICDX.

In Australia, AI data center managers have been required to meet many requirements, namely the NABERS rating (National Australian Built Environment Rating System), PUE (Power Usage Effectiveness), WUE (Water Usage Effectiveness), CUE (Carbon Usage Effectiveness) and LEED (Green Globes and Energy Star), in addition to having to meet ISO 14001 on environmental management system standards for improving environmental performance, and ISO/IEC TS 22237-4:2018 on covers environmental controls in data centers.[13] This concept needs to be adopted in Indonesia for sustainable AI data center investment management. Meanwhile, RECs in Indonesia currently have only been implemented for electricity supply through Presidential Regulation Number 112 of 2022 concerning the Acceleration of Renewable Energy Development. Provisions regarding the acceleration of renewable energy development for electricity supply include hydroelectric power plants, geothermal power plants, solar power plants, wind power plants, biomass power plants, biogas power plants, tidal power plants, and biofuels. Meanwhile, the implementation of RECs as a requirement for licensing AI data center investments in Indonesia is not yet stipulated as a legal basis for data centers. Several legal bases for data centers in Indonesia include Law Number 27 of 2022 concerning Personal Data Protection, Government Regulation Number 71 of 2019 concerning the Implementation of Electronic Systems and Transactions, a breakthrough in legal regulations that requires data centers to be located domestically, and Government Regulation Number 5 of 2021 concerning the Implementation of Risk-Based Business Licensing, which regulates business licensing, including the breakthrough requirement to register as an Electronic System Provider (PSE) and meet applicable standards. The Government should revise Government Regulation Number 28 of 2025 concerning the Implementation of Risk-Based Business Licensing to include the obligation of REC ownership for prospective AI data center investors before obtaining a permit to establish an AI data center in Indonesia for PB in the electronic system and transaction administration sector, including those covering business activities according to Article 186 of Government Regulation Number 28 of 2025, specifically Article 186 paragraph 1 letter d concerning artificial intelligence-based programming activities. Moreover, the Government is currently planning to advance the development of an integrated AI data center in one area located in Bintan and Batam (Riau, Sumatra).

This progressive step by the government needs to be balanced with strict regulations to maintain the balance between technological progress and environmental preservation of Indonesia as a gemah ripah loh jinawi region. Later in the implementation of further supervision, the Government must guarantee that every business actor who, based on the results of supervision, is found to be inconsistencies or violations of the fulfillment of business permits (PB) by business actors in the sub-sector of artificial intelligence-based programming activities including the construction of AI data centers can be subject to administrative sanctions in the form of written warnings, revocation of REC and revocation of business permits (PB), so that it is necessary to add provisions to Article 534 of Government Regulation Number 28 of 2025. Integrating renewable energy into data centers may seem daunting, especially when traditional energy sources dominate. However, the transition can be gradual, with several key strategies that allow data centers to move towards sustainability without disrupting their operations. Several strategies incorporating sustainable energy assets, such as data centers, can reduce operational costs while supporting green initiatives. For example, solar panels, wind turbines, and hydropower can be used to generate electricity with large capacities.[14] Another effective strategy is to sign a long-term contract with energy suppliers to purchase renewable energy.

4 Conclusion

Integration of renewable energy into AI data center management in Indonesia could learn from the concept of AI data center mitigation in Australia, which has implemented pro-sustainability administrative obligations such as NABERS rating, PUE, WUE, CUE, and LEED. Indonesia can adopt its implementation concisely as a unified requirement for issuing REC as a mandatory certification that AI data center management operator companies must own before being allowed to invest in AI data centers in Indonesia. REC menjadi syarat dan instrumen penting untuk investasi pusat data yang berfungsi sebagai bukti penggunaan energi bersih. REC as a document proof that the AI data center operator company does not only use food-grade clean water as the only source of cooling energy but also has proven to be ready to have other pro-renewable energy options (solar panels, wind turbines, hydropower) either because of their own technological readiness or in collaboration with other parties as energy suppliers in long-term contracts as proof of mandatory documents.

References

1. K. P. Purba, I. Garniwa, Analysis of Additional Generation Planning in the Batam-Bintan Power System to Improve Reliability. IJECBE. **3** (2), (2025). doi: https://doi.org/10.62146/ijecbe.v3i2.133
2. F. Lopez, C. Diguet, Digital Conquest: Spatiality, Energy and Data Centres, (Bristol University Press. 2025). doi: https://doi.org/10.51952/9781529252187
3. A. Cahyadini, P. Amalia, F. Fahriza, Tax Strategy as an Alternative to Tax Incentives to Stimulate Investment in the Global Minimum Tax Era in Indonesia. Laws. **14** (5), 66 (2025). doi: https://doi.org/10.3390/laws14050066
4. S. S. Donohue, M. Suski, C. Chen, Fire Protection and Life Safety Design in Data Centers, (Data Center Handbook, **1** ed., H. Geng, Ed., Wiley, 2021). doi: https://doi.org/10.1002/9781119597537.ch28
5. M. A. Masnun, N. Noviyanti, I. B. Santoso, B. Wedhatami, A. Abiyoga, Water as a Fundamental Right: State Responsibilities and Regional Water Supply System Solutions, Indones. J. Adm. Law Local Gov. **1** (1), (2024). doi: https://doi.org/10.26740/ijalgov.v1i01.35854
6. Y. S. Hussein, M. Alrashd, A. S. Alabed, S. Alomar, Data Centre Infrastructure: Design and Performance, Latest Advances and New Visions of Ontology in Information Science, (M. Saberi Kamarposhti, M. Sahlabadi, Ed., IntechOpen, 2023). doi: https://doi.org/10.5772/intechopen.109998
7. S. A. Goswami, D. A. Darji, K. C. Patel, S. Dave, Establishing AI-Specific Cloud Computing Infrastructure: Advances in Computational Intelligence and Robotics, (A. K. Sharma, Nitin, S. Kumar, Ed., IGI Global, 2025). doi: https://doi.org/10.4018/979-8-3693-9694-0.ch005
8. N. Iman, The Hidden Costs of Intelligence: Artificial Intelligence and Machine Learning Adoption and the Paradox of Exponential Digital Growth. Sustainability and Climate Change. **18** (3), 225–241 (2025). doi: https://doi.org/10.1089/scc.2025.0017
9. D. R. E. Ewim, N. Ninduwezuor-Ehiobu, O. F. Orikpete, B. A. Egbokhaebho, A. A. Fawole, C. Onunka, Impact of Data Centers on Climate Change: A Review of Energy Efficient Strategies. J. Eng. Exact Sci. **9** (6), 16397–01e (2023). doi: https://doi.org/10.18540/jcecvl9iss6pp16397-01e
10. M. Herrera, X. Xie, A. Menapace, A. Zanfei, B. Brentan, Sustainable AI infrastructure: A scenario-based forecast of water footprint under uncertainty, 31 Juli 2025, Engineering. doi: https://doi.org/10.31223/X55M86
11. R. B. Hiremath, AI-Embedded Data Centres: Promoting Sustainability and Reducing Water Footprint, in 2024 First International Conference on Data, Computation and Communication (ICDCC), Sehore, India: IEEE, (2024), 40–44. doi: https://doi.org/10.1109/ICDCC62744.2024.10961316
12. D. Mytton, Data centre water consumption. npj Clean Water. **4** (1), 11 (2021). doi: https://doi.org/10.1038/s41545-021-00101-w
13. K. Deniswara, F. K. Wijaya, E. J. Handitya, Determinant of Carbon Emission Disclosure: Empirical Studies on Energy Companies in Indonesia, in Proceedings of

the 2023 14th International Conference on E-Education, E-Business, E-Management and E-Learning, Shenzhen China: ACM, (2023), 283–289. doi: https://doi.org/10.1145/3588243.3588283
14. S. Kim, B. T. H. Lim, B. L. Oo, Energy Consumption and Carbon Emissions of Mandatory Green Certified Offices in Australia: Evidence and Lessons Learnt across 2011–2020. Sustainability. **14** (21), 13773 (2022). doi: https://doi.org/10.3390/su142113773
15. J. J. Mesa-Jiménez, A. L. Tzianoumis, L. Stokes, Q. Yang, V. N. Livina, Long-term wind and solar energy generation forecasts, and optimisation of Power Purchase Agreements. Energy Reports. **9**, 292–302 (2023). doi: https://doi.org/10.1016/j.egyr.2022.11.175