GREENWISE
CONSULTING



SUSTAINABLE INFRASTRUCTURE

2025

GREENWISE WHITE PAPER VOL 12

(+62)81287879838
info@greenwise.co.id
greenwise.co.id

TABLE OF CONTENTS

Foreword	01
Introduction to Infrastructure in Indonesia and Development Trends	02
Government Policy on Infrastructure Development in Indonesia	04
Global Conditions in Mainstreaming Sustainability and ESG Aspects in the Infrastructure Sector	14
National Conditions in Mainstreaming Sustainability and ESG Aspects in the Infrastructure Sector	17
The Importance of Every Party in Understanding Sustainability and ESG Aspects in the Infrastructure Sector	23
Direction of Human Resources Development Required in Supporting Sustainability and ESG Aspects in the Infrastructure Sector	27
Direction of Technology Development Required in Supporting Sustainability and ESG Aspects in the Infrastructure Sector	30
Direction of Financing Development Required in Supporting Sustainability and ESG Aspects in the Infrastructure Sector	33
Greenwise's Position in Supporting Sustainability and ESG Aspects in the Infrastructure Sector	37
Expectations and Needs of Sustainability and ESG Aspects in the Infrastructure Sector	40
Bibliography	44



Foreword

We Greenwise Consulting are pleased to present this white paper on sustainable infrastructure development in Indonesia. At a time when environmental responsibility and social equity are increasingly critical to long-term business success, the infrastructure sector faces both a challenge and an opportunity to redefine its role in shaping a sustainable future.

Indonesia's national development plans, including the RPJMN 2025-2029 and Vision 2045, demonstrate a clear commitment to integrating sustainability into infrastructure policy. Regulatory frameworks are evolving to align with global ESG standards, while financial instruments such as green bonds and public-private partnerships are creating new avenues for responsible investment. However, the transition to sustainable infrastructure requires more than policy alignment because it demands proactive engagement from the private sector.

This white paper provides a multidimensional analysis of sustainable infrastructure, offering actionable insights for businesses navigating this transformation. Chapter 4, National Conditions for Mainstreaming Sustainability and ESG Aspects in the Infrastructure Sector, is particularly relevant, outlining Indonesia's regulatory landscape, fiscal incentives, and emerging best practices. From green construction standards to circular economy applications, the foundations for sustainable development are already in place.

The path forward requires a holistic approach. Technological innovation, workforce development, and stakeholder collaboration must converge to create infrastructure that is not only efficient but also resilient and inclusive. Greenwise Consulting's LESTARI platform, detailed in Chapter 9, exemplifies how data-driven ESG management can enhance transparency, streamline compliance, and unlock investment opportunities.

To business leaders and policymakers: Sustainable infrastructure is no longer optional, it is a strategic decision for business. The risks of inaction include regulatory non-compliance, reputational damage, and exclusion from future financing opportunities. Conversely, early adopters stand to gain competitive advantages, access to green capital, and alignment with global sustainability benchmarks.

This white paper serves as both a guide and a call to action. By embracing sustainability today, we can build infrastructure that supports economic growth while preserving Indonesia's natural resources and improving quality of life for generations to come.

Lenny Hidayat
Founder & Partner Greenwise Consulting

CHAPTER 1

INTRODUCTION TO INFRASTRUCTURE IN INDONESIA AND DEVELOPMENT TRENDS

1.1 Infrastructure development in RPJMN 2020-2024.

Indonesia has made significant strides in infrastructure development under the National Medium-Term Development Plan (RPJMN) 2020-2024. This plan, aligned with the RPJPN 2005–2025, Indonesia's Vision 2045, and the President's vision and mission, prioritizes infrastructure as a key driver of economic transformation and public welfare. With a budget of IDR 6,445 trillion, the government has focused on several critical areas to strengthen connectivity, support economic growth, and promote equitable development.

The development of basic service infrastructure, such as clean water and sanitation, has been a priority to improve public welfare. Additionally, the government has emphasized multimodal connectivity to boost economic growth, including the expansion of toll roads, ports, and airports. Projects like the Trans-Sumatra and Trans-Java Toll Roads have enhanced interregional connectivity, while the development of Mass Rapid Transit (MRT) and Light Rail Transit (LRT) systems has improved urban transportation.

In the energy sector, the government has set a target of achieving a 23% renewable energy mix by 2025. Investments in solar, wind, and hydroelectric power have been accelerated to support environmental sustainability. The digital sector has also seen significant progress, with the Palapa Ring project and the development of data centers playing a crucial role in accelerating Indonesia's digital transformation.

Despite these achievements, challenges such as funding constraints, regulatory hurdles, and the impact of the COVID-19 pandemic have slowed the pace of some projects. Nevertheless, the government has actively promoted Public-Private Partnerships (PPPs) to attract private sector investment and ensure the completion of key infrastructure initiatives.

1.2 Infrastructure plan in RPJMN 2025-2029

The RPJMN 2025-2029 will build on the progress of the previous plan, with a stronger emphasis on sustainable and inclusive infrastructure development. The government aims to address regional disparities by focusing on equitable growth beyond Java, ensuring that all regions benefit from infrastructure investments.

Key agenda items include the development of integrated transportation networks, such as expanding railway systems and improving intermodal connectivity. Green infrastructure will also be a priority, with investments in eco-friendly projects like electric public transportation, renewable energy plants, and sustainable waste management systems. The development of smart cities, leveraging digital technologies for efficient urban governance, will further enhance the quality of life in urban areas.

In the energy sector, the RPJMN 2025-2029 targets a more progressive energy transition, with a focus on increasing the share of renewable energy and improving energy efficiency in industries. The digital infrastructure agenda will continue to expand, supporting the growth of the digital economy and ensuring widespread access to high-speed internet.

These plans aim to create a more resilient and sustainable infrastructure ecosystem, capable of supporting Indonesia's long-term economic goals and addressing emerging challenges such as climate change and rapid urbanization.

1.3 The role of infrastructure in the national economy and global competitiveness.

Infrastructure plays a pivotal role in Indonesia's national economic growth and global competitiveness. High-quality infrastructure reduces logistics costs, enhances productivity, and attracts foreign direct investment (FDI), all of which are essential for economic development. By improving connectivity and access to essential services, infrastructure also helps reduce regional disparities and promotes inclusive growth.

On the global stage, modern and sustainable infrastructure positions Indonesia as a key player in the Asia-Pacific region. Projects like deep-sea ports, international airports, and integrated economic zones enhance Indonesia's role as a logistics and trade hub. Additionally, robust digital infrastructure supports the growth of the digital economy, including e-commerce, fintech, and the creative industries, which are increasingly important in the global market.

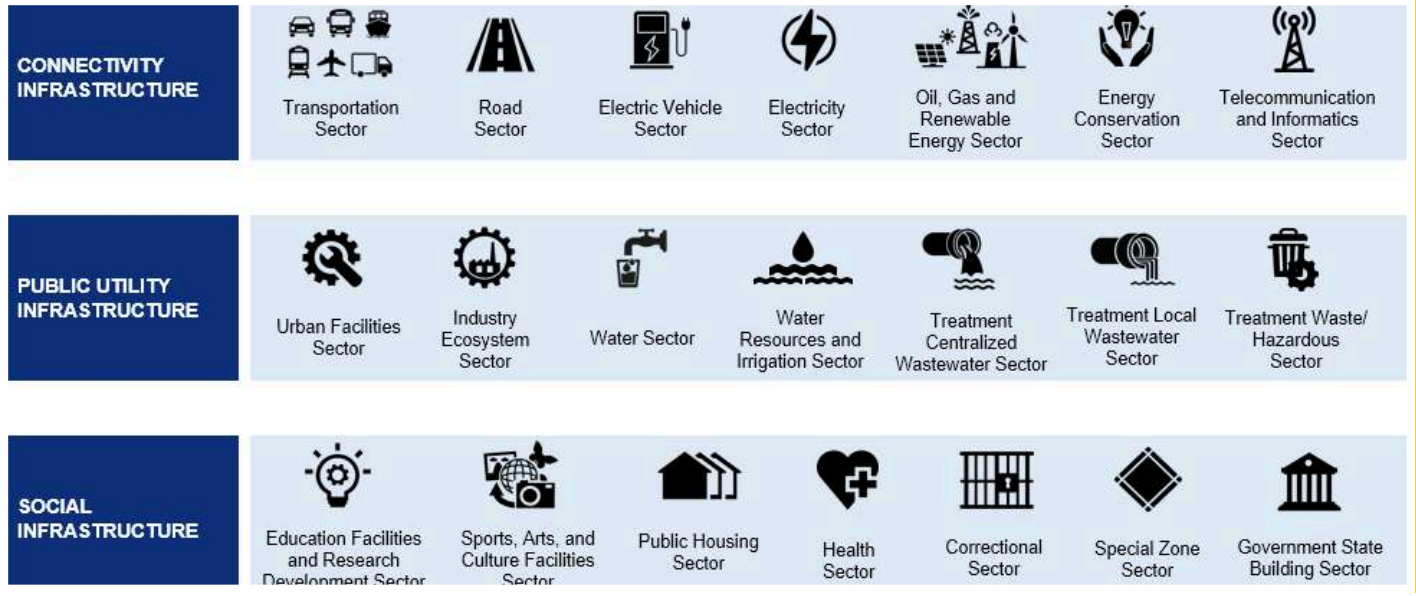
Infrastructure development also aligns with the Sustainable Development Goals (SDGs) and supports Indonesia's transition toward a green economy. By investing in renewable energy, sustainable transportation, and smart technologies, Indonesia can improve its environmental performance while boosting economic competitiveness.

CHAPTER 2

GOVERNMENT POLICY ON INFRASTRUCTURE DEVELOPMENT IN INDONESIA

2.1 Infrastructure Sector in Indonesia

Infrastructure is the technical, physical facilities, systems, hardware, and software needed to perform services to the community and support network structures so that economic, social-economic and social growth of the community can run well1. In the development of infrastructure in Indonesia. There are 22 types of infrastructure and many sub-types of infrastructure regulated by the Government of the Republic of Indonesia with Regulation of the Minister of National Development Planning/Head of the National Development Planning Agency 7/2023 about Implementation of PPP (Public-Private Partnerships) Business Entities in the Provision of Infrastructure, in which the private sector can participate in its development.



In the provision of multi-sectoral public service infrastructure, it requires the cooperation of various stakeholders who become a whole collaboration in order to present the needs effectively and efficiently as a fulfillment of government obligations in the provision of infrastructure2. Collaboration from the central government, local governments, the private sector as implementers and cooperation in financing both from financing institutions or funding from foreign loans and grants will provide a multiplier effect in the future to become a catalyst for accelerating infrastructure development in Indonesia.

2.2 Types of infrastructure provision schemes/Instruments in Indonesia

In Indonesia, infrastructure provision schemes are categorized into several types according to their scope based on the involvement of public or private parties3, the source of funding and the implementation of the cooperation. Some explanations are as follows:

1

Government Infrastructure Provision

This scheme uses the state budget (APBN/Budget State) or regional budget (APBD/Budget Regional) which is implemented through the procurement of government goods and services. This scheme is commonly used for basic infrastructure or basic needs based on the needs in public services.

2

Government Special Provision

The government provides several special funds aimed at infrastructure development, such as the Special Allocation Fund (DAK): used for regional infrastructure development, Village Fund: used for rural infrastructure development and Sovereign Wealth Fund (SWF) used for funding strategic infrastructure projects (PSN), Bonds and Sukuk.

3

Delivery through SoE's Scheme

The government can also mandate State-Owned Enterprises (SOEs) or Regional-Owned Enterprises (BUMDs) to build and operate infrastructure under a self-financing scheme or with government support.

4

Public-Private Partnership (PPP) Scheme

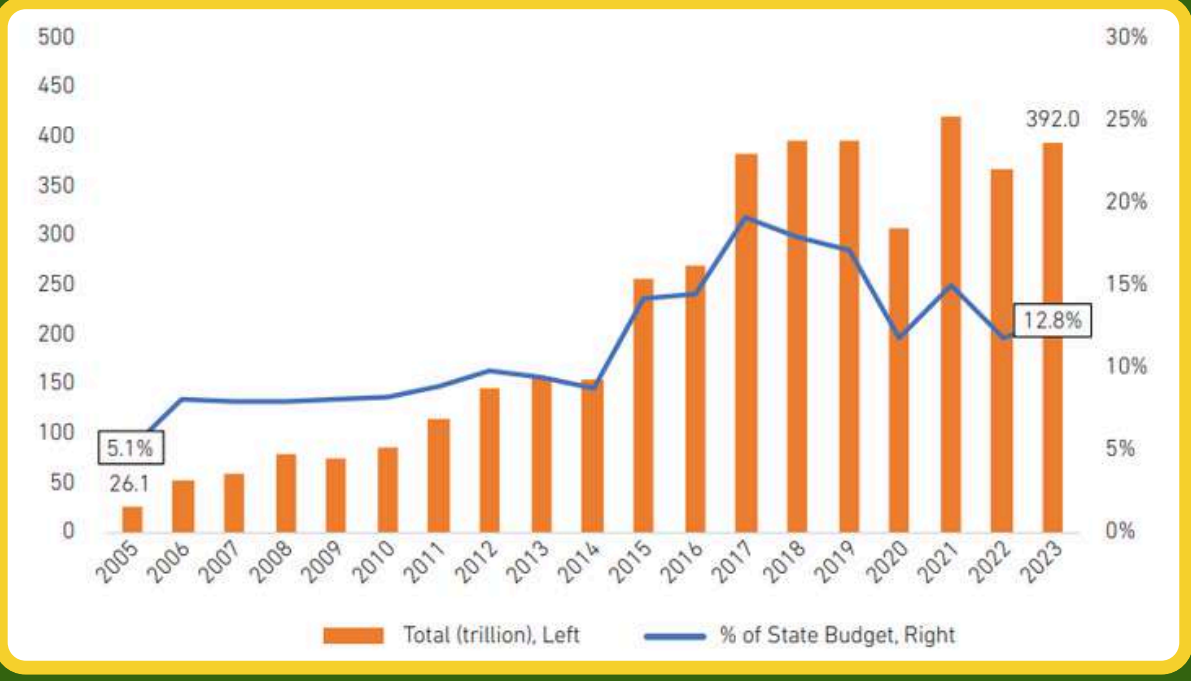
This scheme in which the government cooperates with the private sector to build and manage infrastructure under a profit-sharing, concession, or other scheme. This scheme has been widely used since the term "KPS" was first applied in Indonesia and regulated through Presidential Regulation (Perpres) Number 67/2005 on Government Cooperation with Business Entities in the Provision of Infrastructure.

5 Private Investment Scheme

In this scheme, the private sector builds and operates infrastructure with a pure investment scheme, without any direct government involvement in the form of concessions or PPP. Examples of infrastructure that are often built with this scheme are industrial estates, private ports, and Independent Power Producer (IPP)-based power plants.

6 International Financing Schemes

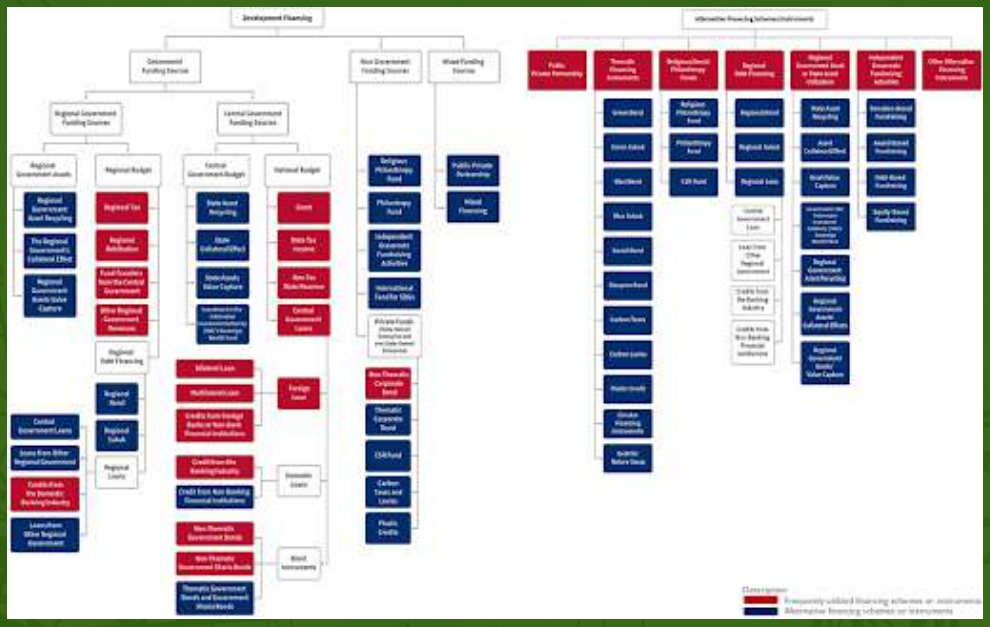
The government also receives loans, foreign grants (PHLN) from international institutions including thematic programs such as for sustainable infrastructure financing by combining several financing such as climate funds, sustainability funds or others.





Infrastructure spending in the state budget until 2023 is allocated IDR392 trillion (12.8% of total spending), down from a peak of IDR418.26 trillion in 2021. The highest proportion occurred in 2017, at almost 20% of the state budget. These funds are channeled through four expenditure groups, with the infrastructure provision scheme as the main driver of a more massive increase in provision4. The development of financing is done by considering the availability of funding that can be utilized such as Pension Funds, Trust Funds, Venture Capital, Hajj Funds, Land Value Capture or Carbon Pricing.

Development finance comes from a variety of sources, including government funds, the private sector, as well as mixed schemes that combine the two. Central and local governments rely on budgets sourced from taxes, non-tax revenues, grants, as well as domestic and international loans. In addition, asset optimization through asset recycling and value capture is further strengthened to support sustainable funding5.



Beyond the government budget, the non-government sector also plays a role through private investment, philanthropy, and financial instruments such as corporate bonds and bank loans. Social and environmental impact-based funding, such as CSR funds and SDGs funds, are also strategic sources for sustainable development6.

Innovative approaches are increasingly developing with Public-Private Partnership (PPP) schemes and various green financial instruments, such as green bonds, blue bonds, carbon taxes and plastic credits. This diversification of funding sources enables more inclusive development, reduces the government's fiscal burden, and accelerates the transition to a sustainable green economy.



2.3 Condition of Infrastructure Development Policy in Indonesia

The year 2025 is an important year in continuing Infrastructure development, President Prabowo Subianto as President-elect 2025-2029 is committed with the Coordinating Ministry for Infrastructure and Regional Development of the Republic of Indonesia in accelerating this. Including the establishment of 77 PSN in the 2025-2029 period consisting of 29 new PSN and 48 continued PSN7, there are more than 20 projects intersecting with the development of the Infrastructure sector. Especially IKN which is still continuing with a budget allocation plan of approximately Rp 48.8 trillion from 2025 to 2029, while Infrastructure in the realm of the Ministry of Public Works has decreased by 73% from the initial allocation of Rp 110.95 trillion to Rp 29.57 trillion after efficiency8.

Although the development of Infrastructure policy does not always rely on financing, so far several existing or newly implemented policies have progressed with a description of several related policy lists as follows

Regulation	Terms of Regulations
Basic Regulations	
Law Number 6 of 2023	Establishment of Government Regulation in Lieu of Law Number 2 of 2022 on Job Creation into Law
Presidential Regulation Number 12 of 2025	National Medium-Term Development Plan 2025 - 2029
Establishment of Government Regulation in Lieu of Law Number 2 of 2022	Job Creation
National Strategic Project (PSN) Regulations	
Government Regulation Number 42 of 2021	Facilitation of National Strategic Projects
Presidential Regulation Number 66 of 2020	Funding for Land Acquisition for Public Interest Development in the Implementation of National Strategic Projects

Capital City (IKN) Regulations	
Minister of Finance Regulation Number 220 of 2022	Government Support for Public-Private Partnership (PPP) and Creative Financing to Accelerate Infrastructure Development in Nusantara Capital City
Minister of National Development Planning/Bappenas Regulation Number 6 of 2022	Procedures for Public-Private Partnership Implementation in Nusantara Capital City
LKPP Regulation Number 3 of 2024	Guidelines for Infrastructure Provision and Procurement of Goods/Services with Special Provisions for the Preparation, Construction, and Relocation of the Capital City, and Governance of the Special Region of Nusantara Capital City
LKPP Regulation Number 1 of 2023	Procedures for Procurement of Executing Business Entities for Infrastructure Provision through Public-Private Partnerships in Nusantara Capital City
LKPP Head Decree Number 277 of 2024	Procurement Document Model for Public-Private Partnership Executing Business Entities in Infrastructure Provision Projects in Nusantara Capital City

Regulation	Terms of Regulations
Public-Private Partnership (PPP) Regulations	
Presidential Regulation Number 38 of 2015	Public-Private Partnership in Infrastructure Provision

Minister of National Development Planning/Bappenas Regulation Number 7 of 2023	Implementation of Public-Private Partnerships in Infrastructure Provision
Minister of National Development Planning/Bappenas Regulation Number 2 of 2020	Procedures for Implementing Public-Private Partnerships in Infrastructure Provision
Minister of National Development Planning/Bappenas Regulation Number 6 of 2022	Procedures for Public-Private Partnership Implementation in Nusantara Capital City
LKPP Regulation Number 1 of 2025	Procurement Procedures for Public-Private Partnerships in Infrastructure Provision
LKPP Regulation Number 29 of 2018	Procedures for Procurement of Executing Business Entities for Infrastructure Provision Through Public-Private Partnerships Initiated by Ministers/Heads of Agencies/Regional Heads
LKPP Head Regulation Number 19 of 2015	Implementation of Procurement of Business Entities in Public-Private Partnership Infrastructure Provision
LKPP Head Decree Number 126 of 2023	Procurement for Infrastructure Provision through Public-Private Partnerships
Infrastructure Financing, Facilitation, and Payment Regulations	
Minister of Finance Regulation Number 180 of 2020	Facilities for Project Preparation and Transaction Execution in Public-Private Partnership Infrastructure Provision
Minister of Finance Regulation Number 170 of 2018	Feasibility Support for Partial Construction Costs in Public-Private Partnership Infrastructure Projects

Minister of Finance Regulation Number 260 of 2016	Payment Procedures for Service Availability in Public-Private Partnership Infrastructure Provision
Minister of Finance Regulation Number 170 of 2015	Guidelines for Feasibility Support for Partial Construction Costs in Public-Private Partnership Infrastructure Provision
Minister of Home Affairs Regulation Number 96 of 2016	Service Availability Payment in Regional Public-Private Partnership Infrastructure Provision
Financial Services Authority Regulation Number 46 of 2020	Infrastructure Finies
Government Guarantee Regulations	
Presidential Regulation Number 78 of 2010	Infrastructure Guarantees in Public-Private Partnership Projects Conducted Through Infrastructure Guarantee Enterprises

Regulation	Terms of Regulations
Minister of Finance Regulation Number 8 of 2016	Implementation Guidelines for Infrastructure Guarantees in Public-Private Partnership Projects
Land, Area, and Forestry Regulations	
Law Number 2 of 2012	Land Acquisition for Public Interest Development
Government Regulation Number 39 of 2023	Implementation of Land Acquisition for Public Interest Development

Government Regulation Number 43 of 2021	Resolution of Spatial Planning, Forest Areas, Permits, and/or Land Ownership Inconsistencies
Government Regulation Number 40 of 2021	Implementation of Special Economic Zones
Government Regulation Number 23 of 2021	Forestry Management
Government Regulation Number 20 of 2021	Regulation of Neglected Areas and Land
Government Regulation Number 18 of 2021	Management Rights, Land Rights, Apartment Units, and Land Registration
Government Regulation Number 13 of 2017	Amendment to Government Regulation Number 26 of 2008 on National Spatial Planning
Presidential Regulation Number 78 of 2023	Handling of Social Impact in Land Provision for National Development
Presidential Regulation Number 62 of 2023	Acceleration of Agrarian Reform Implementation
Minister of Finance Regulation Number 139 of 2020	Funding Procedures for Land Acquisition for National Strategic Projects by the State Asset Management Agency
Minister of Agrarian Affairs and Spatial Planning/National Land Agency Regulation Number 18 of 2021	Procedures for Determining Management Rights and Land Rights

State-Owned Asset (BMN) Management Regulations	
Government Regulation Number 28 of 2020	Management of State/Regional-Owned Assets
Minister of Finance Regulation Number 40 of 2024	Procedures for Using State-Owned Assets
Minister of Finance Regulation Number 168 of 2023	Implementation Guidelines for Tax Deductions on Income Related to Work, Services, or Individual Activities
Minister of Finance Regulation Number 165 of 2021	Procedures for the Disposal of State-Owned Assets
Minister of Finance Regulation Number 115 of 2020	Utilization of State-Owned Assets

Regulation	Terms of Regulation
Minister of Home Affairs Regulation Number 7 of 2024	Guidelines for the Management of Regional-Owned Assets

The various regulations related to the provision of infrastructure in Indonesia mentioned earlier constitute the bulk of the existing regulatory basis and are not yet fully specific to the infrastructure sector10, the development of a diversity of provision types and schemes is of course ongoing, taking into account the scheme and life cycle nature of the infrastructure.

CONDITIONS FOR MAINSTREAMING SUSTAINABILITY AND ESG ASPECT IN THE INFRASTRUCTURE GLOBAL SECTOR

3.1 Global Net Zero Commitments and their impact on infrastructure policy.

The infrastructure sector acts both as a dominant contributor to global emissions as well as a victim of physical risks (e.g., droughts, floods, and rising sea levels). Construction and operation of infrastructure account for 79% of global greenhouse gas emissions (World Bank, 2019), while embodied carbon from materials like cement and steel adds another 11% (Global ABC, 2021). Adding this with the global push for net-zero commitments, infrastructure policy and investment are being transformed globally. Over 140 countries, including major economies like the EU, U.S., and China, have now pledged net-zero targets, with most set for 2050 (Climate Action Tracker, 2023). These commitments accelerate the rethinking of infrastructure governance, financing, and design to align with decarbonization goals.

Net-Zero Drivers and Policy Shifts

Regulatory Pressure:

- The EU's Carbon Border Adjustment Mechanism (CBAM) and U.S. Inflation Reduction Act (IRA) penalizes high-carbon infrastructure imports and incentivizes low-emission alternatives (European Commission, 2023; White House, 2022).
- Mandatory climate disclosures (e.g., IFRS S2, SEC rulings) now require infrastructure projects to quantify and mitigate Scope 1, 2, and 3 emissions (IFRS Foundation, 2023).

Technological and Planning Innovations:

- Green Infrastructure mandates: Cities like Copenhagen and Singapore now require nature-based solutions (e.g., urban wetlands, permeable pavements) to constitute ≥30% of new projects (C40 Cities, 2022).
- Material transitions: Policies favor low-carbon cement (e.g., EU's Net-Zero Industry Act) and circular economy practices like modular construction (OECD, 2023).

Financial Realignment:

- Multilateral development banks (MDBs) like the World Bank have tied 75% of financing to climate co-benefits by 2025 (World Bank, 2022).

3.2 Development of Sustainability and ESG Aspects at the Global Level

Integrating ESG into infrastructure decisions requires a systematic and verifiable governance approach that balances a project's environmental and social risk reduction with long-term value for investors. In light of this, several global guidelines and frameworks provide guidance on achieving this balance, such as the G20 Principles for Quality Infrastructure Investment, OECD Compendium of Policy Good Practices for Quality Infrastructure Investment, and UN International Good Practice Principles for Sustainable Infrastructure. Together, these principles emphasize an enabling environment for infrastructure that is not only resilient but also equitable and low-carbon. The latter complements the prior resources in providing a summary of good practice for sustainable infrastructure policies, planning, preparation and delivery aimed at creating the enabling environment for sustainable infrastructure that supports the achievement of the SDGs.

1. Equity, Inclusiveness, and Empowerment through a balance between social and economic infrastructure investment to respect, protect and fulfil human rights and promote well-being, particularly of more vulnerable or marginalized groups. This principle can be done through developing a Resettlement Action Plan when necessary, developing occupational health and safety policies that align with national or international standards, and developing and implementing a management plan to promote inclusivity.

2. Avoiding Environmental Impacts of infrastructure systems and investing in natural infrastructure to make use of nature's ability to provide essential, cost-effective infrastructure services and provide multiple co-benefits for people and the planet. Key best practices of this principle include but are not limited to monitoring scope 1, 2, and 3 greenhouse gas emissions to track and reduce the infrastructure's carbon footprint and developing a comprehensive waste management system for responsible waste disposal

3. Comprehensive Life Cycle Assessment of Sustainability, including the cumulative impacts of multiple infrastructure systems on ecosystems and communities over their entire lifespans, to avoid "locking in" infrastructure projects and systems with various adverse effects. For example, embodied carbon from construction materials like cement and steel contributes 11% of global CO_2 emissions, highlighting the need for circular design.

4. Responsive, Resilient, and Flexible Service Provision to meet actual infrastructure needs, allow for changes and uncertainties over time, and promote synergies between infrastructure projects and systems.

5

Transparent, Inclusive, and Participatory Decision-Making that includes stakeholder analysis to identify and determine appropriate engagement for each key stakeholder, ongoing public participation, and grievance mechanisms for all stakeholders.

6

Evidence-Based Decision-Making that includes regular monitoring of infrastructure performance and impacts based on key performance indicators and the promotion of data sharing with all stakeholders.

7

Fiscal Sustainability and Innovative Financing to close the infrastructure investment gap within the context of increasingly constrained public budgets.

8

Enhancing Economic Benefits through employment generation and support for the local economy

9

Resource Efficiency and Circularity to minimize infrastructure's natural resource footprint, reduce emissions, waste and other pollutants, and increase the efficiency and affordability of services.

10

Strategic Planning to ensure the alignment of infrastructure policies and decisions with global sustainable development agendas and to strengthen the enabling environment.

Together, these principles advocate for an integrated approach that achieves multi-functionality in infrastructure, which minimizes ecosystem disruption, is energy and resource efficient, and contributes to healthy, vibrant, and cohesive communities. A prime example of this is the sustainable urban drainage system (SuDS) in the Eddington development, Cambridge. Apart from its main function in getting excess water out as soon as possible and minimizing flash floods, the SuDS provides additional green space and habitat, which helps sequester CO_2, reduce urban heat island effect, and add visual aesthetics to the urban landscape.

NATIONAL CONDITIONS FOR MAINSTREAMING SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR

4.1 ESG integration in infrastructure planning

Indonesia is committed to supporting the Sustainable Development Goals (SDGs) in its efforts to eradicate poverty, reduce inequality, and address the impacts of climate change. This commitment is reflected in the Enhanced Nationally Determined Contribution (ENDC), which sets a self-determined emission reduction target of 31.89% and an internationally supported emission reduction of 43.2% by 20301.

At the national level, this commitment is realized through various policies. In development planning, the National Long-Term Development Plan (RPJPN) 2025-2045 has a very strong development principle where the vision is 'Nusantara State, Sovereign, Advanced, and Sustainable' and the fifth target is 'Decreasing GHG Emission Intensity towards Net Zero Emissions'. Of the eight Development Missions, there are already several agendas that specifically voice the Environmental, Social, and Governance (ESG) aspects of development such as realizing governance transformation, realizing equitable and just regional development, and realizing quality and environmentally friendly facilities and infrastructure2.

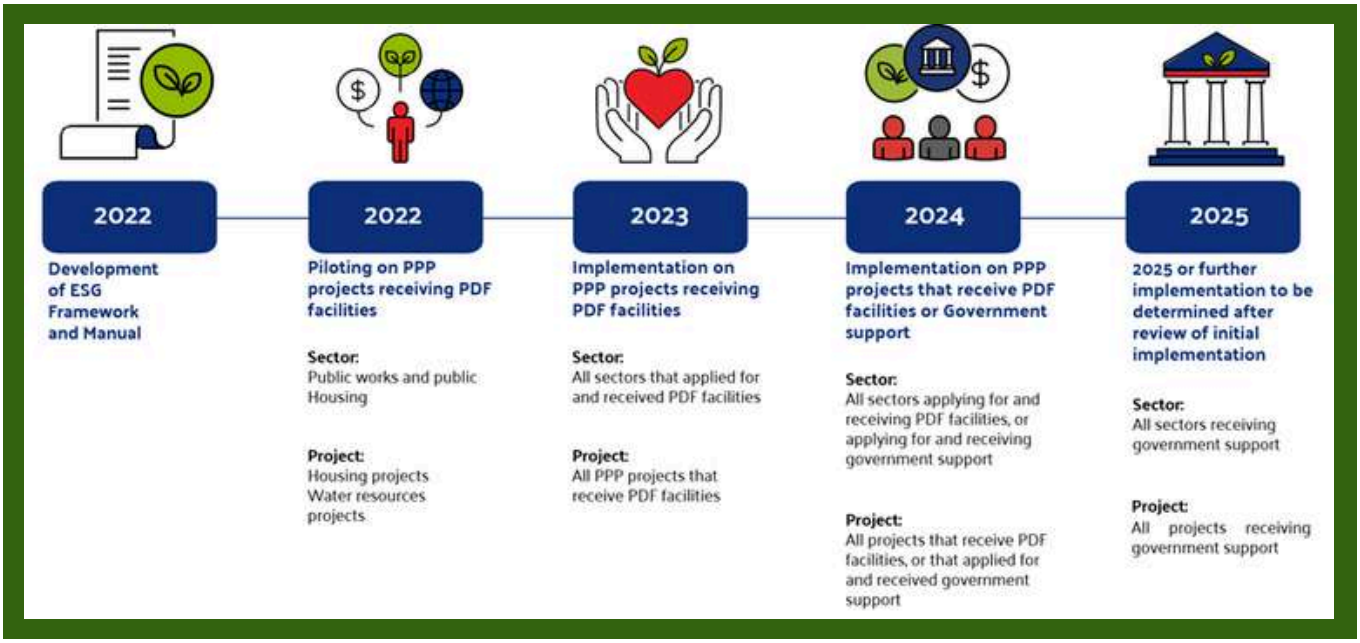
Additionally, the National Medium-Term Development Plan (RPJMN) 2025-2029 as the first stage of RPJPN implementation has explained the President's Vision and Mission 2025-2029 called Asta Cita. Social aspects have been integrated in infrastructure development contained in the third Asta Cita, namely continuing infrastructure development and increasing quality employment, encouraging entrepreneurship, developing creative industries and developing agromaritime industries in production centers through the active role of cooperatives3.

In the context of fiscal policy, Indonesia already has noteworthy achievements in terms of environmental, social and governance integration in infrastructure planning. Some of these include the publication of two documents by the Ministry of Finance, namely the Environmental, Social and Governance (ESG) Framework Book on Government Support and Facilities and the Environmental, Social and Governance Manual by the Ministry of Finance.

The Government of Indonesia, in this case the Ministry of Finance, has taken the initiative to apply ESG principles in government and facilities support for infrastructure financing. To encourage the implementation of infrastructure projects, the Ministry of Finance provides various facilities and support in the form of Project Development Facility, Viability Gap Fund, infrastructure financing, and Availability Payment4. These facilities and support are in place to implement the integration of ESG into infrastructure planning, and the roadmap for implementing the ESG framework can be seen in the following figure.



Figure 1. Roadmap for Implementing the ESG Framework



Source: Ministry of Finance, 2022

The purpose of the ESG Framework is to ensure that infrastructure development that receives support from the Ministry of Finance meets ESG principles. In its implementation, the ESG Framework will be one of the assessments in determining the provision of support to the provision of financing. Stakeholders involved in the project must meet the ESG standards contained in the ESG framework. There are 4 standards in the environmental dimension, namely pollution prevention and waste management, biodiversity conservation, natural resource management and energy efficiency, and climate change and disaster risk mitigation and adaptation. In the social dimension, there are 4 standards, that are labor and work environment standards, diversity, equality, inclusion and access, social interests, and cultural heritage. Meanwhile, there are two standards in the governance dimension, such as leadership and governance and risk and control standards.



The integration of ESG into infrastructure development projects, especially those funded under the PPP system, can be done at all stages of the project life cycle, such as planning, preparation, transaction, and management5. Some examples of ESG mainstreaming may include the following:

Table 1. Mainstreaming ESG into PPP

Project life cycle	Component
Planning	• Preliminary studies should include environmental, social, and governance risk assessments • Public consultation and stakeholder engagement in PPP projects, including indigenous peoples and vulnerable groups • The Materiality Assessment Tool (MAT) can be used at this stage as an initial indentification
Preparation	• Approval of government support should include an ESG data sheet outlining the ESG risks of the project, as a reference for all key stakeholders • Pre-feasibility studies should include comprehensive socio-economic benefits, mapped to the SDGs • EIA documents should cover broad categories of risks, including topics such as greenhouse gas emissions and gender, as well as specific mitigation measures
Transaction	• Tender documents and agreements include ESG safeguards and commitments to undertake ESG management during project implementation (pre-construction, construction, operation) • Ensure ESG assessment with MAT is updated with the latest information
Management	• Monitoring reports should include the status of the project's ESG impacts, a regularly updated ESG risk register, and the status of existing ESG management activities • Proactive management of ESG risks and achievement of higher ESG performance • Some activities may proceed to the transaction stage such as site determination, land acquisition, and environmental permits

Source: Kementerian Keuangan, 2025

The Ministry of Finance has undertaken various initiatives to navigate the implementation of ESG in Ministries/agencies5. The Ministry of Finance has assisted and coordinated with the Ministry of Public Works in implementing ESG in infrastructure projects. In addition, it has also ensured that ESG is integrated in PPP projects with the support of the Project Development Facility in various sectors through the development of the ESG Manual. In terms of procurement, the Ministry of Finance supports and actively contributes to LKPP's initiative to integrate ESG in transaction documents and PPP contract agreements, where the ESG Framework and Manual will be the reference for such documents. On the other hand, the Ministry of Finance encourages further integration in the project implementation stage by expanding the scope of support for project preparation and implementation assistance.

In terms of incentives, there are already pilots that can be further accelerated in infrastructure projects. The Ministry of Public Works reports that there are already rewards for four infrastructure projects that incorporate sustainable construction, namely the Binjai-Stabat Toll Road project, Kretek II Bridge, Sadawarna Dam, and Semeru Permanent Residence.

4.2 Development of green construction and circular economy.

Green construction is part of a sustainable construction approach with minimizing negative impacts on the environment throughout the building process as its main goal6. A building is said to be green construction if it meets six key assessment aspects such as proper land development, energy and refrigerant efficiency, water conservation, material sourcing and cycling, indoor air quality and comfort, and building environment management7. Meanwhile, the Ministry of National Development Planning/Bappenas adopted the concept of circular economy as an economic model that applies a systemic approach to minimize the use of resources8. Green construction and circular economy are concepts that support each other to realize sustainable development.

There has been various evidence of green construction and circular economy development. In 2023, the Ministry of Public Works inaugurated environmentally friendly subsidized houses in West Java, through the Indonesia Green Affordable Housing Program where the houses are designed with an environmentally friendly concept, using sustainable and energy-efficient building materials9. In addition, in the construction of the Indonesian Capital City (IKN), the Ministry of Public Works has implemented the use of green construction materials to reduce carbon emissions such as hydraulic cement with a lower clinker content and paint with lower organic components and containing plant materials10. By the end of 2023 in Garut Regency, there has been the construction of roads with plastic asphalt covering 120.8 km which utilizes around 1,000 tons of plastic bag waste11. In terms of construction waste recycling, a study on a health infrastructure development project shows that the application of the circular economy principle itself can minimize construction waste by applying the principles of rethink, refurbish, refuse, and reduce12.

4.3 Cross-sector collaboration on national sustainability standards.

Green Industry Standard (SIH) is a standard for implementing green industry, where green industry is defined as an industry that in its production process prioritizes efforts towards efficiency and effectiveness in the use of resources in a sustainable manner so that it can align industrial development with the sustainability of environmental functions and can provide benefits to the community13. In addition to increasing the competitiveness of the manufacturing industry that applies sustainable principles, SIH is expected to be a guideline for companies in carrying out efficient and environmentally friendly production processes14 and can be used as a tool in reducing greenhouse gas emissions15. In 2024, 7 construction material standards have been regulated, such as sheet steel, bar steel, coated sheet steel, ceramic tiles, sheet glass, water-based paint and Portland cement, from a total of 34 standards through a program with 118 SIH issuances.

An environmentally friendly label (Ecolabel) is a mark or label given to environmentally friendly products16. This statement logo/label shows environmental aspects, is one of the tools for environmental management, and is a means of conveying accurate, verifiable and non-misleading information to consumers regarding the environmental aspects of a product, its components or its packaging17. The Ministry of Environment has two types of ecolabels, where type I has ISO 14020 as its basis and type II is based on a self-declaration scheme. There are already 16 active ceramic tile ecolabels as of 2024 through certifiers from 29 products. Meanwhile, there are already 4 active concrete ecolabels as of 2024 through verifiers from 53 products.

In addition to reviewing the material aspect, there are also green building certification standards. A building can be declared a green building if it has obtained Greenship certification issued by the Green Building Council Indonesia (GBCI). This certification aims to encourage sustainable and environmentally friendly development in the property sector in Indonesia. GBCI has several types of Greenship certification, namely new building (NB), existing building (EB), interior space (IS), homes, neighborhoods, and net zero emission. In July 2024, there were more than 60 buildings in Indonesia that were confirmed to be green buildings with Greenship certification from GBCI7.

As a ministry tasked with building infrastructure throughout Indonesia, the Ministry of Public Works has also issued various regulations regarding infrastructure sustainability. Several key regulations include Regulation of the Minister of Public Works and Housing 7/2024 on Sustainable Business Development, Regulation of the Minister of Public Works and Housing 21/2021 on Green Building Performance Assessment, and a roadmap for sustainable construction which is currently still in the process of being drafted.

The Policy Institute for Procurement of Goods/Service as a ministry in the procurement sector has issued regulations related to sustainability. One of the key regulations that has been ratified is the Decree of the Head of LKPP 157/2024 on Guidelines for Sustainable Government Procurement of Goods/Services.

In terms of fiscal, the Ministry of Finance has issued the ESG Framework and Manual as mentioned in sub-chapter 4.1. In addition, the Financial Services Authority has issued Regulation of the Financial Services Authority 51/2017 on Implementation of Sustainable Finance for Financial Services Institutions, Issuers, and Public Companies which regulates the implementation of sustainable finance by relevant stakeholders.



4.4 Barriers to ESG implementation: limited data and transparency.

The challenges of implementing ESG in the infrastructure sector are limited data and transparency. In calculating greenhouse gas emissions to implement environmental components, the emission factor value is still limited and there is a default value for the same component but issued by different stakeholders such as the default value for fuel issued by the Ministry of Energy and Mineral Resources, Pertamina, and PLN. In addition, the use of global emission factor values that refer to countries with four seasons will affect the accuracy of calculations for Indonesia, which is a country with two seasons. In terms of industry players, many companies in Indonesia do not yet have an effective ESG reporting system so that the availability of adequate data is still a challenge18. The lack of oversight and law enforcement mechanisms can also hamper the implementation of ESG in the infrastructure sector.



CHAPTER 5

THE IMPORTANCE OF EVERY PART IN UNDERSTANDING SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR

5.1 Private sector responsibility in implementing sustainability standards.

The private sector plays a crucial role in advancing sustainability by integrating ESG (Environmental, Social, and Governance) principles into infrastructure projects. Companies must adhere to international sustainability frameworks, such as the UN Sustainable Development Goals (SDGs) and ESG reporting standards, to minimize environmental impact, promote social responsibility, and ensure transparent governance. Through sustainable design, responsible resource use, and ethical labor practices, private entities contribute significantly to the long-term viability of infrastructure projects (United Nations, 2015; Global Reporting Initiative, 2021).

Several key aspects define private sector responsibility:

- Sustainable Design & Construction – Utilizing eco-friendly building materials, energy-efficient designs, and sustainable land-use planning to minimize negative environmental effects (Global Reporting Initiative, 2021).

- Resource Efficiency – Implementing waste reduction strategies, water conservation, and renewable energy solutions to reduce carbon footprints (United Nations, 2015).

- Corporate Governance & Compliance – Establishing internal policies and third-party audits to ensure adherence to sustainability regulations and ethical labor practices (International Finance Corporation, 2022).

Companies that proactively address these responsibilities help create infrastructure that meets the needs of current and future generations while reducing environmental harm.





5.2 contribution of the private sector in participating in building sustainable infrastructure

Beyond compliance with sustainability standards, private companies actively invest in green technology and sustainable construction practices. By leveraging innovative solutions such as renewable energy, circular economy principles, and resilient materials, businesses can reduce carbon footprints and enhance project sustainability. Additionally, public-private partnerships (PPPs) enable the private sector to collaborate with governments and non-profit organizations in creating infrastructure that balances economic growth with environmental and social well-being (World Bank, 2020; International Finance Corporation, 2022).

Key contributions include:

- Investment in Green Technologies – Funding research and implementation of solar, wind, and hydroelectric power solutions to support sustainable infrastructure (World Bank, 2020).

- Public-Private Partnerships (PPPs) – Collaborating with government entities to finance and develop resilient infrastructure with long-term environmental and social benefits (International Finance Corporation, 2022).

- Sustainable Supply Chain Management – Ensuring that suppliers follow ethical sourcing practices and prioritize environmental sustainability (OECD, 2021).

These initiatives foster a balanced approach between economic growth and environmental responsibility.

5.3 Academia's contribution to sustainability research and innovation.

Research institutions and academia serve as critical drivers of knowledge creation and innovation in sustainable infrastructure. Through in-depth studies, technological advancements, and policy recommendations, academia helps shape industry best practices and informs policymakers on effective sustainability strategies. Universities and research centers also play a key role in developing skilled professionals equipped with the expertise to implement and manage ESG-compliant infrastructure projects (National Academy of Sciences, 2019; Harvard Business Review, 2021)



Academia contributes through:

- Technological Innovation – Developing new materials, construction techniques, and energy-efficient solutions to reduce environmental impact (National Academy of Sciences, 2019).

- Policy and Framework Development – Conducting research to influence sustainability regulations and urban planning guidelines (Harvard Business Review, 2021).

- Capacity Building and Education – Training the next generation of engineers, architects, and policymakers in ESG principles and sustainability-focused decision-making (United Nations, 2015).

By bridging research and industry applications, academia plays a vital role in driving long-term sustainability transformations..

5.4 Community participation in monitoring green infrastructure projects.

Active involvement from local communities ensures accountability and the successful implementation of sustainable infrastructure projects. Public participation in monitoring and feedback mechanisms allows for transparency, social inclusivity, and the alignment of projects with actual community needs. Citizens and advocacy groups can contribute by engaging in environmental assessments, providing local insights, and holding stakeholders accountable for sustainability commitments (OECD, 2021; Environmental Protection Agency, 2023).

Communities contribute by:

- Participatory Environmental Assessments – Engaging in public consultations and environmental impact assessments to provide local insights (Environmental Protection Agency, 2023).

- Grassroots Advocacy and Oversight – Holding stakeholders accountable for sustainability commitments through local monitoring groups (OECD, 2021).

- Adoption of Sustainable Practices – Encouraging sustainable behaviors such as waste management, water conservation, and renewable energy adoption within communities (World Bank, 2020).

Community engagement is crucial to ensuring that green infrastructure projects truly meet environmental and social sustainability goals.



CHAPTER 6
DIRECTION OF HR DEVELOPMENT REQUIRED TO SUPPORT SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR

6.1 Green job development in Indonesia that supports sustainable infrastructure

Green jobs can be particularly important for driving sustainable infrastructure in Indonesia, and collectively help meet long-term environmental targets. This role is part of a growing trend known as green jobs, which are rapidly becoming very important as it helps Indonesia to grow alongside the reducing impact on the environment and choosing renewable energy. Green jobs play a crucial role in decreasing carbon emissions and increasing resource efficiency within the construction, energy and transportation sectors.

Indonesia is betting on green jobs and infrastructure in its Nationally Determined Contributions (NDCs) under the Paris Agreement. Programs that support the development of renewable energy projects, as well as implementing green building standards, have been introduced by the government to help encourage green jobs. Employment opportunities are generated through these initiatives, and infrastructure development is in line with environmental sustainability goals.

Challenges, however, do exist for the expansion of green job opportunities, especially regarding the necessity for skilled labor and investments in green technologies. These challenges can only be solved by teamwork between government, private sector and educational institutions. Indonesia can establish active partnerships and offer training programs that will help create a skilled workforce able to promote sustainable infrastructure development and meet the environmental targets it has set.

6.2 Digitalization of workforce skills with ESG understanding

It leads to the creation of a new labor market (new jobs: Jobs 4.0) in the digital economy, which not only requires workforce skills to be digitalized but also requires to understand about ESG (Environmental, Social, and Governance). As industries undergo digital transformation, demand for workers who are both tech-savvy and know what they are doing when it comes to sustainability practices is growing. A McKinsey & Company report stated that there is an increase in productivity and innovation driven through digital transformation, especially when combined with ESG (McKinsey, 2021)

Educational institutions and training centers in Indonesia are beginning to incorporate ESG principles into their curricula to prepare the workforce for the demands of a sustainable economy. Programmes in digital skills, including data analytics and artificial intelligence, are being blended with subjects including sustainability and corporate responsibility. Such a holistic approach allows workers to be prepared to be contributing both to an immensely productive technological force and to environmental stewards.

The role of the private sector is also critical in this transformation. Companies are investing in workshops and online courses to upskill their employees on ESG and digital skills. In this way, they are not only improving the capabilities of their workforce, but also bearing in mind the standards of sustainability and global practices. Indonesia must embrace both digitalization and an understanding of ESG to differentiate itself in the global marketplace; such dual-focus from the onset will be crucial to keeping up with the competition.

6.3 The role of professional organizations in sustainability standards.

Providing the following narrative presents certain benefits that will make any professional organization in Indonesia aware of a need to promote and implement meaningful sustainability standards among all industries. These are the organizations that establish guidelines and offer certifications, making sure businesses are complying with environmental and social governance. Professional organizations play a major role in the adoption of corporate sustainability reporting standards that assist organizations in understanding and controlling their environmental impact.

In the country such as the Indonesian Institute of Accountants (IAI) and the Indonesian Chamber of Commerce and Industry (KADIN) have played an important role in promoting sustainability standards. They provide capacity building programs, workshops, and services to businesses on incorporating sustainability into their business model. First, these efforts are foundational for establishing a culture of accountability and transparency, which are preconditions of sustainable development.

Additionally, professional organizations bring together the public and private sectors for a joint effort at sustainability. All of these organizations work hand in hand while influencing policy-making and having sustainable standards for industries. Such collaborations not only bolster the credibility of sustainability efforts but also inspire action towards Indonesia's sustainability goals.

6.4 Strengthening workforce capacity down to the roots

Strengthening workforce capacity at the grassroots level is essential for ensuring that sustainable development initiatives in Indonesia are inclusive and effective. This involves providing training and resources to local communities, particularly in rural areas, to enhance their skills and knowledge in sustainable practices. Empowering local communities is key to achieving sustainable development goals, as it ensures that development efforts are rooted in the needs and capabilities of the people.

In Indonesia, there have been a range of grass-roots initiatives in place to improve workforce capabilities--community based training programs or collaboration with local NGOs are just two examples. They help individuals engage in the local and national sustainability efforts by focusing on sustainable agriculture training, renewable energy, waste management, and other similar programs that prepare young minds to contribute towards making their communities more sustainable. Indonesia is able to form a more sustainable and adaptive work performance to environmental problems by investing in the capacity building of the grassroots.

Additionally, building workforce capacity at the grassroots level will require a multi-stakeholder approach. Ensuring that training programs are effective and responsive to local needs will require strong partnership between the government, private sector, and civil society. This would allow Indonesia to create an inclusive basis for sustainable development that benefits people at all social level.

The modular, work-based training model strengthens workforce capacity through hands-on, real-life experiences in the work setting and improves institutional capability, providing a practical example of workforce development and systems strengthening.



CHAPTER 7

DIRECTION OF TECHNOLOGY DEVELOPMENT REQUIRED TO SUPPORT SUSTAINABILITY AND ESG IN THE INFRASTRUCTURE SECTOR

7.1 IoT in sustainable infrastructure management.

IoT is changing the paradigm of sustainable infrastructure management through a variety of computer programs that collect or download real-time data for instantaneous optimization of resources. They collect data on energy usage, water consumption, and waste management so that the facilities can be operated more efficiently. This technology allows many intelligent buildings to adjust their light and heating systems based upon the numbers of people in the building for more than just energy efficiency purposes.

According to a study conducted by McKinsey that had been released, IoT applications in infrastructure could provide energy and maintenance savings of up to 20% and 25%, respectively, as a result of predictive maintenance and optimized resource allocation that are so important for the sustainable management of infrastructures. They also suggest that IoT can contribute to longer asset life by providing timely data for maintenance and repairs.

In addition, it provides such information to stakeholders from real-time data, thereby enhancing decision-making. This works well for the cities, as they want to apply the best measures for managing resources to achieve sustainability. Integrated with AI and big-data analysis, the IoT is typically better equipped to make a sustainable impact on infrastructure.



7.2 Drones and AI for project sustainability monitoring.

Drones equipped with high-resolution sensors and cameras can track the progress of construction projects, monitoring every aspect of the job site in real-time, thus improving accuracy and efficiency. AI integration with drones enhances monitoring of large construction of projects where manual monitoring can be very inefficient and costly. Furthermore, it can help monitor the effect of construction work on its vicinity and ensure compliance with corporate sustainability standards.

AI algorithms can look for such challenges (like overspending of resources or potential threats to the biosphere) and help mitigate them early, scaling up drone derived data processing. Issues such as budget and time constraints can also be dealt with through proactive measures aided by AI. According to a study by PwC, the amalgamation of AI and drone technology can increase the accuracy and efficiency of project monitoring while simultaneously reducing costs by as much as 50%.

AI can take proactive measures to alleviate problematic budget and time constraints by predicting potential damages down the line. In addition to helping to meet AI's efficiency targets, drones may also be used to ensure compliance with mandated regulations and unsafe scenarios on-site, thus preventing workers from potentially life-threatening accidents with significant savings on the costs associated with unplanned delays. The combination of drones and AI is variety in the infrastructure sector making it a reality to meet sustainability goals.



7.3 Energy-efficient building materials based on recycling.

IoTherefore, the advancement of energy conservativism structures materials is an ongoing high-performance bedrock for carbon emission reduction in the building's ravenous development industry. Emphasizing recycled materials, from reclaimed wood to recycled steel to eco-friendly concrete, are increasingly becoming sustainable alternatives to conventional building materials. Using recycled materials not only minimizes waste–which, in turn, uses fewer resources and energy during the manufacturing process.

According to data from the Journal of Cleaner Production, construction using recycled materials can save 30% of energy. Moreover, because such materials typically have lower embodied energy, their production and transportation consume relatively little energy material inputs, making them even more sustainable. It also notes that recycling has the added benefit of improving the thermal performance of buildings, thereby cutting down on heating and cooling.

Moreover, utilizing recycled materials can help circular economy principles by extending the life cycle of materials and reducing dependence on virgin materials. This strategy not only promotes sustainability, but can constitute sound economics by making materials cheaper and waste disposal less costly. Continue to read: The Emerging Trends in Energy-Efficient Sustainable Building Materials.

7.4 Smart grid for energy distribution efficiency in industrial areas.

In the areas where a larger volume of energy is consumed, smart grids were designed for additional efficiency of electricity distribution. Intelligent grids utilize modern sensing methods, communications modalities, and data analytic techniques to maximize energy flow, reduce losses in transmission, and enable integration with more renewable sources. Smart grids allow for real-time monitoring and productive management of electrical networks and, thus, a higher reliability and efficiency of energy distribution. According to a recent International Energy Agency report, "Smart Grids can provide through optimal mechanisms energy efficiency increase by at least 15%, and significantly decrease greenhouse gas emission levels." Secondly, this framework assists in integrating renewable energy sources, mainly solar and wind, by handling variability and ensuring continuous supply of energy. All these capabilities are the critical enactments associated with changing over into a low-carbon energy system. Apart from that, with respect to energy security, smart grids provide much better responses to demand and energy storage. These allow flexible and resilient energy systems that can respond to changing patterns of demand and disruptions. As long as the industrial areas grow, it provides a good ground for utilizing smart grid technologies for cleaner energy management



CHAPTER 8

DIRECTION OF FINANCING DEVELOPMENT REQUIRED TO SUPPORT SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR

8.1 The role of financial institutions in green infrastructure financing.

Sustainable infrastructure development requires not only technology and human resources, but also innovative financing approaches that are oriented towards Environmental, Social, and Governance (ESG) principles. In Indonesia, efforts to support green infrastructure are increasingly prominent, driven by the need to mitigate climate change, meet sustainable development targets (SDGs), and attract responsible global investment.

8.2 OJK Green Taxonomy as a reference for sustainable financing.

Financial institutions, both national and international, play a central role in encouraging the financing of green infrastructure projects. Dian Ediana Rae, Chief Executive of Banking Supervision (PBKN) of OJK said that the total distribution of sustainable banking loans/financing has reached Rp1,959 Trillion in 2023, the realization of distribution refers to the sustainable category as POJK 51/2017 and POJK 60/2017 which was revised in POJK 18/2023 related to the definition of Environmentally Sound Business Activities (KUBL). Several major banks in Indonesia, such as Bank Mandiri and BRI, have set targets to increase green financing in their portfolios for sustainable projects by 2025. In addition, financial institutions have also started to develop innovative products such as Sustainability-Linked Loans (SLL) and Green Loans, which provide incentives for companies that meet sustainability criteria.

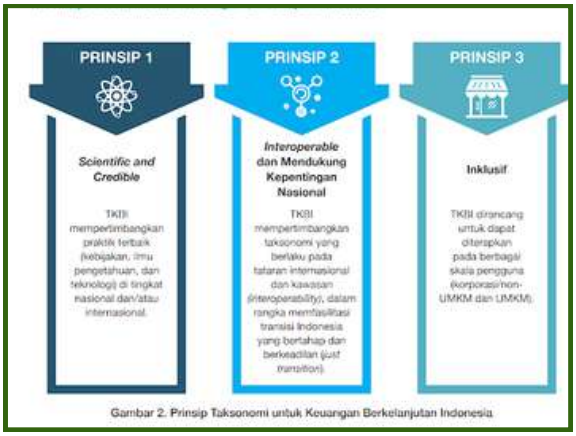
8.3 Blended finance in supporting green infrastructure projects.

The OJK Green Taxonomy, launched in 2021, is the main guide in classifying environmentally friendly economic activities. The taxonomy covers energy, forestry and other land use (FOLU), waste, agriculture, industry (IPPU).

The Indonesian Taxonomy of Sustainable Finance (TKBI) is built on three key complementary principles. These principles are designed to ensure that the taxonomy can be effectively applied and aligned with international standards, while taking into account national interests and inclusiveness.



Gambar 3. Fokus Sektor TKBI sesuai *Enhanced* NDC 2022



Gambar 2. Prinsip Taksonomi untuk Keuangan Berkelanjutan Indonesia

The Indonesian Taxonomy of Sustainable Finance (TKBI) is built on three key complementary principles. These principles are designed to ensure that the taxonomy can be effectively applied and aligned with international standards, while taking into account national interests and inclusiveness.

Detail target pengurangan emisi NDC *related sector* sebagaimana dijelaskan pada Tabel 1.

Tabel 1. Proyeksi *Business as Usual* (BaU) dan penurunan emisi sektor NDC

Sector	GHG Emission Level 2010 (MTon CO2-eq	GHG Emission Level 2030 (MTon CO2-eq)			GHG Emission Reduction (MTon CO2-eq)		GHG Emission Reduction % of Total BaU	
		BaU	CM1	CM2	CM1	CM2	CM1	CM2
Energy	453,2	1.669	1.311	1.223	358	446	12,5%	15,5%
Waste	88	296	296	253	40	43,5	1,4%	1,5%
IPPU	36	69,6	63	61	7	9	0,2%	0,3%
Agriculture	110,5	119,66	110	108	10	12	0,3%	0,4%
FOLU	647	714	214	-15	500	729	17,4%	25,4%
TOTAL	**1.334**	**2.869**	**1.953**	**1.632**	**915**	**1.240**	**31,89%**	**43,20%**

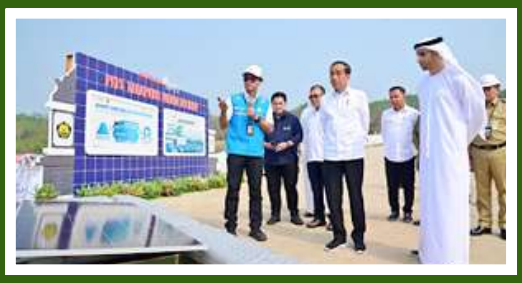
Sumber: *Enhanced NDC Indonesia*, 2022

With the Green Taxonomy, financial institutions can more easily identify projects that meet the demand criteria as a reference for more specific demand categories, currently OJK has issued the Indonesian Green Taxonomy (THI) and the Indonesian Sustainable Finance Taxonomy (TKBI), which contain definitions and categorizations of funding financing. Indonesia's greenhouse gas (GHG) emission reduction targets are set for each priority sector with two scenarios: CM1 (with domestic resources) and CM2 (with international support). The following table shows the Business as Usual (BaU) projections and emission reduction targets until 2030 for each sector, which illustrate Indonesia's commitment to reducing GHG emissions.

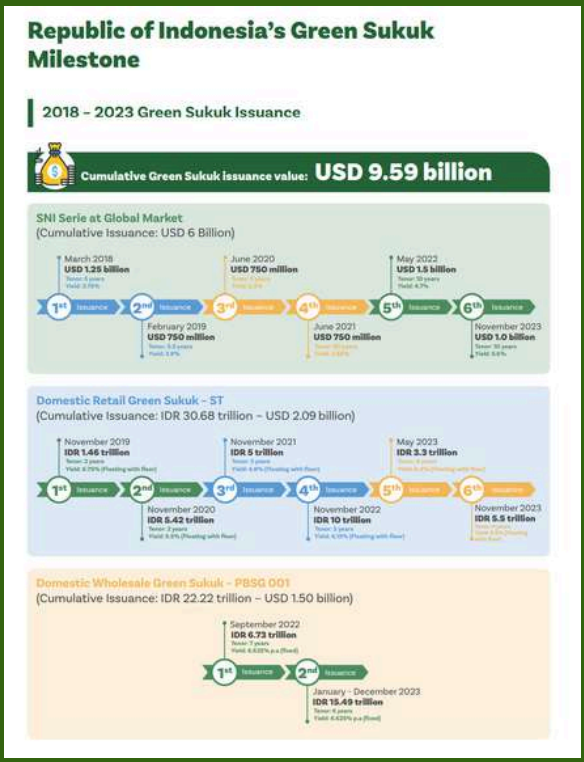
8.4 Green bond and green sukuk schemes in Indonesia.

Blended finance is an innovative solution to the challenge of financing green infrastructure projects that require large amounts of capital but carry high risks. It combines funding from public, private and philanthropic sources to reduce risk and attract more investors. A successful example of blended finance in Indonesia is the Cirata Floating Solar Power Plant project in West Java, which became an important milestone in the development of national renewable energy. With a total value of USD 140-145 million, the project is managed by PT Pembangkitan Jawa Bali Masdar Solar Energi (PMSE), a joint venture between PLN Nusantara Power with 51% ownership and Masdar UAE with 49% ownership. This joint venture structure represents a strong collaboration between an Indonesian state-owned enterprise and an international investor with experience in renewable energy development. Commercially, Cirata Floating Solar Power Plant has a capacity of 192 MWp.





Green bonds and green sukuk have become a significantly growing financing instrument in the green bond and green sukuk market since their initial issuance in 2018 in Indonesia. As a country with the largest Muslim population in the world, Indonesia became a global pioneer by issuing the world's first sovereign green sukuk. This development shows the government's strong commitment in supporting sustainable infrastructure financing through Islamic and conventional financial instruments. From 2018 to 2023, Indonesia has shown consistency in issuing green sukuk, both in the global and domestic markets. This achievement can be seen from the total cumulative value of issuance which reached USD 9.59 billion, consisting of global series issuance (SNI Serie), retail green sukuk (Green Sukuk-ST), and wholesale green sukuk (PBSG). Here are the details of Indonesia's green sukuk issuance milestones:

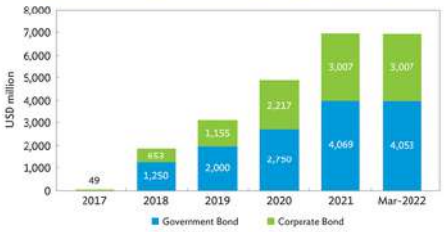






The development of Indonesia's sustainable bond market can also be seen from the composition of issuers, which is not only dominated by the government but also begins to involve the corporate sector. The following graph shows the growth of sustainable bond issuance based on the type of issuer from 2017 to 2022:

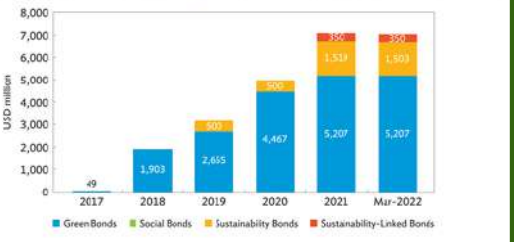
Figure 1: Sustainable Bonds Outstanding by Issuer Type



USD = United States dollar.
Note: All data as of 26 July 2022. Data were obtained using Bloomberg LP's SRCH function. The SRCH criteria included green bonds, social bonds, sustainability bonds, sustainability-linked bonds, and transition bonds.
Sources: *AsianBondsOnline* and Bloomberg LP.

In a broader context, sustainable financing instruments in Indonesia have grown to be diverse, including green bonds, social bonds, sustainability bonds, and sustainability-linked bonds. This diversification indicates the growing maturity of Indonesia's sustainable finance market, as shown in the following chart:

Figure 2: Sustainable Bonds Outstanding as a Share of the Sustainable Finance Market



USD = United States dollar.
Note: All data as of 26 July 2022. Data were obtained using Bloomberg LP's SRCH function. The SRCH criteria included green bonds, social bonds, sustainability bonds, sustainability-linked bonds, and transition bonds.

CHAPTER 9

GREENWISE POSITION IN SUPPORTING SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR



9.1 Infrastructure sector sustainability consulting and assessment.

Indonesia is a developing country with a vast geographical area and currently requires adequate infrastructure to support development, reduce regional disparities, and improve the quality of life for its population. The Indonesian government has prioritized infrastructure development as a key component of national development. The shift in Sustainable Development Goals highlights the importance of integrating ESG (Environmental, Social, and Governance) aspects across all sectors, including infrastructure. The Investors are increasingly directing their investments toward projects that generate positive ESG impacts.

The objective of applying ESG principles in Indonesia's infrastructure sector is to demonstrate that development is not solely focused on economic growth but also considers environmental sustainability and social impact. By adopting ESG principles, the government can enhance the quality of life in a sustainable manner. Implementing ESG standards also aims to strengthen institutional capacity in managing infrastructure projects responsibly and transparently while ensuring active stakeholder involvement in the development process.

Infrastructure that fails to consider sustainability aspects can negatively impact the environment and society, leading to increased carbon emissions, natural resource exploitation, and social inequality due to community displacement. Integrating ESG into infrastructure development reflects Indonesia's commitment to supporting global development goals while maintaining a balance between economic growth, environmental conservation, and social well-being.

Greenwise Consulting serves as a strategic partner for companies and the government in adopting ESG principles for infrastructure projects. One of the main challenges in ESG implementation within the infrastructure sector is the lack of understanding of sustainability standards and how to integrate them into project planning and execution. To address this, Greenwise collaborates with various stakeholders and provides training programs and workshops that help them understand the importance of ESG and how to implement it effectively. For example, Greenwise has collaborated with DJPI, KIAT, and ARUP in an educational workshop on validation, identifying barriers to infrastructure decarbonization in Indonesia.

9.2 Collaboration with strategic partners for green technology development.

Green technology refers to environmentally friendly and low-carbon technology designed to reduce carbon emissions, which contribute to climate change. It represents a paradigm where industrial activities not only produce goods and services but also consider their environmental impact. The development of green technology is also a key driver in achieving the Sustainable Development Goals (SDGs), particularly Goal 9.

The implementation of green technology is essential for realizing sustainable infrastructure. As the global community grapples with the escalating challenges of climate change and environmental degradation, the role of green technology in advancing sustainability has become increasingly crucial.

Greenwise Consulting actively collaborates with strategic partners, including technology companies, research institutions, government agencies, and non-governmental organizations. These collaborations aim to accelerate the adoption of innovative solutions for green infrastructure development that is more efficient and environmentally sustainable.

Greenwise Consulting partners with several technology startups, such as RackCorp, demonstrating a commitment to providing sustainability solutions to its clients through the implementation of best-practice technology. Additionally, Greenwise participates in research initiatives to develop more efficient and sustainable low-carbon construction methods.

Greenwise also collaborates with financial institutions, such as the Fiscal Policy Agency, to create green financing schemes that support sustainable infrastructure projects. ESG-based project funding aims to encourage more companies to invest in green technology and sustainable solutions.

9.3 Regulatory and policy advocacy related to green infrastructure.

In support of Indonesia's Vision 2045, the Indonesian government continues to promote the implementation of sustainable development, as outlined in the National Long-Term Development Plan (RPJPN) 2025-2045. One concrete step in this effort was the bilateral negotiation between Indonesia and Germany on October 1, 2019, which resulted in the Green Infrastructure Initiative (GII). This initiative aims to support Indonesia's efforts to reduce greenhouse gas emissions sustainably by providing a Financial Cooperation (FC) facility over five years, with a total value of up to EUR 2.5 billion. The funding supports environmentally and climate-relevant infrastructure projects through subsidized loans and promotional loans, which are channeled via the German Development Bank (KfW).

Green infrastructure is a promising solution for building a sustainable future by utilizing natural elements such as vegetation, plants, parks, and water flow systems to address urban challenges. Beyond its environmental benefits, green infrastructure plays a crucial role in maintaining and enhancing biocapacity while considering social, cultural, and economic aspects to improve overall quality of life.

Sustainability in the infrastructure sector is not solely dependent on technological innovation but also on regulations and policies that support ESG implementation. Greenwise is actively involved in policy advocacy to promote more progressive regulations related to green infrastructure development. As part of this effort, Greenwise collaborates with stakeholders, including regulators, industry associations, and international institutions, to design policies that accelerate the transition toward sustainable infrastructure. Some key initiatives undertaken by Greenwise include developing policy recommendations on fiscal incentives for green projects and standardizing sustainability certification for construction companies.



9.4 LESTARI as End-to-End Sustainability Management

As a consulting firm committed to sustainability, Greenwise offers end-to-end sustainability management solutions through its flagship product and service, LESTARI. Greenwise developed LESTARI to support sustainability and ESG aspects. LESTARI stands for Leading Emission Sustainability Tracking and Reporting Initiatives, a platform designed by Greenwise with the support of experts in sustainability technology.

LESTARI streamlines ESG data processing and analysis, reducing manual work and accelerating data-driven decision-making for companies to meet regulatory requirements and global standards while unlocking new investment opportunities. Its user-friendly and easily accessible interface enhances stakeholders' ability to monitor accountability and transparency across business activities.

Key advantages of LESTARI include securing sensitive corporate data through sovereign cloud technology, ensuring compliance with local regulations, and offering a tailored end-to-end solution to meet specific corporate needs. It also supports sustainability reporting in line with global standards such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). Additionally, the system is equipped with data analytics technology to enhance ESG reporting accuracy and efficiency.

With LESTARI, companies can identify ESG opportunities and challenges within their operations, develop risk mitigation strategies, and ensure regulatory compliance, strengthening their sustainability efforts.

CHAPTER 10

EXPECTATIONS AND NEEDS OF SUSTAINABILITY AND ESG ASPECTS IN THE INFRASTRUCTURE SECTOR



10.1 Alignment of national regulations with global ESG standards.

Indonesia's infrastructure sector must align its regulatory framework with global ESG (Environmental, Social, and Governance) standards to ensure compatibility with international investment and trade practices. This alignment is critical for attracting foreign direct investment (FDI) and accessing global green financing mechanisms. Key steps include (ada kotak-kotak bagan):

- **Harmonizing Policies:** Updating national policies, such as the RPJMN 2025-2029 and sector-specific regulations, to incorporate internationally recognized ESG frameworks like the UN Sustainable Development Goals (SDGs), G20 Principles for Quality Infrastructure Investment, and OECD guidelines.

- **Standardization:** Adopting standardized ESG reporting metrics (e.g., GRI, SASB) for infrastructure projects to enhance transparency and comparability with global benchmarks.

- **Capacity Building:** Strengthening the expertise of regulatory bodies and local governments in implementing and enforcing ESG-compliant policies.

For example, the OJK Green Taxonomy can be expanded to include more detailed sector-specific criteria, ensuring alignment with the EU Taxonomy and other international standards. This will facilitate cross-border investments and reduce barriers for Indonesian projects in global markets.

Prediction: By 2027, Indonesia will enforce stricter ESG disclosure mandates for infrastructure projects, aligning with global frameworks like the EU Taxonomy and IFRS S2, while carbon pricing mechanisms will reshape financing decisions. Firms should conduct regulatory gap analyses and develop compliance roadmaps to help clients adapt, while engaging in policy advocacy to shape practical ESG standards and upskilling leadership teams on emerging reporting requirements.

10.2 Improving the competitiveness of green infrastructure in the international market.

To position Indonesia as a leader in sustainable infrastructure, the following strategies are essential:

- **Certification and Labeling:** Promoting certifications like Greenship (GBCI) and ISO 14001 for infrastructure projects to enhance their appeal to international investors and buyers.

- **Innovation Hubs:** Establishing centers of excellence for green technology (e.g., renewable energy, smart grids) to foster innovation and export potential.

- **Showcase Best Practices Projects:** Highlighting successful projects such as the Cirata Floating Solar Power Plant and IKN's green construction to demonstrate Indonesia's capabilities in sustainable development.

- **Collaboration with international partners,** such as the Green Infrastructure Initiative (GII) with Germany, can also provide access to advanced technologies and funding, further boosting competitiveness.

In the future global investors will increasingly favor ESG-certified projects by 2030, with green financing premiums and benchmarks like IKN's sustainable development setting new market expectations. Companies must pursue international green certifications (e.g., LEED, Greenship), benchmark against regional peers, and position themselves for ESG-linked due diligence to attract foreign capital and secure contracts in ASEAN smart city initiatives.



10.3 Fiscal and non-fiscal incentives for companies that implement sustainability.

To accelerate ESG adoption, the government and financial institutions should introduce targeted incentives:

Fiscal Incentives:

- Tax reductions or exemptions for projects meeting ESG criteria (e.g., renewable energy, waste management).
- Green bonds and sukuk with preferential interest rates for sustainable infrastructure.

Non-Fiscal Incentives:

- Streamlined permitting processes for ESG-compliant projects.
- Priority access to government contracts and PPP schemes.

The Ministry of Finance's ESG Framework and Manual can serve as a foundation for designing these incentives, ensuring they align with national priorities like the Enhanced NDC targets.

In the future tax incentives (5–10% reductions) for ESG-compliant projects and expanded government guarantees for green PPPs will be policy priority for government, making sustainability a financial imperative. Firms should leverage advisory services to map available incentives, structure PPPs to maximize subsidies, and integrate carbon credits into revenue models, ensuring projects meet thresholds for viability gap funding and low-cost SDG-linked loans.



10.4 Mindset transformation from exploitation to regenerative development.

A paradigm shift is needed to move beyond minimizing harm (sustainability) to actively restoring ecosystems and communities (regenerative development). Key actions include:

- Education and Advocacy: Integrating regenerative principles into academic curricula and professional training programs.
- Community Engagement: Involving local communities in co-designing infrastructure projects to ensure social equity and environmental restoration.
- Circular Economy: Scaling up initiatives like plastic-asphalt roads and construction waste recycling to embed circularity in infrastructure life cycles.

Examples like the Eddington SuDS project in Cambridge illustrate how infrastructure can provide multifunctional benefits (flood control, biodiversity, aesthetics), serving as a model for Indonesia.

Regulatory shifts toward circular economy mandates and community-co-designed infrastructure will redefine project success by 2035, prioritizing net-positive environmental and social outcomes. Consulting firm must guide clients in adopting regenerative practices–such as modular construction and nature-based design–while embedding stakeholder engagement tools and ESG-linked executive KPIs to align long-term profitability with ecological and social restoration.

The infrastructure sector stands at a critical juncture, where sustainability and ESG integration are no longer optional but fundamental to long-term viability and growth. Indonesia's ambitious development goals–coupled with tightening global ESG standards–**demand immediate action from businesses to align with the needs of a low-carbon, socially inclusive** in the business ecosystem. The risks of falling behind are real: stranded assets, lost financing opportunities, and exclusion from high-value projects, **public and private need to think that sustainability ecosystem is tools to manage project / business risk**, and the rewards for early movers are even greater: access to green capital, enhanced brand reputation, and a competitive edge in both domestic and international markets. To meet these needs, businesses must act decisively–starting with a comprehensive ESG audit, investing in workforce upskilling, and embedding circular economy principles into project lifecycles.



BIBLIOGRAFY

A Artiningsih, N. C., Putri, M., Muktiali, S., & Ma'rif. (2019). Infrastructure Development Financing Scheme: Unconventional Infrastructure Development in Semarang City. Retrieved from https://riptek.semarangkota.go.id/index.php/riptek/article/download/61/54

Ahli KPBU Indonesia. (2024). Mengenal PLTS Cirata yang diklaim sebagai PLTS terbesar se-Asia Tenggara, terbesar ketiga di dunia. Retrieved from https://www.ahlikpbuindonesia.or.id/berita-dan-kegiatan/mengenal-plts-cirata-yang-diklaim-sebagai-plts-terbesar-se-asia-tenggara-terbesar-ketiga-di-dunia-part-1/

Antara News. (2024). PLTS Terapung Cirata masuk tahap financial close, bersiap konstruksi. Retrieved from https://www.antaranews.com/berita/2305146/plts-terapung-cirata-masuki-tahap-financial-close-bersiap-konstruksi

Asian Development Bank. (2024). Green bond market survey Indonesia. Retrieved from https://www.adb.org/sites/default/files/publication/843491/green-bond-market-survey-indonesia_0.pdf

Asian Development Bank. (2024). Indonesia Infrastructure Finance Facility. Retrieved from https://documents1.worldbank.org/curated/en/361681490865386287/pdf/Indonesia-Infrastructure-Financing-Facility-Project.pdf

Bamford, L. (2023, May 25). How to ensure sustainability in infrastructure: Best practice for project success. Planning, Building & Construction Today. Retrieved from https://www.pbctoday.co.uk/news/energy-news/sustainability-in-infrastructure-cambridge-university-press-and-assessment/127152/

Bappenas. (2020). National Medium-Term Development Plan (RPJMN) 2020–2024. Ministry of National Development Planning. Retrieved from https://faolex.fao.org/docs/pdf/ins204723.pdf

Bappenas. (2025). National Medium-Term Development Plan (RPJMN) 2025–2029. Ministry of National Development Planning. Retrieved from https://bappenas.go.id/datapublikasishow?q=Rencana+Pembangunan+dan+Rencana+Kerja+Pemerintah&s=&jenis=RPJMN&tahun=2025

Bappenas. (2023). Regulation of the Minister of National Development Planning/Head of Bappenas 7/2023.

BINUS University. (2024). Blue bond dan green bond: Instrumen keuangan untuk masa depan berkelanjutan. Retrieved from https://maksi.binus.ac.id/2024/06/30/blue-bond-dan-green-bond-instrumen-keuangan-untuk-masa-depan-berkelanjutan/

Bisnis.com. (2021). Butuh US$145 juta, ini sumber pendanaan PLTS Terapung Cirata. Retrieved from https://ekonomi.bisnis.com/read/20210804/44/1425563/butuh-us145-juta-ini-sumber-pendaaan-plts-terapung-cirata

Bisnis Hijau. (2025). Potensi 84 GW PLTS apung, kapan dimanfaatkan? Retrieved from https://hijau.bisnis.com/read/20250219/652/1840872/potensi-84-gw-plts-apung-kapan-dimanfaatkan

BPKP. (2024). PLTS Terapung Cirata bentuk komitmen pemerintah wujudkan net zero emission 2060. Retrieved from https://www.bpkp.go.id/id/berita/eL08/plts-terapung-cirata-bentuk-komitmen-pemerintah-wujudkan-net-zero-emission-2060

Cakti, A. (2024, April 22). PUPR: Penerapan green material di pembangunan IKN kurangi emisi karbon. Antaranews. Retrieved from https://www.antaranews.com/berita/4068393/pupr-penerapan-green-material-di-pembangunan-ikn-kurangi-emisi-karbon

CAT Net Zero Target Evaluations. (2023). Retrieved from https://climateactiontracker.org/global/cat-net-zero-target-evaluations/

Clough, H. (2023, January 30). How innovative sustainable drainage systems (SuDS) can help cities keep their heads above water. Planning, Building & Construction Today. Retrieved from https://www.pbctoday.co.uk/news/building-control-news/how-innovative-sustainable-drainage-systems-suds-can-help-cities-keep-their-heads-above-water/120551

CNBC Indonesia. (2021). Raup pendanaan, Sumitomo CS PLTS Terapung Cirata operasi 2022. Retrieved from https://www.cnbcindonesia.com/news/20210804102117-4-265971/raup-pendanaan-sumitomo-cs-plts-terapung-cirata-operasi-2022

CNBC Indonesia. (2023). Ini dia 7 PLTS terapung terbesar dunia, RI nomor berapa? Retrieved from https://www.cnbcindonesia.com/research/20231110165308-128-488150/ini-dia-7-plts-terapung-terbesar-dunia-ri-nomor-berapa

CNBC Indonesia. (2023). PLTS Terapung Cirata sukses, RI bakal lelang 2 proyek lagi. Retrieved from https://www.cnbcindonesia.com/news/20231110113125-4-488006/plts-terapung-cirata-sukses-ri-bakal-lelang-2-proyek-lagi

CNBC Indonesia. (2023). PLTS terapung terbesar ASEAN ada di RI, ini dia pemiliknya. Retrieved from https://www.cnbcindonesia.com/news/20231110122954-4-488019/plts-terapung-terbesar-asean-ada-di-ri-ini-dia-pemiliknya

CNBC Indonesia. (2024). Usai Cirata, PLN bakal bangun PLTS terapung di 3 daerah ini. Retrieved from https://www.cnbcindonesia.com/news/20240530181013-4-542552/usai-cirata-pln-bakal-bangun-plts-terapung-di-3-daerah-ini

CSIS. (2024). Ekonomi hijau dalam visi Indonesia 2045. Retrieved from https://s3-csis-web.s3.ap-southeast-1.amazonaws.com/doc/5763ekonomi-hijau-dalam-visi-indonesia-2045.pdf?download=1

David Baxter. (2022, May 19). A strong enabling environment can integrate ESG into infrastructure investments. Global Infrastructure Hub. Retrieved from https://www.gihub.org/articles/a-strong-enabling-environment-can-integrate-esg-into-infrastructure-investments/

Detik News. (2024). Serba-serbi PLTS Terapung Cirata, terbesar se-Asia Tenggara, ketiga di dunia. Retrieved from https://news.detik.com/berita/d-7034844/serba-serbi-plts-terapung-cirata-terbesar-se-asia-tenggara-ketiga-di-dunia

Direktorat Jenderal Pengelolaan Pembiayaan dan Risiko Kementerian Keuangan. (2024). Laporan kinerja. Retrieved from https://www.djppr.kemenkeu.go.id/laporankinerja

Direktorat Jenderal Pengelolaan Pembiayaan dan Risiko Kementerian Keuangan. (2024). Media files. Retrieved from https://api-djppr.kemenkeu.go.id/web/api/v1/media/3A8FFD55-C75B-4695-B7E7-A0A87A3927D1

Direktorat Jenderal Pengelolaan Pembiayaan dan Risiko Kementerian Keuangan. (2024). Media files. Retrieved from https://api-djppr.kemenkeu.go.id/web/api/v1/media/A99E2679-3F9D-4AA1-956C-D98CC2963BFD

Direktorat Jenderal Pengelolaan Pembiayaan dan Risiko Kementerian Keuangan. (2024). PLTS Terapung Cirata benchmarking program dukungan penjaminan pemerintah di sektor energi terbarukan. Retrieved from https://www.djppr.kemenkeu.go.id/PLTSTerapungCirataBenchmarkingProgramDukunganPenjaminanPemerintahDiSektorEnergiTerbarukan

DPR RI. (2024). Berkas dokumen. Retrieved from https://berkas.dpr.go.id/akd/dokumen/K7-12-632ccc1ea2eeff3d76398b6e56181f5b.pdf

Economic Research Institute for ASEAN and East Asia (ERIA). (2023). Infrastructure for Inclusive Economic Development Volume 1: Lessons Learnt from Indonesia. Retrieved from https://www.eria.org/research/infrastructure-for-inclusive-economic-development-vol1-lessons-learnt-from-indonesia

Environmental Protection Agency. (2023). Community Involvement in Environmental Decision Making.

European Commission. (2023, October). Carbon Border Adjustment Mechanism (CBAM). Retrieved from https://trade.ec.europa.eu/access-to-markets/en/news/carbon-border-adjustment-mechanism-cbam

Febrilla, T. H., Negara, K. P., & Hasyim, M. H. (2024, January 11). Analisis Limbah Konstruksi dengan Pendekatan Ekonomi Sirkular (Studi Kasus: Proyek Pembangunan Gedung RSGM Universitas Brawijaya dan Gedung RSI Surabaya). University of Brawijaya. Retrieved from https://repository.ub.ac.id/id/eprint/207321/

Garuda Yamato Steel. (2024, September 26). Mengenal Proyek Konstruksi Hijau dan Contohnya di Indonesia. Retrieved from https://www.garudayamatosteel.com/id/blog/mengenal-proyek-konstruksi-hijau-dan-contohnya-di-indonesia/

Global Reporting Initiative. (2021). Sustainability Reporting Standards.

Hallegatte, S., Rentschler, J., & Rozenberg, J. (2019). Lifelines: The Resilient Infrastructure Opportunity. World Bank. Retrieved from http://hdl.handle.net/10986/31805

Harvard Business Review. (2021). The Role of Academia in Sustainability Innovation.

IESR. (2024). PLTS Cirata siap beroperasi: Tonggak penting bagi akselerasi pengembangan energi surya untuk dekarbonisasi kelistrikan di Indonesia. Retrieved from https://iesr.or.id/plts-cirata-siap-beroperasi-tonggak-penting-bagi-akselerasi-pengembangan-energi-surya-untuk-dekarbonisasi-kelistrikan-di-indonesia/

Incorporating Global Sustainability Best Practices into Infrastructure Projects. (n.d.). FAST-Infra Label. Retrieved from https://www.fastinfralabel.org/news/incorporating-global-sustainability-best-practices-into-infrastructure-projects

International Finance Corporation. (2022). Public-Private Partnerships for Sustainable Infrastructure.

ITrade CGSI. (2024). Gandeng Masdar UEA, PLN bentuk kajian ekspansi PLTS Terapung Cirata. Retrieved from https://itrade.cgsi.co.id/gandeng-masdar-uea-pln-bentuk-kajian-ekspansi-plts-terapung-cirata

ITrade CGSI. (2024). Presiden: PLTS Terapung Cirata terbesar ketiga di Asia Tenggara. Retrieved from https://itrade.cgsi.co.id/presiden-plts-terapung-cirata-terbesar-ketiga-di-asia-tenggara

Katadata. (2025). Infrastructure Development Shrinks in Prabowo Era. Retrieved from https://katadata.co.id/infografik/67ac0dd0969d6/infografik-pembangunan-infrastruktur-menciut-di-era-prabowo

Kementerian Energi dan Sumber Daya Mineral. (2021). Indonesia's Renewable Energy Roadmap. Retrieved from https://www.esdm.go.id/en/publication/renewable-energy-roadmap

Kementerian ESDM. (2024). Capai financial close, PLTS Terapung Cirata mulai tahap konstruksi. Retrieved from https://www.esdm.go.id/id/media-center/arsip-berita/capai-financial-close-plts-terapung-cirata-mulai-tahap-konstruksi

Kementerian ESDM. (2024). Capai financial close, PLTS Terapung Cirata mulai tahap konstruksi. Retrieved from https://www.esdm.go.id/en/media-center/news-archives/capai-financial-close-plts-terapung-cirata-mulai-tahap-konstruksi

Kementerian ESDM. (2024). PLTS Terapung Cirata tingkatkan bauran EBT. Retrieved from https://www.esdm.go.id/id/berita-unit/direktorat-jenderal-ketenagalistrikan/plts-terapung-cirata-tingkatkan-bauran-ebt

Kementerian ESDM. (2024). Tarif kian kompetitif, pemerintah utilisasi potensi PLTS terapung 9,16 GW. Retrieved from https://www.esdm.go.id/id/media-center/arsip-berita/tarif-kian-kompetitif-pemerintah-utilisasi-potensi-plts-terapung-916-gw-

Kementerian ESDM. (2024). Wujud etalase percepatan transisi energi, PLTS Terapung Cirata bakal resmi beroperasi. Retrieved from https://www.esdm.go.id/id/media-center/arsip-berita/wujud-etalase-percepatan-transisi-energi-plts-terapung-cirata-bakal-resmi-beroperasi

Kementerian Keuangan. (2022). Kerangka Kerja Lingkungan, Sosial, dan Tata Kelola (LST) pada Dukungan dan Fasilitas Pemerintah untuk Pembiayaan Infrastruktur.

Kementerian Keuangan. (2025). Mainstreaming ESG dalam Pembiayaan Infrastruktur.

Kementerian Lingkungan Hidup. (2022, October 2). Enhanced NDC: Komitmen Indonesia untuk Makin Berkontribusi dalam Menjaga Suhu Global. Retrieved from https://ppid.menlhk.go.id/berita/siaran-pers/6836/enhanced-ndc-komitmen-indonesia-untuk-makin-berkontribusi-dalam-menjaga-suhu-global

Kementerian Perindustrian. (2018). Peraturan Menteri Perindustrian Republik Indonesia Nomor 39 Tahun 2018 tentang Tata Cara Sertifikasi Industri Hijau.

Komite Percepatan Penyediaan Infrastruktur Prioritas. (2025). Retrieved from https://kppip.go.id/peraturan-terkait/

Kompas Lestari. (2024). Penyaluran pembiayaan berkelanjutan capai Rp 1.959 triliun pada 2023. Retrieved from https://lestari.kompas.com/read/2024/09/15/190000186/penyaluran-pembiayaan-berkelanjutan-capai-rp-1.959-triliun-pada-2023

Kompas. (2024). Ekspansi PLTS Terapung Cirata dan solusi energi berkelanjutan. Retrieved from https://www.kompas.id/baca/ekonomi/2024/08/20/ekspansi-plts-terapung-cirata-dan-solusi-energi-berkelanjutan

Kominfo Jawa Timur. (2024). Presiden Jokowi resmikan PLTS Terapung Cirata 192 MWp terbesar di Asia Tenggara. Retrieved from https://kominfo.jatimprov.go.id/berita/presiden-jokowi-resmikan-plts-terapung-cirata-192-mwp-terbesar-di-asia-tenggara

Kontan. (2024). PLTS Terapung Cirata bakal beroperasi November 2022. Retrieved from https://industri.kontan.co.id/news/plts-terapung-cirata-bakal-beroperasi-november-2022

Leatherman, S., Ferris, T. G., Berwick, D., Omaswa, F., & Crisp, N. The role of quality improvement in strengthening health systems in developing countries. International Journal for Quality in Health Care.

Matovu et al. (2013). Strengthening health workforce capacity through work-based training. BMC International Health and Human Rights, 13(8).

McKinsey & Company. (n.d.). Buckets of Innovation: How Digital Has Transformed a Mining Company in Indonesia. Retrieved from https://www.mckinsey.com/industries/metals-and-mining/our-insights/buckets-of-innovation-how-digital-has-transformed-a-mining-company-in-indonesia

METI IRes. (2024). Mengenal PLTS Terapung Cirata, terbesar se-Asia Tenggara dan ketiga di dunia. Retrieved from https://metiires.or.id/teknologi/mengenal-plts-terapung-cirata-terbesar-se-asia-tenggara-dan-ketiga-di-dunia/

Ministry of Public Works. (2009). Government Obligation to Provide Infrastructure. Retrieved from https://pu.go.id/berita/kewajibanpemerintah-menyediakan-infrastruktur

Mutu International. (2025, January 18). Kemenperin Luncurkan Standar Hijau untuk 17 Industri. Retrieved from https://mutucertification.com/kemenperin-luncurkan-standar-hijau-untuk-17-industri/

OECD. (2021). The Role of Public Engagement in Green Infrastructure.

OECD. (2023). Greening Infrastructure in Indonesia. Retrieved from https://www.oecd.org/content/dam/oecd/en/events/2023/10/7th-oecd-southeast-asia-policy-network-meeting-on-sustainable-infrastructure/Session%201_Sumedi%20Bappenas.pdf

OECD. (2023). Digital Infrastructure and Economic Growth in Indonesia. Retrieved from https://www.oecd.org/indonesia/digital-infrastructure-economic-growth-indonesia.htm

Otoritas Jasa Keuangan. (2021). Taksonomi untuk Keuangan Berkelanjutan Indonesia. Retrieved from https://ojk.go.id/id/berita-dan-kegiatan/info-terkini/Documents/Pages/Taksonomi-untuk-Keuangan-Berkelanjutan-Indonesia/Buku%20Taksonomi%20untuk%20Keuangan%20Berkelanjutan%20Indonesia%20%28TKBI%29.pdf

Pasar Dana. (2025). Tren pembiayaan hijau di Indonesia diproyeksi akan terus meningkat. Retrieved from https://pasardana.id/news/2025/2/21/tren-pembiayaan-hijau-di-indonesia-diproyeksi-akan-terus-meningkat/

Pemerintah Indonesia. (2024). Undang-Undang Nomor 59 Tahun 2024 tentang Rencana Pembangunan Jangka Panjang Nasional Tahun 2025–2045. Jakarta: Sekretariat Negara. Retrieved from https://indonesia2045.go.id

Pemerintah Provinsi Jawa Barat. (2024). Presiden Joko Widodo resmikan PLTS Terapung Cirata. Retrieved from https://jabarprov.go.id/berita/presiden-joko-widodo-resmikan-plts-terapung-cirata-penjabat-gubernur-jabar-bey-machmudin-11275

PLN Nusantara Power. (2024). Kupas tuntas PLTS Terapung terbesar di Asia Tenggara. Retrieved from https://www.plnnusantarapower.co.id/kupas-tuntas-plts-terapung-terbesar-di-asia-tenggara/

PLN Nusantara Power. (2024). PLTS terapung terbesar di ASEAN segera dibangun di Cirata. Retrieved from https://www.plnnusantarapower.co.id/plts-terapung-terbesar-di-asean-segera-dibangun-di-cirata/

PLN. (2020). Pembangunan PLTS Terapung Cirata 145 MW resmi dimulai. Retrieved from https://web.pln.co.id/cms/media/siaran-pers/2020/12/pembangunan-plts-terapung-cirata-145-mw-resmi-dimulai/

PLN. (2021). Raih pendanaan 3 bank internasional, konstruksi PLTS terapung terbesar di Asia Tenggara dimulai. Retrieved from https://web.pln.co.id/media/siaran-pers/2021/08/raih-pendanaan-3-bank-internasional-konstruksi-plts-terapung-terbesar-di-asia-tenggara-dimulai

PLN. (2023). Jadi pembangkit EBT skala besar, PLTS Terapung Cirata mampu kurangi 214 ribu ton emisi karbon per tahun. Retrieved from https://web.pln.co.id/media/siaran-pers/2023/11/jadi-pembangkit-ebt-skala-besar-plts-terapung-cirata-mampu-kurangi-214-ribu-ton-emisi-karbon-per-tahun

PLN. (2023). Profil PLTS Terapung Cirata. Retrieved from https://web.pln.co.id/cms/media/siaran-pers/2023/11/besok-diresmikan-presiden-ini-profil-plts-terapung-cirata/

Presiden Republik Indonesia. (2025). Peraturan Presiden Republik Indonesia Nomor 12 Tahun 2025 tentang RPJMN 2025–2029.

Presidential Official Press Release. (2025). President Prabowo Emphasizes The Importance Of Infrastructure Development For The National Economy. Retrieved from https://www.presidenri.go.id/siaran-pers/presiden-prabowo-tegaskan-pentingnya-pembangunan-infrastruktur-untuk-perekonomian-nasional/

PT PLN Nusantara Renewables. (2024). Portfolio: Cirata Floating PV. Retrieved from https://ptplnnr.com/id/profile/portfolio/detail/cirata-floating-pv

PT PLN Nusantara Renewables. (2024). Power purchase agreement ratified, PLTS Terapung Tembesi prepares to sell green electricity to PLN Batam. Retrieved from https://www.ptplnnr.com/en/news-and-articles/detail/power-purchase-agreement-ratified-plts-terapung-tembesi-prepares-to-sell-green-electricity-to-pln-batam

PT PLN Nusantara Renewables. (2024). President Joko Widodo inaugurates PLTS Terapung Cirata, the largest solar power plant in Southeast Asia. Retrieved from https://www.ptplnnr.com/news-and-articles/detail/president-joko-widodo-inaugurates-plts-terapung-cirata-the-largest-solar-power-plant-in-southeast-asia

Raden Intan Repository. (2024). Full skripsi. Retrieved from https://repository.radenintan.ac.id/31529/1/full%20skripsi.pdf

Setya, N. D. (2024, October 14). Pengelolaan Sampah Berbasis Ekonomi Sirkular dan Implikasinya bagi Indonesia: Studi Kasus Kota Balikpapan. Kementerian Keuangan. Retrieved from https://kpbu.kemenkeu.go.id/read/1220-1758/umum/kajian-opini-publik/pengelolaan-sampah-berbasis-ekonomi-sirkular-dan-implikasinya-bagi-indonesia

Standard Chartered. (2024). Sustainable energy. Retrieved from https://www.sc.com/id/sustainable-energy/

Transisi Energi Berkeadilan. (2024). Profil PLTS Cirata: Potensi mendorong industri dan bauran EBT nasional. Retrieved from https://transisienergiberkeadilan.id/news/main/detail/profil-plts-cirata-potensi-mendorong-industri-dan-bauran-ebt-nasional

Undip E-Journal. (2024). Artikel jurnal. Retrieved from https://ejournal2.undip.ac.id/index.php/jwl/article/download/16907/pdf

UNDP. (n.d.). Empowering Local Communities for the Sustainable Development. Retrieved from https://www.undp.org/vietnam/publications/empowering-local-communities-sustainable-development-sarcandra-glabra-improving-livelihoods-and-immune-health

UN Environment Programme. (2021). 2021 Global Status Report for Buildings and Construction: Towards a Zero-Emission, Efficient and Resilient Buildings and Construction Sector. Nairobi: UNEP.

UN Environment Programme. (2022). International Good Practice Principles for Sustainable Infrastructure. Nairobi: UNEP.

United Nations. (2015). Sustainable Development Goals.

Unnes Journal. (2024). Artikel jurnal. Retrieved from https://journal.unnes.ac.id/sju/ipmhi/article/download/77908/26265/

UNPRI. (2024, September 19). ESG Incorporation in Infrastructure – What Best Practice Looks Like. PRI. Retrieved from https://www.unpri.org/pri-blog/esg-incorporation-in-infrastructure-what-best-practice-looks-like/9453.article

USAID. (2023). Exploring Alternative Development Financing Schemes and Instruments: Background Study for the 2025–2045 Long-Term National Development Plan (RPJPN).

USAID. (2024). Alternative Instruments for Financing National Development: Inputs for the Preparation of the RPJMN 2025–2029.

Widowati, H. (2023, December 20). Kementerian PUPR Bangun Kompleks Rumah Ramah Lingkungan Bersubsidi. Katadata. Retrieved from https://katadata.co.id/ekonomi-hijau/ekonomi-sirkular/65824983d7d50/kementerian-pupr-bangun-kompleks-rumah-ramah-lingkungan-bersubsidi

Wicaksono, A. (2024, March 9). Prinsip Ekonomi Sirkular Dorong Pembangunan Jalan Aspal Plastik Sejauh 120,8 Km. Medcom.id. Retrieved from https://www.medcom.id/ekonomi/sustainability/GKdP9ldK-prinsip-ekonomi-sirkular-dorong-pembangunan-jalan-aspal-plastik-sejauh-120-8-km

Wijayanto, A. K., Wicaksono, A., & Mahandara, A. (2023, October 24). ESG dan Masa Depan Bisnis: Mengapa Ini Penting? Adco Law. Retrieved from https://adcolaw.com/id/blog/esg-dan-masa-depan-bisnis-mengapa-ini-penting

Wikipedia. (2024). PLTS Terapung Cirata. Retrieved from https://id.wikipedia.org/wiki/PLTS_Terapung_Cirata#Pembangunan

World Bank. (2019). EFI Tip Sheet: Maximizing Climate Co-benefits in MTI Operations.

World Bank. (2020). Building Resilient Infrastructure for the Future.





Further Information

Phone
(+62)81287879838

Email
info@greenwise.co.id

Linkedin
Greenwise Consulting

Website
greenwise.co.id

Thank You For Your Attention

Prepared By

GREENWISE CONSULTING

Join us in building resilient and sustainable infrastructure for a better tomorrow.