Global Green Growth Institute

Renewable Energy

A Green Growth Assessment in Kalimantan

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foreword

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The Government of Central Kalimantan is committed to integrate green growth objectives into economic and development planning. In order to better understand the crucial links between economic growth and impacts on natural capital, the government has formed a partnership and technical collaboration with the Global Green Growth Institute (GGGI). Under this partnership, a framework and a suite of tools have been developed that can be used to help mainstream green growth into existing planning and investment appraisal processes.

This booklet titled “Renewable Energy: A Green Growth Assessment in Kalimantan” is one product of this partnership. It is based on a longer technical report which assesses the monetary costs and benefits associated with renewable energy projects in Central and East Kalimantan. It is a valuable guide to policymakers as it summarizes the main results and recommendations of the report.

This report also complements other efforts by BAPPEDA Central Kalimantan and GGGI to integrate green growth objectives into planning documents. These include the report on "Central Kalimantan: moving towards green growth" and two district-level Green Growth Strategies for Murung Raya and Pulang Pisau.

Achieving green growth relies to a large extent on the capability of an economy to produce clean energy. At the same time we also need to secure sufficient supply of electricity in Kalimantan. In Central Kalimantan, a significant number of households are still lacking access to the power grid. But the generation of electricity is still mainly based on fossil – fuel based technologies such as diesel and coal.

This is a timely report to show the potential contribution of renewable energy sources toward achieving both energy security and a cleaner environment. Using extended Cost Benefit Analysis (eCBA), the study presents monetary values of costs and benefits associated with four renewable energy technology projects in Central and East Kalimantan. The results of this study have also implications for the energy situation of Kalimantan as a whole economic corridor.

I hope that this report will stimulate a wider public discussion on the viability of clean energy options in Kalimantan.

Key Messages

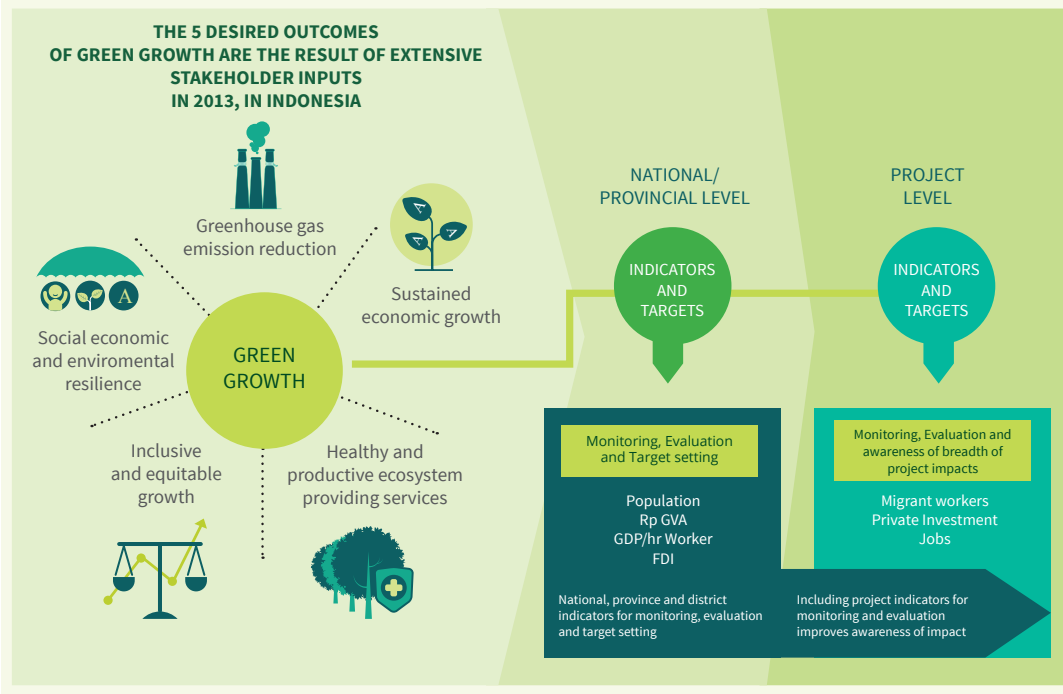
- We have conducted an extended Cost Benefit Analysis (eCBA) on four renewable energy projects in Central and East Kalimantan (Micro Hydro, Solar PV, Biomass (woodchip), Biogas (POME)) and considered the wider benefits of increased renewable power generation for Kalimantan as a whole.
- Potential green growth benefits associated with policy interventions in the four projects are substantial, with economic rate of returns above 25% under certain assumptions.
- For the off-grid projects, local communities mostly benefit from clean lighting, local business development and emissions reductions. For the on-grid project, the benefits center on the avoided fossil fuel generation costs and GHG emissions.
- Off-grid projects require substantial public support to make them attractive. Support measures include capital grants and technical and managerial support to local communities and governments.
- The larger, on-grid or private power producer projects are more attractive, but could be even more attractive with end-user tariffs or feed-in tariffs that reflect the full economic and environmental cost of generation.
- Based on indicative technical potential, green growth benefits could be scaled up to USD 1 – 9 bn a year across Kalimantan (3 – 16% of GDP). This would require investment of USD 10 – 57 bn, of which at least USD 6- 39 bn would need to come from public funds.

Introduction

A fundamental objective of the GoI-GGGI program is to mainstream green growth within Indonesia's economic and development planning processes. To this end, the Green Growth Program is developing a framework and toolkit that can be used by a variety of government agencies especially those involved in planning and economic activities, including investment appraisals. This framework, developed with stakeholders in 2013 and 2014, aims to make green growth performance measurable in terms of the five desired outcomes below, using a series of national, regional and project-level indicators.

Green Growth Assessments, including extended Cost Benefit Analysis (eCBA), are tools developed to measure and compare the green growth performance of investments. Extensive stakeholder consultation has been undertaken to support measurement.

The toolkit can be used at a high-level to prioritise projects with high green growth potential, or those that would benefit from a green growth re-design. At a more detailed level, the toolkit can be used for Green Growth Assessment at the project level using economically rigorous tools such as eCBA.



eCBA is a way of systematically comparing economic, social and environmental costs and benefits. It helps decision makers to answer questions such as:

- What is the green growth performance of the project as it is currently designed?
- What is the value to the economy, society and the environment of this performance?

How can we re-design a project to improve its green growth performance?

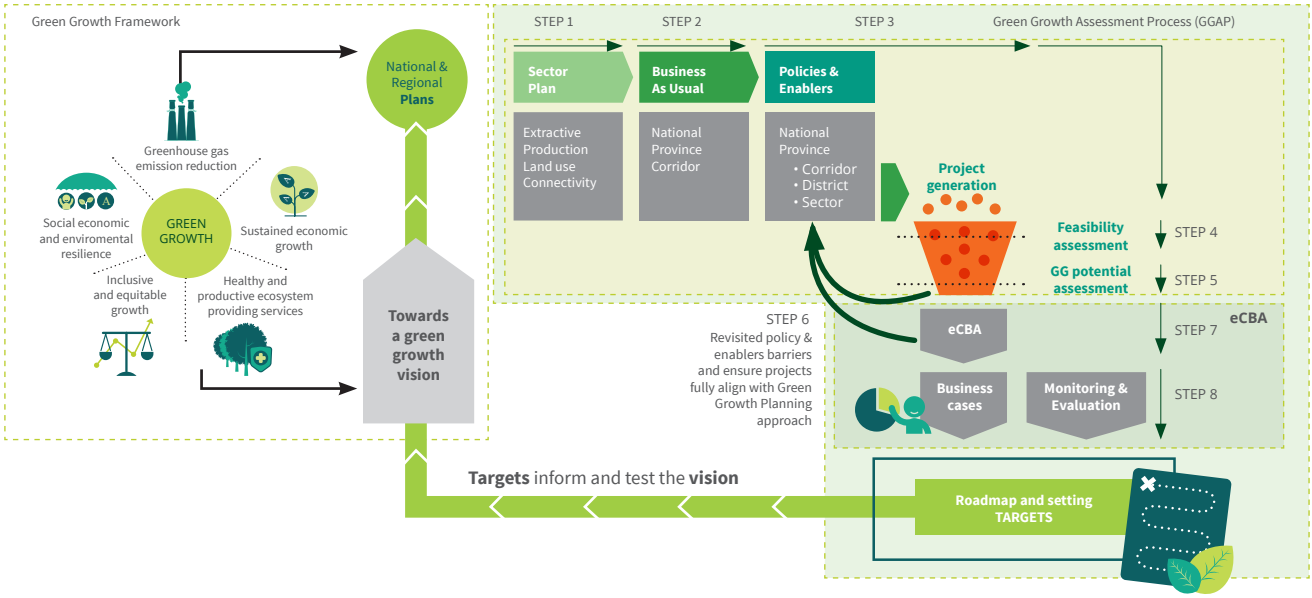
What are the synergies and trade-offs in re-designing a project ?

How much capital investment is required to achieve this improved performance?

What policy instruments are needed to drive investment and behavioral change?

We have performed a Green Growth Assessment of four renewable energy projects in Central and East Kalimantan.

We applied the eCBA method to understand the scope of opportunity to re-design the project, improving social, economic and environmental outcomes. A full technical report outlining the context, methodology and findings in detail is available upon request to the Joint Secretariat of the Green Growth Program.



The practical implementation of this extended Cost Benefit Analysis involved 7 steps

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Identify project baseline	Identify small green growth options	Map impact pathways	Collect data	Extended Cost Benefit Analysis	Validate findings	Consider implications
Consult project stakeholders Review project documentation	Consult project stakeholders Literature review	Identify outputs, outcomes and impacts Assess materiality, identify scope for eCBA	Collect data from project documentation, local market, and international technology	Quantify costs and benefits of green growth interventions Value cost and benefits to society	Validate findings with stakeholders	Consider implications of results for policy Consider implications for project re-design and investment

Renewable Energy in Kalimantan

The 'economic corridor' of Kalimantan represents a zone of activities focusing on the production and processing of national mining and energy reserves.

At present, Kalimantan relies heavily on fossil fuels including diesel and coal for on-grid power (see chart), and diesel generator sets for off-grid power. The deployment of renewable capacity on and off grid is likely to bring substantial benefits and drive broader green growth. Diversifying Kalimantan's fuel mix towards more renewable energy will not only increase rural electrification rates, but also create benefits by avoiding social and environmental costs, as carbon emissions from coal-fired power generation will be reduced. Specific social, economic and environmental benefits identified from the four case studies here include:

Better health

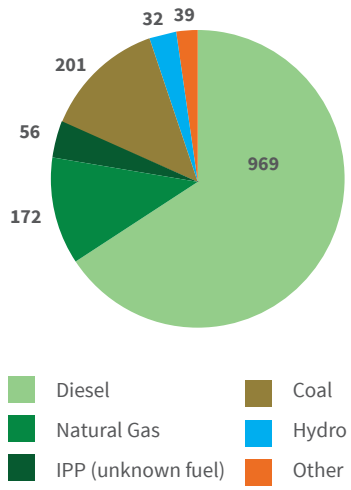
Higher household income

Lower emissions

Better educational outcomes

Business **Development**

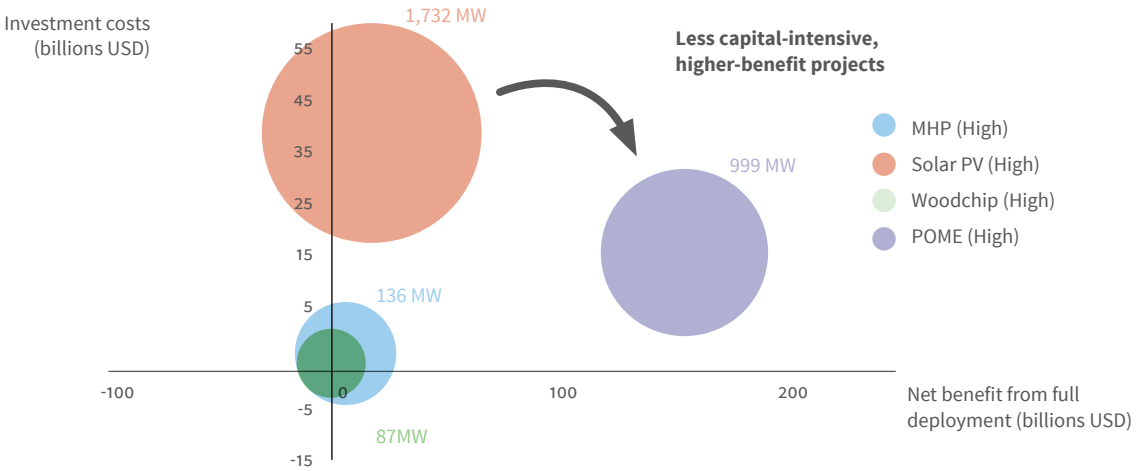
Kalimantan Power Capacity (MW) in 2012



The size of these benefits across the Kalimantan corridor has been obtained by indicatively scaling-up the benefits calculated from the four case studies (see next section). We estimate that annual average net social benefits of USD USD 1 - 9 bn (3-16% of GRDP) are realizable. This would require 'overnight' investment of USD 10 - 57 bn today, in order to deploy around 1,600 – 3,000 Megawatts (MW) across the four identified technologies.

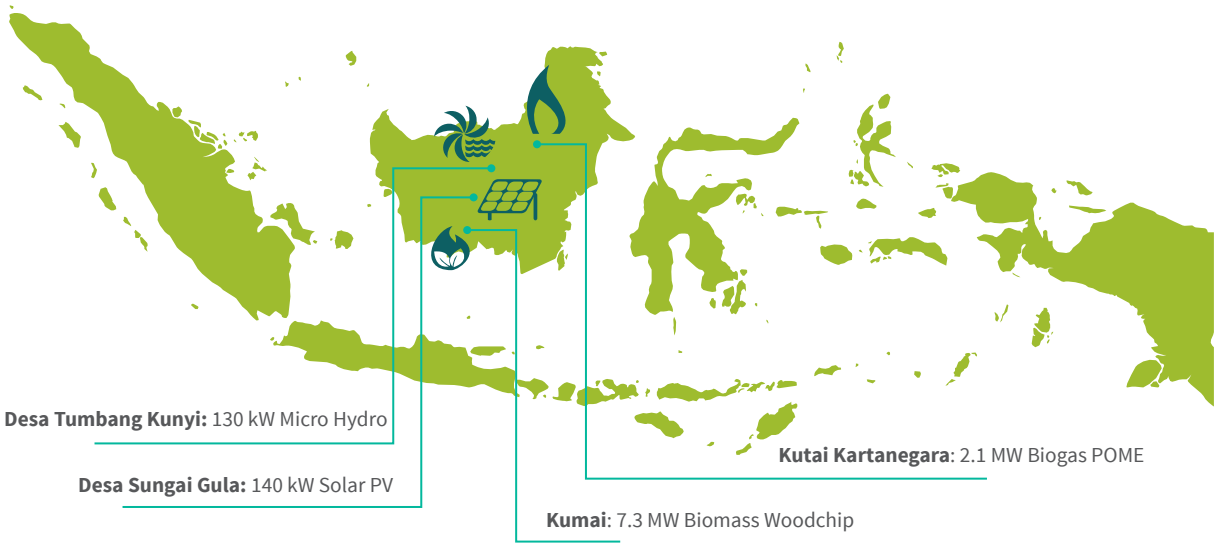
It should be noted that these results should not be interpreted as saying that some technologies are better than others. Different applications of power (villages, mills) in different locations have different needs, requiring assumptions that are subject to uncertainty, specifically in regard to physical, engineering and linear scale-up costs. Moreover, future capex costs of these four technologies, especially solar PV, might be declining quicker than anticipated. But given limited public and private funds, the results of the study do hint at a potential plan for prioritizing investment in the short-term. Further research is needed to create an integrated renewable energy strategy for Kalimantan.

Supporting policy incentives and broader reforms are crucial in realizing these benefits. The upper end of this range of benefits is illustrated below.



Note:
Bubble area is proportional to total Megawatts potentially deployable

Green Growth Assessment Of Four Renewable Energy Projects



The **micro hydro (MHP)** project is planned to be installed in the village of Tumbang Kunyi, Sumber Barito district, Murung Raya regency, Central Kalimantan. Based on the feasibility study, a 130 kW plant is proposed, which would supply electricity to around 400 homes and 40 other users over a low-voltage mini-grid. Previously, communities were relying on diesel generators and kerosene lamps for power. A not-for-profit community co-operative is expected to run the plant financed by a capital grant from provincial government.

The **solar PV** project is an early-stage analysis in the village of Sungai Gula, Permata Intan district, Murung Raya regency, Central Kalimantan. A 140 kW Solar PV array is proposed here, which would supply power to around 300 homes, also over a low-voltage mini-grid. Currently, some households have diesel gensets and some have no power at all. The village is expected to shortly uptake a mini-grid 140 kW diesel generator in the absence of renewables investments. The business model is yet to be determined but it is expected that local government would fund the capital costs.

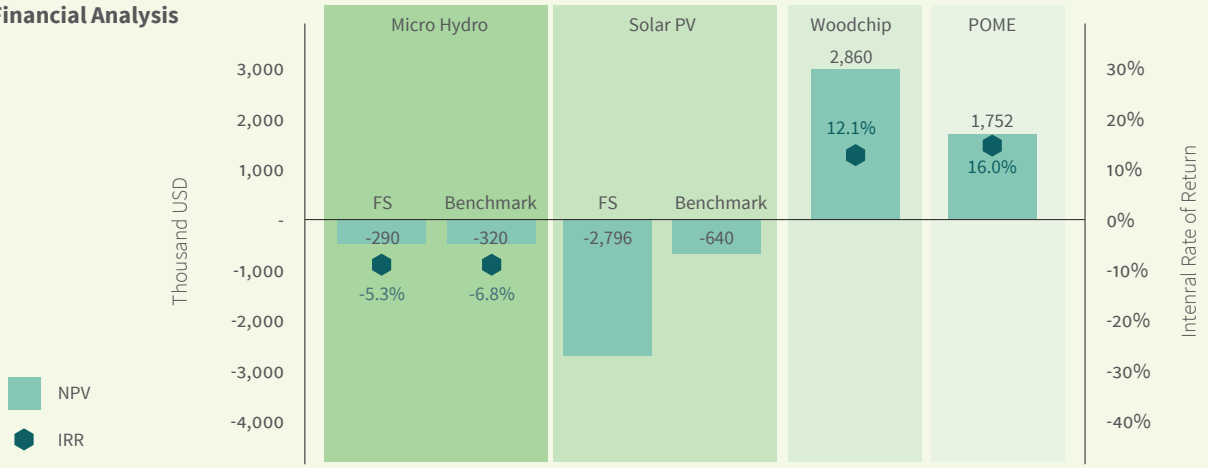
The **biomass (woodchip)** project in Natai Peramuan village, Kumai district, Kotawaringin regency, Central Kalimantan was registered under the UN Clean Development Mechanism in 2012, and uses waste residue from chipping operations to power a 7.3 MW biomass generator. The electricity generated powers the chipping mill and the excess power (around half the kWh) is sold back to PLN on the grid. Without this project, the chipping mill would buy power from the grid, which in Central Kalimantan is diesel and coal dominated. Although the project is CDM-registered, it has not issued any carbon credits to date.

The **biogas (Palm Oil Mill Effluent; POME)** project in Muai village, Kembang Janggut district, Kutai Kartanegara regency, East Kalimantan, has been operational since 2012, and captures biogas from wastewater treatment in a palm oil mill. The biogas is fed to two biogas engines with generator sets with a total capacity of 2.1 MW to power the palm oil mill. There is no excess power, and any excess biogas is flared in an enclosed system. Prior to the project, the electricity was generated with a biomass boiler running on palm kernel shell and palm oil fibro as well as a number of diesel generator sets. The project is CDM-registered and has issued 27,782 CERs to date.

Results

Looking solely at the cash flows expected from these four projects, and based on a range of assumptions, two technologies (micro hydro, and solar PV) are likely to be unattractive to private investors: both generate negative Internal Rate of Return (IRR). Biomass (woodchip) and biogas (POME) are more attractive to private investor with IRRs of 12.1% and 16.0%.

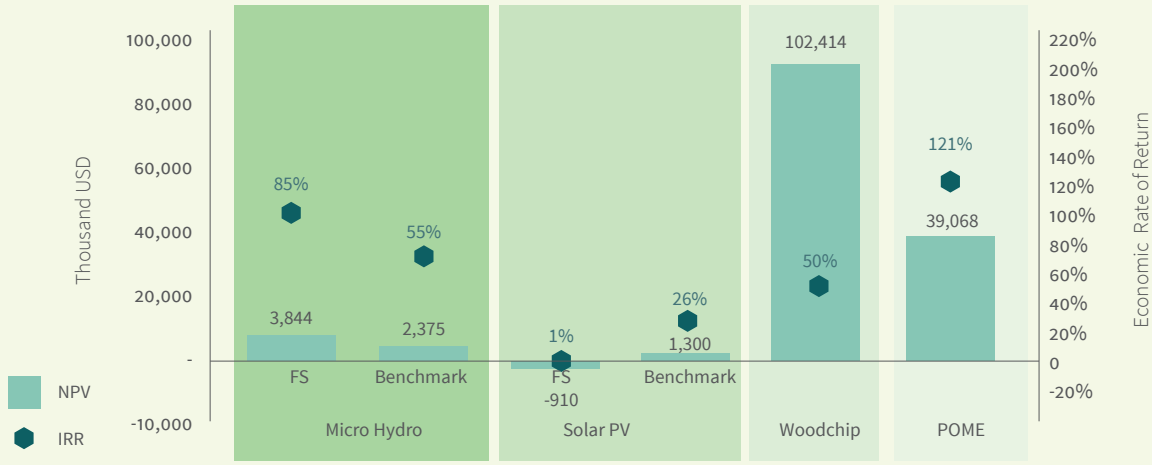
Financial Analysis



Note: FS = Feasibility Study data. Benchmark = Substituting some FS data for international benchmarks

But, taking into account social, economic, and environmental benefits, the four renewable energy technologies generate positive Economic Rates of Return (ERR), with most generating an ERR above 25%.

extended Cost Benefit Analysis



Overall the key benefits, which are also representative of other renewable projects, can be broken down as follows:

- **Economic Growth benefits of USD 83m:** the value of avoided generation cost by PLN (and associated subsidy by Ministry of Finance) and diesel and kerosene fuel savings for local communities, minus capital and operational costs.
- **Social Development benefits of USD 1m:** the value of better educational attainment from longer and more productive studying hours, and better health from reduced indoor air pollution. Because these project are small in MW terms, these benefits appear small; but, they would be of an order of magnitude higher if the projects were replicated to the same level as the industrial projects.
- **GHG Emissions benefits of USD 61m:** reduced CO_2 emissions as kerosene and diesel displaced from village fuel mixes, and from reduced coal and diesel generation from on-grid power plants. The social cost of carbon is valued at USD 80/tCO_2.

Policy Implications

A number of policy interventions were identified to support investment in renewable energy projects in Kalimantan and more broadly across Indonesia, such as:

- **Improving financial performance**: revenue incentives such as feed-in tariff and carbon incentives; capital grants and subsidies; easier access to domestic and foreign capital.
- **Addressing technical and human capacity**: training of local technicians, certification of external parties, and national guidelines on feasibility studies.
- **Integrated planning**: Kalimantan-wide resource assessment and energy planning.
- **Reducing business and regulatory risks**: clearer identification of area to be electrified by PLN, faster permitting procedures.

The policy matrix below highlights the most important **barriers to the success of renewable energy projects** and the proposed policies to address them.

	Potential barrier to investment	Potential policy Intervention	Outcome	On-grid	Off-grid
Macroeconomic and market policies	Low financial viability	Reform diesel and power prices	Stronger incentive to uptake renewables	●	●
Financial investment policies	Access to capital	Debt guarantees for domestic lenders	Lower hurdle rates and better financial viability of investments	●	●
		Capital grants		●	○
Operational and enabling policies	Low technical expertise in design and operational stage	Capacity building and involvement of wider (including foreign) expertise	Well-designed and maintained projects	●	◗
	Poor resource data	Government investment in resource mapping and research	Lower development risk and higher investment	◗	●
Legal and regulatory policies	Lack of transparency in grid expansion plans	Clearer earmarking of PLN electrification budget to certain areas and better coordination between local PLN staff and local government	Avoiding stranded assets and reduced risk for investments	◗	●

● Frequently relevant ◗ Sometimes/often relevant ○ Rarely relevant

GoI – GGGI Green Growth Program

Government of Indonesia and Global Green Growth Institute (GGGI) have developed a program of activity that is aligned and wholly supportive of achieving Indonesia's existing vision for economic development planning.

The aim is to show, using real examples of Indonesia's development and investment plans at national, provincial and district levels, how economic growth can be maintained while reducing poverty and social inequality, maximizing the value of ecosystem services, reducing GHG emissions, and making communities, economies, and the environment resilient to economic and climate shocks.

The joint GoI and GGGI goal is:

"To promote green growth in Indonesia that recognizes the value of natural capital, improves resilience, builds local economies and is inclusive and equitable".

The specific objectives to achieve this goal are:

- To ensure the green growth vision matches or exceeds existing development targets;
- To track the green growth priorities of Indonesia by providing relevant targets and indicators;
- To evaluate the implications of the country's current development path against green growth targets and indicators and assessing projects and potential policy and investment interventions against this baseline;
- To identify the key sectors and high green growth potential projects and investment interventions that will help deliver green growth development;
- To harness private sector engagement and investment in support of delivering green growth opportunities in Indonesia;
- To undertake economic modeling to analyze each project showing their financial returns and identifying any gaps in the incremental spend required to secure green projects

For more information contact:

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www.gggi.org/indonesia-green-growth-planning/

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