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Institute

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Green Energy Development

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Abbreviations and acronyms

BAU	Business as usual
eCBA	Extended cost-benefit analysis
ESCO	Energy service company
GCF	Green Climate Fund
GGGI	Global Green Growth Institute
GGP&I	Green Growth Planning and Implementation
GHG	Greenhouse gas
GIS	Green Investment Services Unit
INDC	Intended Nationally Determined Contribution
IPSD	Investment and Policy Solutions Division
LEAP	Long-range Energy Alternatives Planning
NDC	Nationally Determined Contribution
NERM	National Energy Road Map (Vanuatu)
NFV	National financing vehicle
NPV	Net present value
OED	Operations Enabling Division
PS	Policy Solutions Unit
RFP	Request for proposal
SDG	Sustainable Development Goal
SO	Strategic outcomes
TL	Thought Leadership Office
TNA	Technology needs assessment

Chapter 1


Introduction

The Global Green Growth Institute (GGGI) works with and supports member countries across four thematic areas: green cities, water and sanitation, sustainable landscapes, and sustainable energy. These guidelines speak to issues in sustainable energy.

The energy sector has a dominant role in the transformation toward green growth, which is reflected in the Nationally Determined Contributions (NDCs) that involve more than 180 countries under the Paris Agreement. All the NDCs include actions related to energy and specific energy-focused targets. The Sustainable Development Goals (SDGs) recognize the role of the energy sector in poverty alleviation, improvement of health and wellbeing, employment creation, and economic growth. SDG7¹ explicitly targets sustainable and affordable access to reliable and modern energy for all.²

GGGI's work in the energy sector directly contributes to **four of GGGI's strategic outcomes (SO)** (Table 1).

Table 1 Sustainable energy and GGGI's strategic outcomes

THEMATIC AREA	THEMATIC FOCUS AREAS	INDICATIVE CONTRIBUTION STRATEGIC OUTCOMES (SO)					
		SO1: GHG reduction	SO2: Green jobs	SO3: Access to services	SO4: Air quality	SO5: Ecosystem services	SO6: Adaptation
 SUSTAINABLE ENERGY	1 Expanded access to affordable and sustainable energy services	○	○	○	○		
	2 Improved sustainable energy generation mix	○	○		○		
	3 Enhancement and integration of energy efficiency	○	○		○		○

Source: GGGI's Refreshed Strategic Plan (2016-2020), 36

Energy production and energy use account for around two-thirds of global greenhouse gas (GHG) emissions and are the largest single source of emissions. The energy sector is also a significant contributor to local air pollution, and member countries' transformation to green models in energy production, storage, and delivery enables capture of green jobs.

GGGI's energy strategy support explicitly recognizes that the NDCs and SDGs are at the core of combating climate change, reducing air pollution, and providing sustainable access to energy services through the following three priority areas:

1 | Expanded access to affordable and sustainable energy services.

2 | Improved sustainable renewable generation mix.

3 | Enhancement and integration of energy efficiency.

GGGI's partner countries can transform their energy sectors toward a more sustainable path, while meeting growing demands and a call for universal access to energy services. GGGI supports member countries in transforming the energy sector toward having a more sustainable and clean energy mix that provides affordable and reliable energy services for all and meets country targets and actions under the NDCs and SDG7. For this, GGGI works and supports to influence energy sector policy, strategic planning and origination, and implementation of investment vehicles and projects in line with the above-mentioned three priority areas of support.

¹ Sustainable Development Goal 7 – Access to sustainable and affordable energy service.

² GGGI, *Refreshed Strategic Plan (2016-2020): Accelerating the Transition to a New Model of Growth*, <http://gggi.org/wp-content/uploads/2017/11/GGGI-Refreshed-Strategic-Plan-2015-2020.pdf>.

1.1 Purpose of the guidelines

GGGI developed these Green Energy Development Guidelines to assist member countries in developing strategic green energy development plans and implementation road maps at every stage of the GGGI value chain. They serve as a reference for government officials, GGGI staff and consultants, development partners, and relevant stakeholders who are working on areas related to or looking to develop a project on green energy. They provide strategies to take toward green energy development, as well as processes to put these strategies into practice.

In summary, GGGI developed the Green Energy Development Guidelines to:

- Provide guidance on how GGGI member countries can conduct energy sectoral assessment, and carry out demand/supply mix forecasting; identify, prioritize, and strengthen mainstreaming of green, inclusive renewable energy and energy efficiency pathways into the national energy sector/subsector strategies and plans to achieve sustainable economic, social, and environmental development.
- Provide guidance to decision-makers on green energy planning and implementation tools, including objectives, targets, measurements, and monitoring and evaluation systems.

- Provide guidance on how to work with development partners and stakeholders along the GGGI's value chain in energy sector's support intervention.
- Highlight key GGGI service offerings to partner countries in their efforts to pursue green growth energy development.

The guidelines are organized as follows:

Chapter 2 presents GGGI's desired outcomes from support interventions under the energy thematic area, approaches to these support interventions, and projects' priority areas. Chapter 3 outlines a process for energy sectoral planning and green energy project development. The process outlines 12 major steps across the GGGI value chain, each with detailed explanation and schematics.

1.2 Definitions of keywords and phrases

Table 2 provides definitions of important words and phrases used in this document.

Table 2 Definitions of keywords and phrases used in the Green Energy Development Guidelines

IMPORTANT WORDS AND PHRASES	DEFINITIONS
Green growth	<ul style="list-style-type: none"> • A development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. It seeks opportunities for economic growth that are low-carbon and climate-resilient, prevent or remediate pollution, maintain healthy and productive ecosystems, create green jobs, reduce poverty, and enhance social inclusion.
Green energy development	<ul style="list-style-type: none"> • Energy sector/subsector development pathways that implement renewable energy (on- and off-/mini-grids) and energy efficiency projects rather than conventional fossil fuel energy projects.
GGGI's approaches for green energy development interventions	<ul style="list-style-type: none"> • GGGI uses a comprehensive inclusive green energy investment approach for its green energy development support to member countries. <ul style="list-style-type: none"> • On-grid, off/mini-grids, and/or off-grid (standalone) renewable energy projects: These refer to projects or investments that contribute to enhancing renewable energy production mix and focuses on either or both off/mini-grids and/or standalone renewable energy production in order to increase access to sustainable energy in poor rural areas of member countries, or encompasses main grid-based projects that enhance sustainable energy production in member countries. • Energy efficiency projects: These refer to projects or investments that focus on efficient uses of energy through promotion of energy efficiency in the public sector, such as developing regulations and building codes in the public sector which contribute to GHG reduction, resource requirement, and climate change mitigation. • Pursuing and choosing either/or both types of projects or interventions entirely depends on the member countries' specific needs. GGGI tailors its assistance to priorities of partner governments. • The approach systematically addresses four major issues for energy sectors in member and partner countries: lack of access to reliable and affordable energy, insecure energy supply, energy inefficiency, and air pollution.

IMPORTANT WORDS AND PHRASES

GGGI's value chain (see box 1 below)

DEFINITIONS

- It is the backbone of GGGI service offerings to member countries. Each component of the value chain is followed by a systematic appraisal process that captures learning, sharing, and application of experience and knowledge from programs, and ensures the robustness of GGGI advice and assistance. The four major phases are:
 - **Phase I – Diagnosis**
 - **Phase II – Green impact assessment**
 - **Phase III – Sector/subsector strategy and planning**
 - **Phase IV – Design, financing and implementation**

- GGGI's value chain sets out a green growth energy sectoral planning and implementation approach for all four phases.

Service offerings

- GGGI service offerings are products or services derived from the GGGI value chain and offered to member country governments. The service offerings are designed to establish a prerequisite to the next step of the value chain. The extent to which they drive the process forward is the main determinant of their value.
- All service offerings are sufficiently standardized and delivered through either the inclusive green energy approach or the green energy investment approach, depending on the needs and priorities of member country governments.

Bankable green energy projects

- Renewable energy and energy efficiency projects are identified as technically and financially viable, as well as environmentally sustainable and socially inclusive.

Steps in the planning and development process of green energy programs and their projects

- The green energy planning and development process has 12 major steps, which are continuously built and interconnected through four interlinked phases along the GGGI value chain.
 - **Phase I (steps 1 to 6)** – This is important for guidance on how to undertake planning green energy development programs. The steps include energy sector/subsector baseline assessments, energy demand projection, supply mix forecasting, identification of green energy pathways, prioritization, synthesis of findings, and preparation of member countries' green energy plans.
 - **Phase II (steps 7 and 8)** – This includes energy sectoral policy and market assessment, as well as design and development of national green energy deployment programs. The steps involved are important in bridging green energy plan creation (Phase III) and designing, financing, and implementing green energy projects (Phase IV).
 - **Phase III (steps 9 to 11)** – This covers pre-feasibility and feasibility studies, and access to financing for projects.
 - **Phase IV (step 12)** – This is essential for designing, financing, and implementing green energy projects.
- Box 1 provides an illustration of the 12 steps and their corresponding phases on the GGGI value chain.

Implementation partners

- GGGI's development partners primarily focus on implementing on-grid and off-/mini-grid renewable energy projects and energy efficiency projects.

Box 1 Steps in green energy development through the 4 phases of the GGGI value chain

The GGGI value chain provides the basis for service offerings that the institute delivers to partner countries. It consists of four major phases: diagnosis; green impact assessment; sector/subsector strategy and planning; and design, financing and implementation. The figure below illustrates key steps under these processes to develop green energy programs and projects for GGGI's energy thematic area.

PHASE I: DIAGNOSIS

Reviews and assesses macroeconomic, policy, and institutional setup in partner countries' energy sector/subsectors.

PHASE II: GREEN IMPACT ASSESSMENT

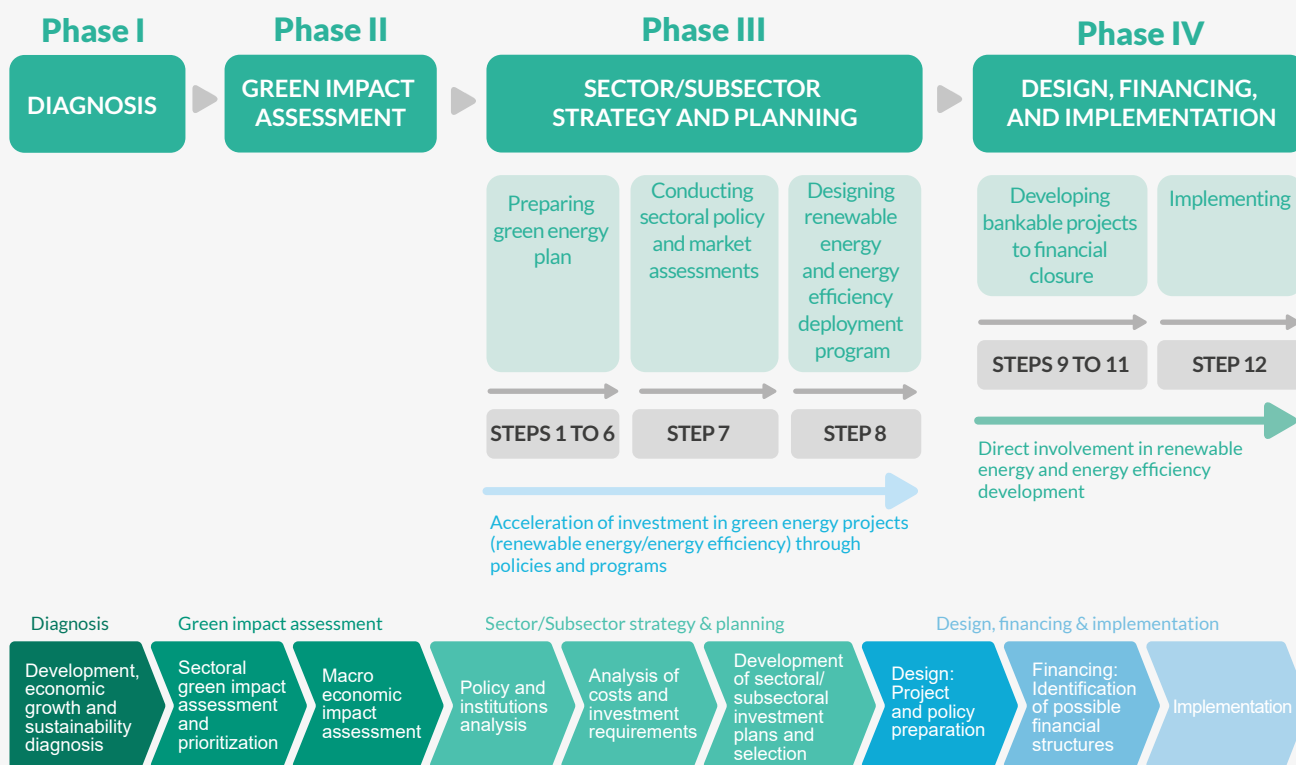
Assesses the implications of green energy pathways on economic, social, and environmental sustainability which includes also an assessment of renewable energy resources and energy efficiency measures.

PHASE III: ENERGY SECTOR/SUBSECTOR STRATEGY AND PLANNING

Involves assessing energy sector baselines, gaps, and needs, as well as forecasting the energy demand and renewable generation mix supply, followed by identifying and prioritizing green energy pathways for partner countries. Interventions focus on facilitating and creating enabling environments to accelerate and catalyze investment for renewable energy and energy efficiency projects.

PHASE IV: DESIGN, FINANCING AND IMPLEMENTATION

Focuses on supporting member governments in developing pipelines of bankable green energy projects that lead to financing and project implementation. GGGI provides support in designing, structuring, and arranging financing capital. Support includes designing national financing vehicles and financial instruments to accept and effectively use climate finance toward green energy projects.



1.3 How to use the guidelines

GGGI developed the Green Energy Development Guidelines based on its experience in providing support to green energy development efforts in member countries. The guidelines are neither a manual nor a step-by-step toolkit. Rather, they offer general guidance for the process of identifying, prioritizing, planning, and implementing green energy development pathways along the GGGI value chain. GGGI advises users to use additional guidance, handbooks, and tools during the planning and implementation of renewable energy and energy efficiency projects to grasp in-depth knowledge and skills.

GGGI recommends reading the Green Energy Development Guidelines completely to understand them thoroughly, as they provide major concepts and an overview on how to conduct green energy sectoral planning and development — which focuses on renewable and energy efficiency projects — and mainstream this into member countries' national energy development plans. However, given the wide range of coverage within 12 steps, depending on the knowledge and skill level of the users, the guidelines can be used to meet specific needs of users. For instance, users in member countries where green energy development plans already exist may not need guidance for steps 1 to 6. These users may start with steps 7 and 8. Similarly, users in member countries that have recently conducted major pre-feasibility and feasibility studies of green energy projects may not need guidance for steps 9 and 10. These users may start with step 11.

1.4 Target users of the guidelines

The Green Energy Development Guidelines aim to support GGGI's staff who are working on green energy projects in member countries and help member countries mainstream

green energy development into their national energy sector's development plans. In addition, the guidelines can also be useful for international and national development partners, agencies, private sector partners, and individual experts who work closely with GGGI's energy thematic team.

In addition, the guidelines give a set of recommended actions to policymakers, project managers, green energy practitioners, and development partners, while allowing flexibility and customization in the country of practice.

1.5 Why green energy development?

Lack of access to energy affects all aspects of development (e.g. economic, social, and environmental) and quality of life. Improvements in the standard of living include increased agricultural output, enhanced industrial output, and the provision of efficient transportation, adequate shelter, health care, and other human services, all of which require access to energy. Therefore, provision of sustainable energy is an important requirement to sustainable economic and social development.

In addition, fossil fuel energy systems are major contributors to climate change, accounting for two-thirds of global GHG emissions. Price volatility and logistical concerns, among others, mean that fossil fuels have a negative impact on energy security.

Together, these challenges indicate a need to transition to a low-carbon energy sector, which lies at the heart of the green economy and green growth agenda for both emerging and industrialized economies.



Chapter 2

GGGI and green energy development

Energy is one of the major strategic thematic areas of GGGI. The energy sector plays a dominant role in the promotion and implementation of green growth. As mentioned above in the introduction section, the dominant role of the energy sector in the transformation toward green growth is reflected in the submission of NDC covering more than 180 countries preceding the Paris Agreement. In addition, all of the INDC submissions include action related to energy, and around 50 percent of NDCs include specific energy-related targets to combat climate change.³

2.1 Energy's desired strategic outcomes

GGGI supports member countries in transforming the sector toward a more sustainable and clean energy mix that provides affordable and reliable energy services for all and meets country targets and actions under the NDCs and SDG7.

GGGI supports member countries in transitioning toward sustainable and renewable energy sources, and enhances energy efficiency to reduce GHG emissions (strategic outcome 1), improves air quality (strategic outcome 4), and contributes to increased energy access to sustainable services (strategic outcome 3). The transition in the energy sector gives rise to opportunities for the creation of green jobs (strategic outcome 2) in member countries. GGGI works across the private and public sectors to foster transformation toward a more sustainable and green energy sector that facilitates local opportunities for the creation of green energy jobs to ensure that GGGI's partner countries capture benefits from global technology development beyond the specific energy sector outcomes. Green energy jobs also contribute to the reduction of energy production and delivery costs and to the development of a sustainable energy sector. GGGI is in the process of developing and applying innovative approaches that support countries in the development of green jobs in the transformation of the energy sector, and will update the guidelines accordingly.

As presented in Table 3, through the energy sector, GGGI aims to support member countries in achieving four strategic outcomes.⁴

Table 3 GGGI's strategic outcomes and energy sector contribution

STRATEGIC OUTCOMES OF GGGI	ENERGY SECTOR CONTRIBUTION
Strategic outcome 1, GHG emission reduction	Reduction in GHG emissions by shifting to renewable energy production and energy efficiency
Strategic outcome 2, Creation of green jobs	Green jobs from the production of renewable technologies' components in partner countries
Strategic outcome 3, Increased access to green, affordable energy	Expansion of access to energy by all through additional renewable energy production
Strategic outcome 4, Improved air quality	Reduction in particles per million through transfer from coal and fossil fuel to renewable clean energy production and energy efficiency

³ GGGI (2017), *Thematic Strategies: Focusing GGGI Work for Greater Impact*.

⁴ GGGI (2017), *GGGI's Refreshed Strategic Plan (2016-2020): Accelerating the Transition to a New Model of Growth*, <http://gggi.org/wp-content/uploads/2017/11/GGGI-Refreshed-Strategic-Plan-2015-2020.pdf>.

2.2 GGGI's guiding principles on service delivery

GGGI provides in-country service aligned with its guiding principles of being objective, independent, and demand-driven.

GGGI energy project activities emphasize inclusiveness, considering the impact of proposed programs and projects on the poor and the vulnerable through a formal process and mechanism to provide for the inclusion of such groups and ensure they benefit from investments. Other GGGI principles in energy programs and project interventions include the following:

- GGGI's engagement is demand-driven and focuses on solving the government's priority problems in the energy sector/subsectors without being partial to particular energy technologies, suppliers, and/or financiers.
- GGGI focuses on building on existing systems/structures and markets in member countries to catalyze renewable energy and energy efficiency programs incorporating best practices into channel investments. GGGI aims to develop and build on what is already in place in member countries, and works to influence current planning processes to pave the way for renewable energy and energy efficiency.
- GGGI's approach is flexible, enabling it to link to and collaborate with appropriate knowledge partners and with appropriate capacity development, project development, and financing institutions in the energy thematic area.

2.3 GGGI's major activities in energy service delivery to achieve energy outcomes

GGGI will work to achieve its energy strategic outcomes through the following major activities:

- Strengthen green energy concepts in the energy sector/subsector plan and policies at national and subnational levels.
- Support the realization of green energy plans and policies through the development and financial structuring of bankable projects, financial instruments, and financing vehicles.
- Improve multi-directional knowledge sharing and learning in green energy development.

Depending on the local government's needs in partner member countries, GGGI's country programs will focus on identifying policy, planning, and regulatory barriers to scaling up renewable energy, or removing financial barriers through specialized investment services for scaling renewable energy generation, access to sustainable energy services, and energy efficiency. GGGI's strategic outcomes for the energy sector are aligned with the member countries' energy targets and actions reflected in NDC commitments under the Paris Agreement and in SDG7.

More specifically, GGGI aims to:

- Identify the need for effective national and subnational energy sector/subsector planning, accompanied by effective financial and institutional frameworks to enable actions on the ground. Green energy development reflects this outcome by:
 - Assessing the partner country's energy sector/subsector, socio-economic, political, and environmental conditions to outline the technical background and status quo in relation to the energy sector's policies, strategies, and plans.
 - Ensuring that the energy policy framework is ready to provide a legitimate and enabling environment for green energy interventions.
- Increase green investment flows that are translated into concrete actionable green energy bankable projects focusing on both climate mitigation and adaptation. In this regard, the green energy development process focuses on the following:
 - The design and application of the investment prioritization framework and criteria, which identify a prioritized list of green energy investment options.
 - Comprehensive pre-feasibility and feasibility studies, which are conducted to access financing, as well as strong monitoring and evaluation systems, which must be built into the project and maintained throughout the process, from concept to implementation.
 - Social and environmental safeguards, which need to be assessed to ensure that GGGI-supported energy projects adhere to the necessary standards and allow for continuous learning and development for both GGGI and partner governments.

In the early stages of planning and project development, GGGI supports to influence and provide global best practices on safeguards and how to incorporate this into project design.

- Improve multi-directional knowledge sharing and learning between countries on green energy development. Effective knowledge management is built into the green energy development process – from the way it is developed to the products that it creates. The green energy development process is:
 - Developed in consultation with several key partners. This has enhanced internal knowledge sharing and has opened the way to a community of practice on green energy development.

- Not a static set of guidelines but a continuously evolving document that is refined over time for improvements based on South-South knowledge exchange. This is done through presentations or consultation workshops with participation from experts in interested countries.
- Elaborated in this guideline, making it easier to disseminate knowledge on green energy development among member countries and development partners. The guidelines give a set of recommended actions to policymakers, project managers, green energy practitioners, and development partners, while allowing flexibility and customization in the country of practice. The guidelines are communicated across a wide range of stakeholders and audiences, enhancing multi-directional knowledge sharing and learning.

2.4 Intervention approaches and major service offerings

GGGI's energy intervention prioritizes three areas: expanded access to affordable sustainable energy access, improved sustainable renewable energy generation mix, and enhancement and integration of energy efficiency.

The priority areas are identified in order to address major sector challenges in member countries, including lack of access to energy service, insecure energy supply and dependence on imported fossil fuels, and inefficient utilization of energy.

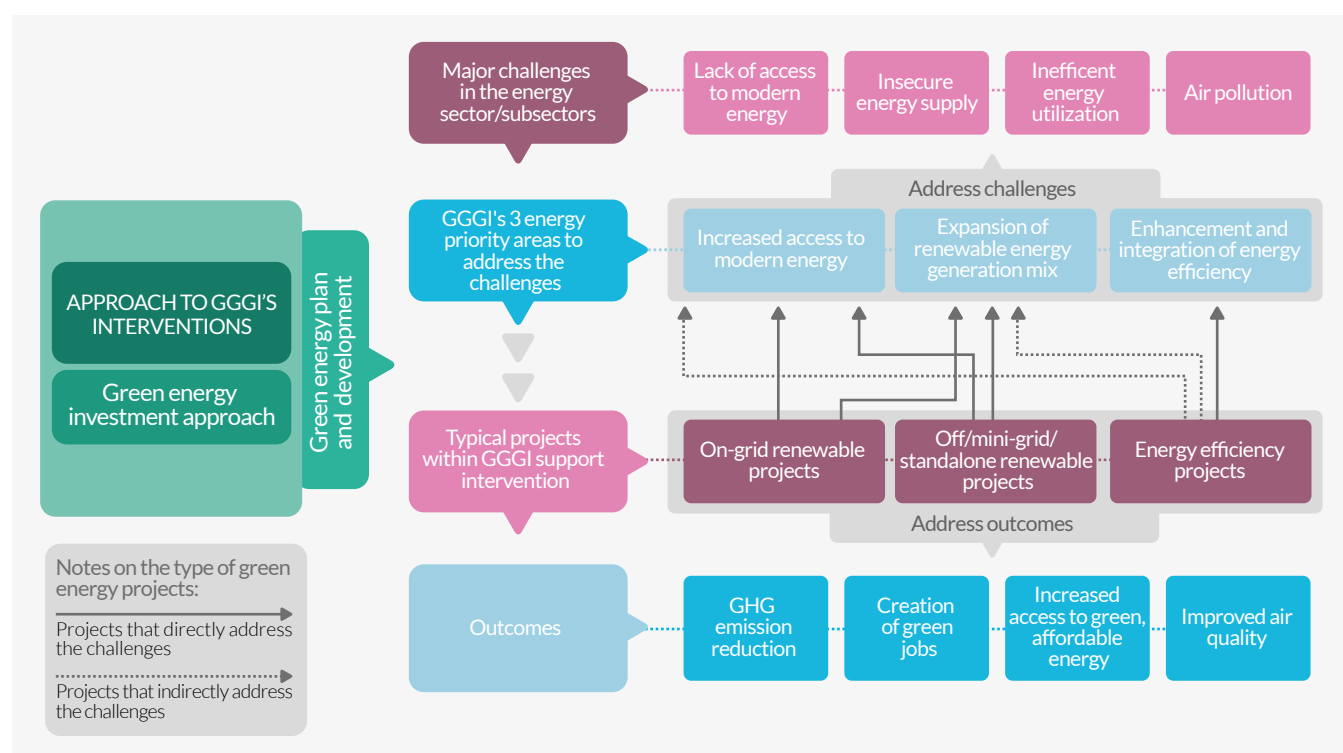
2.4.1 GGGI intervention approach: Inclusive green energy investment

GGGI follows a comprehensive inclusive green energy investment approach to providing green energy development support in member countries.

1. **On-grid, off/mini-grid, and/or off-grid (standalone) renewable energy projects.** These refer to projects or investments that contribute to enhancing renewable energy production mix and focuses on either or both off/mini-grids and/or standalone renewable energy production in order to increase access to sustainable energy to poor rural areas of member countries, or encompasses main grid-based projects, which enhance sustainable energy production in member countries.
2. **Energy efficiency projects:** These refer to projects or investments that focus on efficient uses of energy through promotion of energy efficiency in the public sector, development of regulations and building codes in public sector thereby contributing to GHG reduction and resource requirement, and climate change mitigation in member countries.

Choosing either or both types of projects or intervention support entirely depends on the member countries' specific needs. GGGI will continue to support the priority of partner governments. Figure 1 presents GGGI's energy intervention approach and priority areas to address the energy sector's challenges and meet the desired outcomes.

Figure 1 GGGI's approach and priority focus areas to address energy sector challenges and meet desired outcomes



2.4.2. GGGI's major service offerings in the energy thematic area

Table 4 summarizes major service offerings by GGGI to member countries in the energy thematic area.

Table 4 GGGI's major service offerings and examples of building track record and a pipeline of bankable energy projects

GGGI's priority areas for energy interventions	Main constraints of the energy sector/subsector in member countries	Major GGGI service offerings' focus areas	Examples of building track record with GGGI's green energy support	Pipeline of bankable green energy projects with arranged finance (based on NDC assessments) ⁵
<p>1 Expanded access to affordable sustainable energy services</p>	<p>High upfront costs in expanding the power utility network to rural areas accessing electricity services</p> <p>Unclear energy sector policies and implementation model directed at supporting energy access to rural areas</p>	<p>Overall:</p> <ul style="list-style-type: none"> Supports member countries in achieving affordable and sustainable energy access in line with SDG7 through the development and implementation of sustainable business models for main grid, off/mini-grid and off-grid (stand-alone) renewable energy projects through working with relevant development partners Assists governments in clarifying energy policies and regulations to improve access and mobilize investments Supports the exploration of investment opportunities targeting energy services for productive uses in agriculture and small-scale manufacturing, tourist, and food processing industries, which is particularly important for creating employment opportunities <p>Specific:</p> <ul style="list-style-type: none"> Supports the development of a pipeline of bankable green growth energy projects Assists in the design and structuring of commercially viable green energy projects that attract appropriate finance, and getting them financed Supports in structuring financial solutions that blend public/concessional finance and commercial/private finance in order to reduce risk and consequently support public and private parties with commercially viable green energy project structures 	<p>Fiji:⁶</p> <ul style="list-style-type: none"> Supported the development of the NDC implementation road map Initiated pre-feasibility studies for 100 percent renewable electricity in Fiji's third and sixth biggest islands <p>India: ^(7; 8)</p> <ul style="list-style-type: none"> Supported a green growth strategy project Green growth strategy for Karnataka – case studies including green energy options such as waste heat recovery electricity generation⁹ Assists in designing Access to Clean Energy (ACE) Fund to support off/mini-grids sector companies <p>Mozambique:</p> <ul style="list-style-type: none"> Supporting the development of renewable energy for productive uses in rural areas (focus on solar PV) <p>Vietnam:</p> <ul style="list-style-type: none"> Supported the development of biomass waste-to-energy provincial planning (in cooperation with GIZ) Supported the preparation of bankable projects, including biomass-to-energy electricity production 	<ul style="list-style-type: none"> India: Waste Heat Recovery Program - USD 100 million Indonesia (1): Development of Solar PV for West Nusa Tenggara – USD 75 million Indonesia (2): Palm Oil Mill Effluent (Waste-to-Energy Project) - USD 30 million Senegal: Waste-to-Energy Using Biogas Co-generation - USD 2 million Vietnam: Waste-to-Energy - USD 95 million

⁵ Central Asia Regional Economic Cooperation (CAREC) Program, <http://www.carecprogram.org/uploads/events/2017/08-ICT-for-Energy/Presentations/10%20GGGI%20and%20Green%20Finance.pdf>.

⁶ GGKP, *Fiji Fact Sheet*, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20Fiji%20-%20Implementation%20of%20the%20Green%20Growth%20Framework.pdf>.

⁷ GGNP, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20India%20-%20Mainstreaming%20and%20Implementation%20of%20GG%20Strategies%20-%20Karnataka.pdf>.

⁸ GGNP, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20India%20-%20Green%20Growth%20Planning%20Strategies.pdf>.

⁹ GGGI (2014), <http://www.nn4energy.in/images/5857e9832eaa6case2.pdf>.

GGGI's priority areas for energy interventions	Main constraints of the energy sector/subsector in member countries	Major GGGI service offerings' focus areas	Examples of building track record with GGGI's green energy support	Pipeline of bankable green energy projects with arranged finance (based on NDC assessments) ⁵
<p>1 Expanded access to affordable sustainable energy services</p>	<p>Fragile/unsustainable financial performance of power utilities</p> <hr/> <p>Weak governance of the energy sector</p>	<ul style="list-style-type: none"> Assists in designing innovative financial mechanisms often in the form of funds and instruments that reduce and possibly mitigate risks and overcome other barriers specific to green growth energy development Supports establishing dedicated vehicles capable of blending international and domestic sources of capital for financing green growth energy development Supports in prioritizing green energy projects and instruments that are impactful and are catalytic, i.e., they mitigate risk sufficiently to pave the way for private investment in the energy sector/subsector Assists in integrating social and environmental considerations into green energy projects, valuing and monetizing natural assets where possible 	<p>Indonesia:¹⁰</p> <ul style="list-style-type: none"> Supported the preparation of green growth renewable energy options in the East Kalimantan Province Supported the preparation of bankable renewable energy projects <p>Senegal:¹¹</p> <ul style="list-style-type: none"> Supported the country team in developing nine policy recommendations and a strategic plan for scaling up investments in the Energy for Productive Uses (E4PU) program <p>Vanuatu :^(12,13)</p> <ul style="list-style-type: none"> Supported the development of BAU energy demand projection Supported the development of a national financing vehicle to access climate finance 	<p>♦ Vanuatu:¹⁴</p> <p>Off-grid Rural Electrification Project Preparation Facility – USD 30 million</p>
<p>2 Improved sustainable renewable energy generation mix</p>	<p>Inadequate public sector financing to meet growing energy demand in member countries</p> <hr/> <p>Insecure energy supply and dependence on fossil fuel imports</p>	<p>Overall:</p> <ul style="list-style-type: none"> Supports in catalyzing private sector investments through optimizing the use of scarce concessional finance to scale up the deployment of low-carbon domestic renewable energy generation Supports in addressing energy sector challenges to increase the share of renewables in the energy mix through catalyzing private sector investments and optimizing the use of scarce concessional finance to scale up the deployment of low-carbon domestic renewable energy generation; where possible, opportunities to reduce currency mismatch risks will be explored <p>Specific:</p> <ul style="list-style-type: none"> All specific service offerings under priority 1 apply here as well 	<p>All examples under priority area 1 apply here as well</p>	<p>Pipeline of bankable projects under priority area 1 apply here as well</p>

¹⁰ GGGI (2014), *Renewable Energy Options in Kalimantan: A Green Growth Assessment*.

¹¹ GGGI (2016), http://report.gggi.org/2016/wp-content/uploads/2017/06/Energy_planning_and_modeling.pdf.

¹² GGKP, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20Vanuatu%20-%20Green%20and%20Inclusive%20Energy%20Reform.pdf>.

¹³ Government of Vanuatu's Department of Energy (2014), <https://doe.govvu/uploads/pub/BAU-Energy-Projection-for-Vanuatu-GGGI-2016.pdf>.

¹⁴ GGKN, Vanuatu Fact Sheet, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20Vanuatu%20-%20Green%20and%20Inclusive%20Energy%20Reform.pdf>.

GGGI's priority areas for energy interventions	Main constraints of the energy sector/ subsector in member countries	Major GGGI service offerings' focus areas	Examples of building track record with GGGI's green energy support	Pipeline of bankable green energy projects with arranged finance (based on NDC assessments) ⁵
<p>3 Enhancement and integration of energy efficiency</p>	<p>High energy losses and waste of resources in the energy supply chain and on the demand side</p>	<p>Overall:</p> <ul style="list-style-type: none"> Assists partner countries in prioritizing sector policy and increasing awareness among energy users to enhance incentives for energy efficiency by including capacity building related to smart grid technologies, tariffs, and development of technical regulations and building codes; where policy measures, incentives, and regulations are in place or were in the process of being developed, GGGI engages in mobilizing structured finance suited for energy efficiency investments Supports the promotion of energy efficiency in the public sector, develops regulations and building codes, and fosters energy efficiency technologies in the private sector <p>Specific:</p> <ul style="list-style-type: none"> All specific service offerings under priority 1 apply here as well 	<p>Mongolia: ^(15,16)</p> <ul style="list-style-type: none"> Assisted in the technical analysis of green energy scenarios and incorporation into the National Green Development Policy and sectoral action plans Supported the development of strategies for green energy systems to reduce GHG <p>Thailand:</p> <ul style="list-style-type: none"> Supported a GHG reduction road map focused on automotive parts, palm oil, and the frozen food subsector Supporting the design of financial instruments focused on addressing barriers to greater energy efficiency investment in the auto spare part manufacturing sector <p>Peru:</p> <ul style="list-style-type: none"> Assisting in establishing a financial instrument under strengthening Peruvian exports through an energy efficiency program 	<ul style="list-style-type: none"> Mongolia: Energy efficiency heating and small-scale renewable energy in the Ger district

¹⁵ GGGI, <https://www.sei-international.org/mediamanager/documents/Publications/Climate/GGGI-SEI-2014-Mongolia-green-energy-systems.pdf>.

¹⁶ GGGI, *Mongolia Fact Sheet*, <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20Mongolia%20-%20Transition%20to%20Green%20Development.pdf>.

Chapter 3

How to plan and develop green energy programs and projects

GGGI energy-related service offerings for partner countries and associated outputs are designed to establish a foundation for the next step in its value chain.

All the service offerings set out under the energy theme are sufficiently standardized, clarified, applicable, and easy to understand, and are delivered through either the inclusive green energy approach or the green energy investment approach. The approach to be adopted depends on the priorities and needs of the partner government.

Using important background information from Phase I (diagnosis) and Phase II (green impact assessment), the planning process for green energy programs and projects starts at Phase III (sector/subsector strategy and planning), which covers steps 1 to 8. Box 2 offers guidance on the 12 steps of the process, spanning from planning to identifying, prioritizing, and implementing bankable green energy projects.

Box 2 Process to plan and develop green energy projects through the 4 phases of the GGGI value chain

PHASE I: DIAGNOSIS

This involves conducting a macroeconomic review, a policy framework assessment and strengthening, and an institutional assessment.

PHASE II: GREEN IMPACT ASSESSMENT

This involves using tools such as an extended cost-benefit analysis (eCBA) that can measure and compare the performance of investments in green energy projects.

PHASE III: ENERGY SECTOR/SUBSECTOR STRATEGY AND PLANNING

Steps 1 to 6 cover the preparation of a green energy plan; step 7 guides the conduct of policy and market assessments; and step 8 focuses on the design of renewable energy and energy efficiency deployment programs.

Step 1 Conduct energy sectoral baseline assessments and forecasting of energy demand

Step 2 Set objectives and measures for green energy project development

Step 3 Describe alternative development pathways for the energy sector

Step 4 Screen green growth components from the alternative pathways

Step 5 Perform multi-attribute comparison and prioritization of development pathways

Step 6 Synthesize and prepare green energy plans

Step 7 Conduct sectoral policy and market assessments, guided by the green energy plans

Step 8 Design and develop green energy deployment programs

PHASE IV: DESIGN, FINANCING AND IMPLEMENTATION

With a supportive environment for green energy projects in place, these four steps of Phase IV emphasize developing bankable projects to access finance for implementation.

Step 9 Carry out pre-feasibility studies

Step 10 Undertake feasibility studies and develop bankable projects

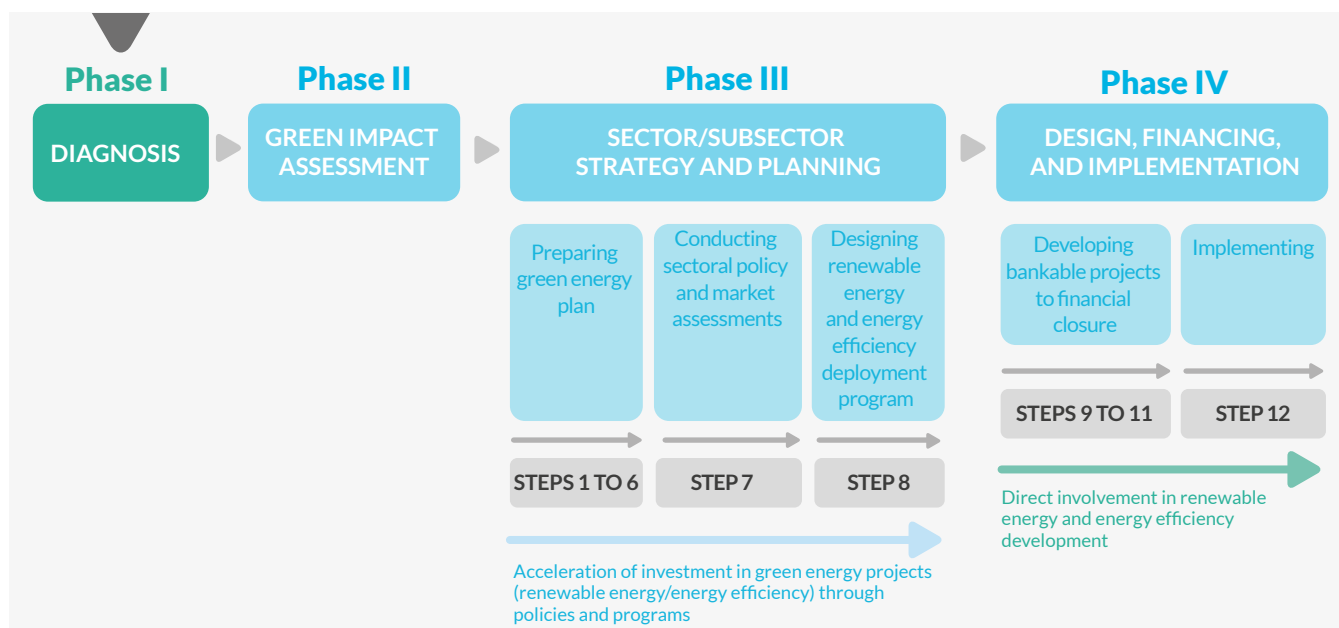
Step 11 Provide financing, through a special vehicle fund

Step 12 Implement the projects

3.1 Phase I: Diagnosis

The green energy program and project development process starts with a macroeconomic assessment of a partner country. Such an assessment is essential to understand and determine the country's national capacity and overall economic performance, as well as to identify major barriers, challenges and opportunities for green energy projects interventions. Figure 2 highlights Phase I within GGGI value chain.

Figure 2 Diagnosis of the energy sector



The diagnosis phase determines if GGGI will provide technical assistance to partner governments for mainstreaming green growth issues into national policies and strategies.

Overall, the diagnosis phase covers the following three major analyses:

1 | Macroeconomic review.

2 | Policy framework assessment and identification of areas to be strengthened.

3 | Institutional assessment of the energy sector.

3.1.1 Macroeconomic review

The macroeconomic review looks at the overall macroeconomic environment of a partner country. It includes the country's financial condition, public debt, economic activities, and employment rate. It also reviews the socio-economic development of all regions in the country to identify the strengths, weaknesses, opportunities, and threats of each. Green energy development is not a standalone activity. It is part of a country's wider socio-economic development. This review ensures a broader perspective in developing green energy projects.

3.1.2 Policy framework assessment and strengthening

National energy policies and regulations can support or derail the development of the energy sector and subsectors. GGGI helps assess and strengthen policies to ensure implementation of green energy programs and projects at later stages.

When strengthening enabling policies, it is important to keep in mind the following principles:

- **National policies must be effectively translated into subnational policies.** Policy coherence across all levels of government is crucial to the successful implementation of projects. Taking into account subnational contexts make national policies relevant in addressing challenges or stimulating green actions locally.

- **A holistic, integrated approach enhances implementation of green energy programs and projects.** A specific policy, such as a policy on water supply, wastewater treatment, or land use, cannot address green energy development sufficiently. Promoting green energy development is not solely in the hands of one particular national institution, but it runs across all government agencies. In assessing the policy and institutional framework, it is important to bear in mind the interconnection of different subsector policies and approaches.
- **A policy package should be straightforward to ensure enforcement and implementation.** Although policy instruments, in general, are sophisticated, it is important to keep the policies simple to facilitate their dissemination and understanding. An overly complex system of regulations and incentives often results in ineffective implementation.

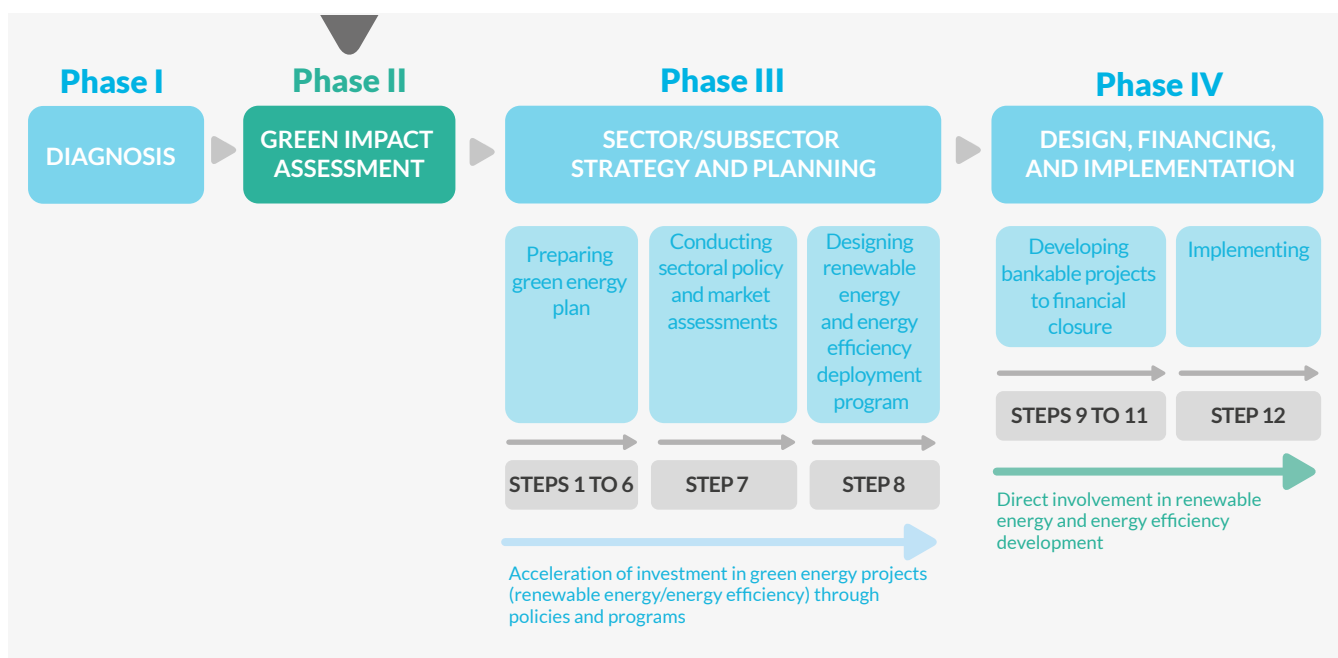
3.1.3 Institutional assessment

Institutional assessment refers to the analysis of the institutional arrangement and stakeholders involved in the energy sector or subsector landscape of a partner country. It maps all key agencies involved, and examines the decision-making process, major agencies involved, and line of authority for energy and related issues. Understanding the system of governance and the decision-making process is important for designing the right green energy development strategy and ensuring its effective implementation.

3.2 Phase II: Green impact assessment

Green impact assessment aims to examine and gauge investment appraisals through representative sample renewable energy and/or energy efficiency projects in terms of economic, social, and environmental benefits. Figure 3 highlights Phase II within GGGI value chain.

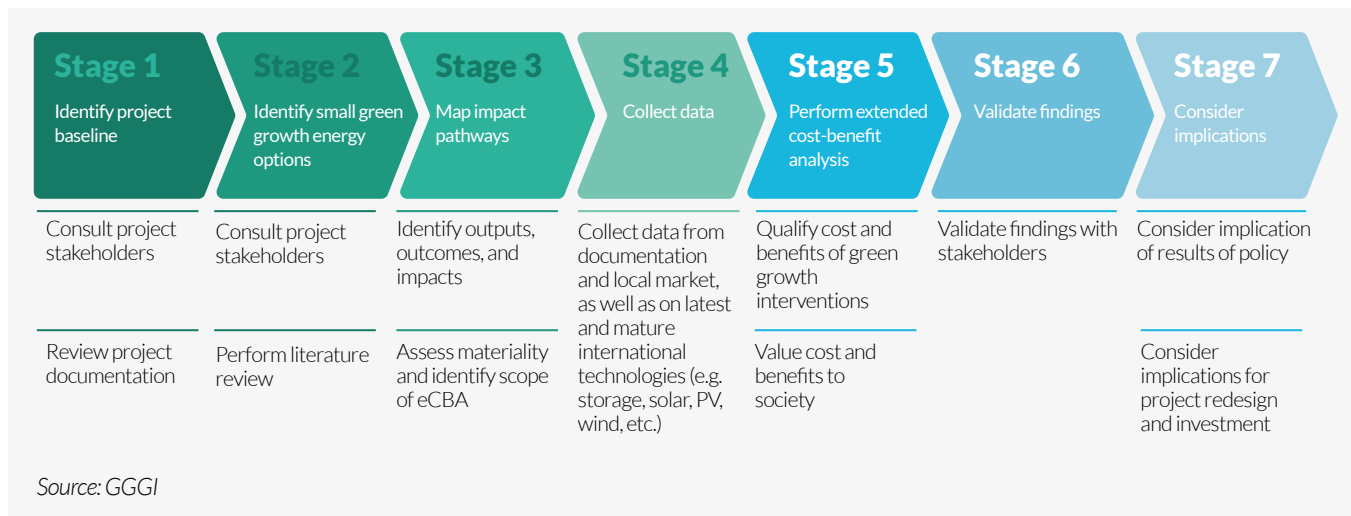
Figure 3 Green impact assessment



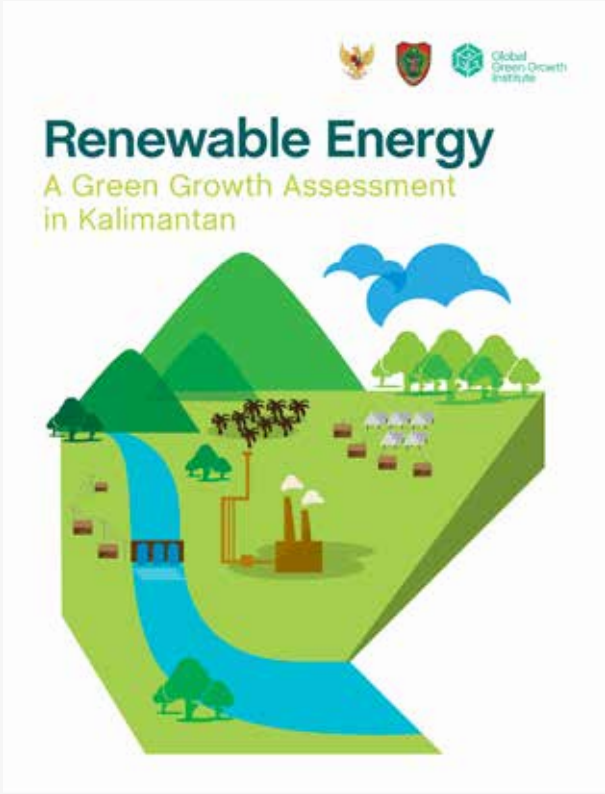
In this phase, GGGI assists partner countries in conducting green growth assessments through tools, such as extended cost benefit analysis (eCBA), that measure and compare the performance of different investment options in green growth-oriented projects, including renewable energy projects. As depicted in Figure 4, to validate impact findings from the eCBA, an extensive stakeholder consultation is organized by key sector partners in collaboration with GGGI. The eCBA¹⁷ toolkit can be used at a high level to prioritize green energy projects with high green growth potential, or those that would benefit from a green growth redesign.

¹⁷ The eCBA aims to systematically compare economic, social, and environmental costs and benefits; help decision-makers assess the potential economic, social, and environmental impacts of projects; and suggest ways to minimize costs and maximize benefits to achieve the intended objectives.

Figure 4 Practical implementation of eCBA in 7 stages



Box 3 Green growth impact assessment for the government of Central Kalimantan, Indonesia



In Indonesia, the government of the Central Kalimantan province is committed to integrating green growth objectives into economic and development planning. To better understand the crucial links between economic growth and impacts on natural capital, the government has formed a partnership with GGGI. Under this partnership, GGGI has developed a framework and a suite of tools to help mainstream green growth into existing planning and investment appraisal processes.

This partnership has resulted in an assessment presented in the report titled “Renewable Energy: A Green Growth Assessment in Kalimantan.” The assessment, which is based on a longer technical report that looks at the monetary costs and benefits associated with renewable energy projects in Central and East Kalimantan, has served as a valuable guide to policymakers.

In supporting the government to deliver the report, an eCBA was conducted to show the potential contribution of renewable energy sources toward achieving both energy security and a cleaner environment. Results from the eCBA present monetary values of costs and benefits associated with both on- and off-grid renewable energy projects (solar photovoltaic, micro-hydropower, biomass, and biogas) in Central and East Kalimantan. The results also show implications for the energy situation of Kalimantan as an economic corridor.

Source : GGGI (2015), http://greengrowth.bappenas.go.id/en/program/download/20151019121653.eCBA_4_Renewable_Energy_Kalimantan_Technical_Report.pdf.

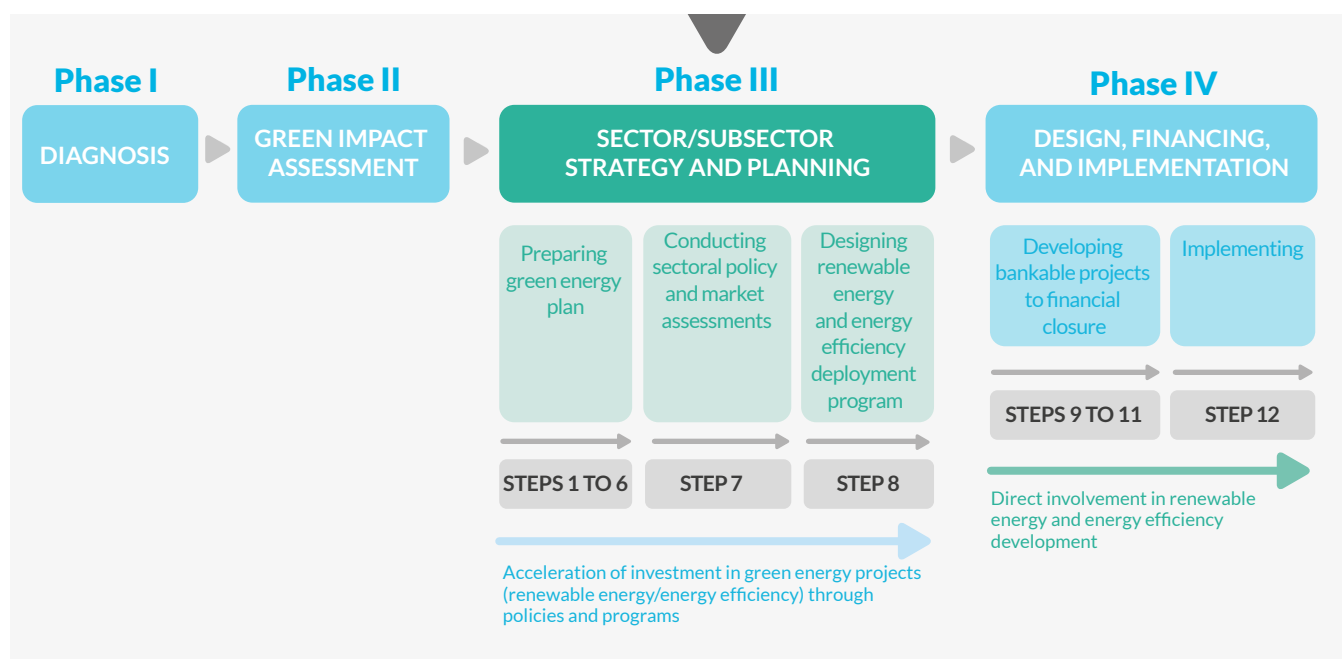
Box 4 Summary of major GGGI service offerings in Phase I (diagnosis) and Phase II (green impact assessment)

- Assist in undertaking green growth analysis of the energy sector.
- Support streamlining of green energy in countries' energy strategies.
- Assist in revising countries' energy road maps and developing implementation plans that include identifying inclusive green growth interventions.
- Support to amend and devise strong policies for green energy project development.

3.3 Phase III: Energy sector/ subsector strategy and planning

Phase III of the GGGI value chain is an important phase where the key tasks of developing an overarching strategy and integrated green energy plan start. As highlighted in Figure 5, tasks in this phase involve steps 1 to 8, which are categorized into three major parts: preparing a green energy plan (steps 1 to 6), conducting sectoral policy and market assessments (step 7), and designing and developing renewable energy and/or energy efficiency deployment programs (step 8).

Figure 5 Energy sector/subsector strategy and planning



Preparing a green energy plan (Steps 1 to 6)

GGGI uses findings from diagnosis (Phase I) and green impact assessment (Phase II) to support a partner country in evaluating existing situations in its energy sector or subsectors. Assessments primarily look at the sector's baselines, challenges, and needs.

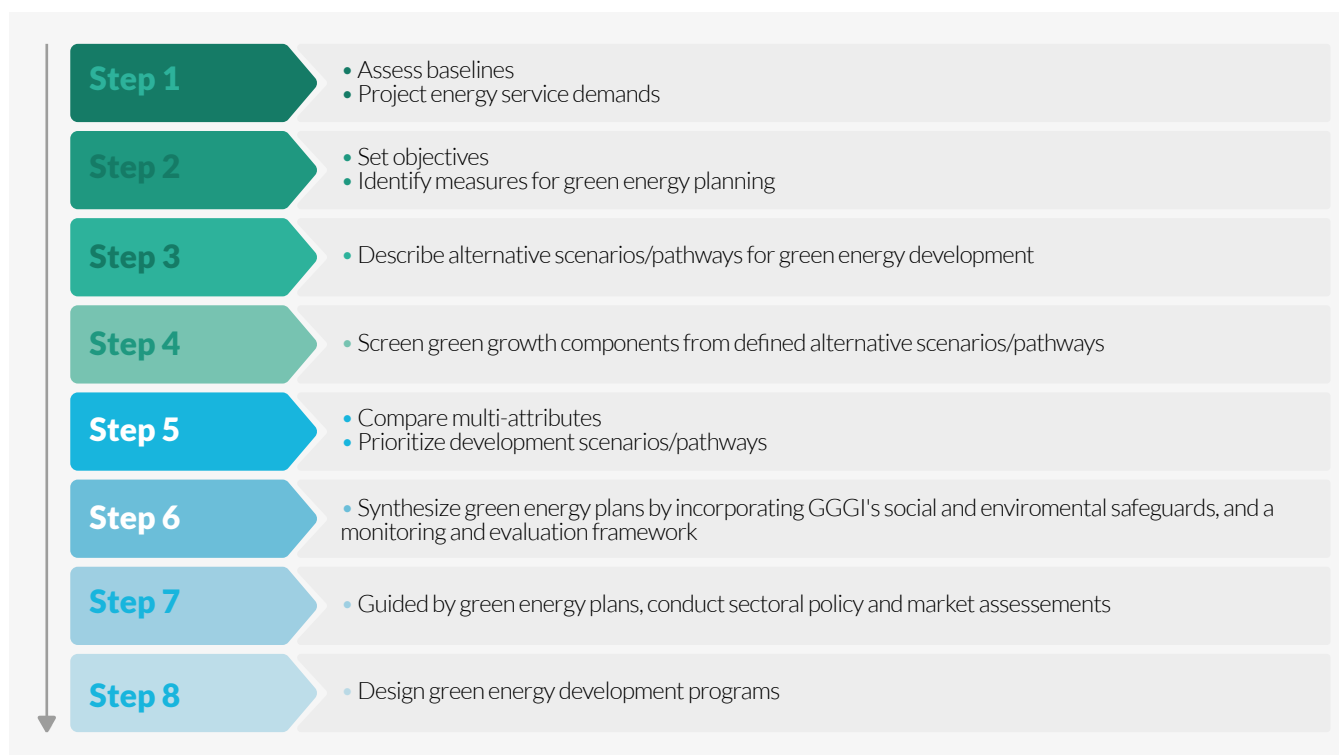
Assessments on baselines, challenges, and needs are based on a review of existing energy sector strategies. They enable GGGI to help the country develop the nation's green energy plan. Based on such essential assessments, GGGI provides technical assistance to a partner government, particularly in reviewing existing energy sector strategies and plans, and developing a national green energy plan.

GGGI provides support based on a partner government's specific needs. For instance, if a partner government has already prepared a green energy plan, GGGI's support will focus on the latter stages of the plan, such as undertaking pre-feasibility and feasibility studies and preparing pipelines of bankable projects on the basis of the government's identified and prioritized areas of interventions. If not, GGGI assists governments in readying a green energy plan.

GGGI decides and provides technical advisory services by using tools such as a needs assessment matrix, partners and activities mapping, and a problem tree. These tools help create a comprehensive understanding of governance, the policy framework, and development activities within the energy sector or subsectors in a partner country. Based on such baseline knowledge and extensive stakeholder engagements and consultations, objectives and targets of green energy interventions are set out. Green energy projects and their pathways are then identified and prioritized by applying an investment prioritization framework.

As depicted in Figure 6, energy sector/subsector planning involves six steps, including assessing baselines, setting objectives, identifying and then prioritizing alternative green energy development pathways, and finally synthesizing green energy plans. Step 7 covers sectoral policy and market assessments, and step 8 tackles the development of green energy deployment programs.

Figure 6 GGGI's green energy planning process



3.3.1 Step 1. Assessing the energy sector/subsector baseline

A holistic and integrated energy sector/subsector baseline assessment involves the following:

- Reviews the baselines and projects the energy demands of the sector/subsectors.
- Examines the financial situation and trends in the energy sector/subsector infrastructure.
- Studies and identifies major barriers or challenges and needs in the energy sector/subsectors.

3.3.1.1 Undertaking integrated baseline assessments and energy demand projection

The structure used in green energy planning should identify and emphasize the most energy-intensive sectors, subsectors, end users, and fuels. This requires reviewing past statistics and other data available from official resources, as well as existing projections of macroeconomic parameters and other pertinent drivers of energy demand. These data are important for developing a baseline understanding of the current status, challenges, and opportunities in the energy sector/subsector.

A business as usual or reference scenario, also described as a “baseline” scenario or pathway, typically projects how an economy and its energy sector might evolve if the recent historical policy, economic, and technological trends continue to prevail. A business as usual scenario, therefore, describes what might be expected to happen if a country does not aggressively pursue green growth and related policies. In its simplest form, projections of future energy demand result from two types of parameters, taking into account all the relevant end-use sectors in an economy: driving activity and energy intensity.

- **Driving activity** is an economic, demographic, or another variable that influences the demand for energy services in a particular sector, subsector, or end use. Examples include the number of households, a fraction of urban/rural/electrified households, vehicle miles, tons of steel produced, a fraction of cars that are fueled with diesel, and a fraction of low-income rural households using woodstoves.
- **Energy intensity** refers to the amount of energy consumed annually per unit of activity with a given technology (or aggregate energy intensity across technologies) to provide an energy service. Examples include liters of gasoline per kilometer traveled, the amount of fuelwood used per household per year for cooking and/or heating, and the aggregate amount of crop waste used in the agricultural sector. Energy intensities can change over time in any given path and for any given technology. Box 5 presents an analytical formula for estimating energy demand projections.

Box 5 Projecting energy demand in a partner country

Energy demand projections = \sum Driving activity \times Energy intensity

WHERE:

Driving activity is an economic, demographic, or another variable that influences energy demand.

Energy intensity is the amount of energy consumed annually per unit of activity using a given technology.

Source: Adopted from LEAP energy planning tool

According to the World Bank’s Energy Sector Management Assistance Program, energy sector scenario modeling for energy planning involves two major steps: baseline establishment and energy demand forecasting.

Energy demand forecasting

Once the energy sector/subsector baseline or business as usual scenario is established, energy demand forecasting follows. Demand forecasts need to be designed to estimate the amount of energy and/or power that will be needed over the years. In green energy planning, demand forecasts typically look at energy and power requirements over the medium to long term, often from 15 to 30 years into the future.

A demand forecast helps to decide:

- The level of growth in energy supplies, including the required amount of electricity generation.
- Applicable resources or supply infrastructure types.
- Expansion of ways supply systems.
- The energy demand reduction measures or options to apply based on energy supply fuels/types, sectors/subsectors, end-user groups, and geographic areas where changes in demand will be the most important.

Energy demand projections play an important role in green energy planning because they help evaluate the need for new resources. Projections quantify the potential resources available through an application of green energy options. This potential is the difference between the existing reference scenario's energy efficiency and that of alternative scenarios incorporating green growth options. Trending forecasts,¹⁸ econometrics,¹⁹ and end-use forecasts²⁰ are commonly used to conduct energy demand forecasting.

Data and modeling tools are the two most important input resources required for energy planners to undertake both baseline establishment and energy demand forecasting.

Data

Data on power generation facilities are typically available from ministries in charge of the electricity sector and/or from electrical utility companies. International compilations, including United Nations documents, offer information on the electricity sector in a given country. In-country case studies and international literature, including documents from the International Energy Agency and other sources, may provide details on costs of operation of generation options, particularly new options.

Modeling tools for green energy planning

Although there is a range of energy models and tools²¹ for green energy planning, the process of choosing which modeling tool to use involves considerations such as the capacity of the planning team to use the models, level of detail needed in the planning results, availability and cost of models, and types of planning questions to be addressed.

Models for planning include top-down econometric models and models using simple extrapolation techniques that rely on bottom-up or demand-driven techniques such as the Long-range Energy Alternatives Planning (LEAP) system and MARKEL TIMES. Hybrid models that incorporate features of both bottom-up and top-down models can be difficult and often complex.

Box 6 highlights one commonly used modeling tool, LEAP.

¹⁸ Trending forecasts are based on the simplest technique. It assumes that past rates of change in trends in driving activities (e.g., tons of cement produced) or energy intensities (e.g., electricity use per ton of cement) will continue into the future. It uses historical data (e.g., sales data or electricity use data per unit output) to calculate a growth rate, which is then applied to estimate future consumption and demand.

¹⁹ Econometric forecasts are similar to trending forecasts as they generally assume that past relationships between variables, such as output or ownership of appliances and various economic or demographic factors, continue to hold into the future, but they are generally more detailed than trending forecasts. In preparing an econometric forecast, the first step is to look for "statistically significant" historical relationships between economic variables and driving activities or energy intensities.

²⁰ End-use forecasts attempt to build estimates of energy needs starting with an analysis of what energy is and will be used for. For example, an end-use model of residential electricity use might include separate estimates of electricity used for lighting, water heating, cooking, space heating, air conditioning, fans, entertainment, and other appliances.

²¹ Major energy modeling tools can be found at <https://www.energycommunity.org/default.asp?action=tools>.

Box 6 The Long-range Energy Alternatives Planning (LEAP) system

The LEAP system is a widely used software tool for energy policy analysis and climate change mitigation assessment developed by the Stockholm Environment Institute. It has been adopted by various organizations, researchers, and analysts in more than 190 countries worldwide. Its users include government agencies, academics, non-governmental organizations, consulting companies, and energy utilities. It has also been used by multiple entities, ranging from households, factories, cities, and states for national, regional, and global applications.

Integrated planning

LEAP is an integrated modeling tool that can be used to track energy consumption, production, and resource extraction in all sectors of an economy. It is a demand-driven tool in that the user first describes current and future energy requirements for households and the transport, industry, and other sectors. The user then utilizes LEAP to model processes such as electricity generation, coal mining, and other energy supply systems that provide fuel for final consumption.

LEAP can be used to account for both energy sector and non-energy sector GHG emission sources and sinks. In addition to tracking GHGs, LEAP can be used to analyze emissions of local and regional air pollutants, which makes it well-suited to studies on the climate co-benefit of local air pollution reduction. Finally, LEAP can track the direct costs of fuel, resources of devices and systems that use energy, and energy supply infrastructure to estimate the relative costs of different approaches to providing energy for an economy.

Flexibility and ease of use

LEAP has developed a reputation among its users as a tool for presenting complex energy analysis concepts in a transparent and intuitive way. At the same time, LEAP is flexible enough for users with a wide range of expertise, from leading global experts who wish to design policies and demonstrate their benefits to decision-makers, to trainers who want to build capacity of young analysts embarking on the challenge of understanding the complexity of energy systems.

Modeling methodologies

LEAP is not a model of a particular energy system but rather a tool that can be used to create models of different energy systems where each requires its own unique data structures. It supports a wide range of different modeling methodologies.

On the demand side, these range from bottom-up, end-use accounting techniques to top-down macroeconomic modeling. LEAP also includes a range of specialized methodologies including stock turnover modeling for areas such as transport planning.

On the supply side, LEAP provides a range of accounting and simulation methodologies that are powerful enough for modeling electric sector generation and capacity expansion planning. It is also sufficiently flexible and transparent to easily incorporate data and results from more specialized models.

3.3.1.2 Assessing the financial situation of the energy sector

Assessing the current status of the financial landscape in the energy sector can identify major barriers, gaps, and needs in a partner country. This is important as financing is key to ensure implementation of bankable green energy projects that create desired impacts.

Table 5 presents indicative guidance on assessing major financial conditions related to green growth or energy development in a partner country. As a complement, qualitative assessments of financial systems and arrangement are also conducted.

Table 5 Guidance on assessing financial conditions related to green growth

UNDERLYING FACTORS	MAJOR AREAS TO ASSESS	WHY?
International agreements	United Nations Framework Convention on Climate Change, Kyoto Protocol, Paris Agreement-(I) NDCs, SDGs, etc.	Signal access to global green growth financing
Relevant national policies	Public funds and commitments (at least during the past five years) for green growth projects	Examine, gauge, and inform investors of the actual situation
Fiscal incentives	Taxes (import tax exemption on renewable energy and energy efficiency technologies, fuel-efficient vehicles, etc.) Feed-in tariff Power purchase agreements Subsidy reform policies	Promote investments in green energy projects
Funding sources and extent of flow (both international and local)	International: multilateral development banks, bilateral development agencies National: banks, non-governmental organizations, microfinance institutions, etc.	Detect extent of financial flow within a country
Dedicated funding mechanisms or facilities	Amount of funds and capacity of facilities Types of major services delivered through green growth or energy projects Major green growth or energy projects that benefited from the funds	Help identify national finance conveyance mechanisms to implement green energy projects Help identify existing financing space to scale up projects

3.3.1.3 Identifying and assessing gaps and needs of the energy sector

Further assessments are conducted to identify gaps and needs in the energy sector. These are essential and crucial for pinpointing major areas of green energy interventions in a partner country. Effective tools for such type of assessments include a needs assessment matrix, partners and activities mapping, and a problem tree.

- The **needs assessment matrix** identifies identifies current barriers, gaps and needs against a future desired state. It covers areas such as policy and governance, environmental management, financial management, and implementation. The energy cross-subsector assessment mainly covers households, transport, buildings (public and residential), water supply, water and wastewater treatment, and agriculture and forestry. Refer to the Annex for an example of a needs assessment matrix.
- **Mapping key partners and their major activities in the energy sector** would show areas where resources are well-allocated or inadequate. This enables country programs to identify areas that require attention, niche positions to intervene, minimize duplication of effort, and maximize impacts.
- A **problem tree** (also called situational analysis or problem analysis) sketches out the anatomy of problem causes and effects. It highlights the relationships among various factors that contribute to the problem. It helps look at the energy issues from an integrated and a wider subsector perspective, making it an essential tool in identifying suitable solutions for complex issues in the energy sector.

At this stage, all assessments on the energy sector or subsectors are compiled and presented in a comprehensive baseline assessment report that will be used as a key resource for identifying potential areas of green energy interventions.

3.3.2 Step 2. Setting objectives, targets, and measures for green energy development

Defined objectives and targets are necessary to form the framework for green energy planning and guide decisions on interventions to undertake in a partner country. Once the integrated energy sector/subsector baseline assessment is completed, objectives and targets for green energy interventions are then set.

Objectives, targets, and measures are drafted based on a partner country's vision, earlier stakeholder inputs, and results from the energy sector baseline assessment. Preliminary green energy intervention pathway proposals are shared with stakeholders for comments, and then revised based on the comments received.

Since objectives are most valuable when they are easy to communicate and clear to follow, the development of "smart" objectives are recommended. Refer to the Annex for guidance on typical objectives of green energy planning.

In setting objectives and targets for green energy development, the following actions should be considered:

- Review the baseline assessment as it provides information on trends, performance, barriers, opportunities, and needs.
- Evaluate similar past projects in peer countries, as well as best practices of well-performing programs and projects to determine the feasibility of adapting these practices in a partner country.
- Review similar objectives and targets of peer countries, and assess the extent to which they can be applied in the partner country.

3.3.3 Step 3. Identifying and describing alternative development pathways

Once the objectives and targets for green energy development have been determined, the next step is to evaluate the costs and benefits of green energy development strategies through a direct comparison of two or more energy scenarios or pathways.²²

Alternative scenario development relates to specific aims for a country — such as to increase reliable and affordable access to energy, enhance energy supply and security, and reduce GHG emissions — and reflects different pathways to economic or social development. Typically, the scenarios prepared for comparison are providing the same, or very similar, energy services.

Alternative scenario development begins with a set of overall themes or "storylines," such as a continuation of past practices, export-oriented development, or green growth, which is then translated into economic and demographic assumptions (or "scenario drivers") and strategies for meeting corresponding energy service requirements (e.g., for transport or industrial

production). This translation must include quantitative aspects that guide, for instance, the rate of adoption of key technologies (e.g., the implementation of renewable electricity generation), the rate of change of key energy intensities, and the future values of key driving activities, which could range from the fraction of households in certain types of buildings to the fraction of transport provided by different modes (private vehicle, public vehicle, rail, and others). Alternative scenarios could have just a few or many differences relative to the baseline or reference case.

One example is a recent GGGI study that presented four broad scenarios of how energy supply and demand could evolve in Mongolia through 2035. The scenarios were developed in 2013 with input from a project advisory committee comprising mostly Mongolian government officers.

The four scenarios are as follows:

1 | The reference scenario reflected a continuation of largely coal-based energy supply in an economy driven mainly by mining exports, especially coal and copper. It assumed relatively few changes in energy supply or the intensity of demand other than gradual improvements in some technologies (e.g., vehicles, appliances), consistent with international trends that are likely to evolve regardless of changes in Mongolia's policies.

2 | The recent plans scenario introduced a shift to renewable energy and increased energy efficiency based on recent plans and priorities of the Ministry of Energy and Ministry of Environment and Green Development.

3 | The expanded green energy scenario described a future where Mongolia makes a stronger transition to renewable energy and implements extensive energy efficiency measures across its economy. This scenario was built on the work on renewable energy and energy efficiency potential conducted by the Ministry of Energy and the Ministry of Environment and Green Development.

4 | The shifts in energy export scenario was based on the expanded green energy scenario. In this scenario, starting in 2017, Mongolia shifts the types of fuel and energy that it exports. Rather than exporting an increasing amount of coal from large mines in the South Gobi area and other deposits, Mongolia instead exports renewable (wind and solar) electricity.

²² An energy scenario is an internally consistent "story" of how energy services, consumption of the energy that provides services, and the energy sector infrastructure and resources (power, heat, fuel refining, and other elements) that provide fuel will evolve.

3.3.4 Step 4. Screening green growth components from the alternative pathways

Once general qualitative and quantitative “storylines” for green energy planning scenarios or pathways are established, the next step (in the case of a demand-driven bottom-up analysis) is to include specific components, options, and measures in the scenarios to set them apart from each other.

Drawing upon an initial list of options from typical elements of green energy plans and strategies (which mainly include renewable energy sources, energy efficiency measures, and fuel substitution), the first task is to identify options consistent with the overall scenario storyline. A preliminary screening is needed to determine which of the initial list of options is appropriate for inclusion in the scenario. Signals that could have already been captured from stakeholders’ discussions and consultation meetings are the likely keys to identifying the right options. Green energy project options that stakeholders have identified are more likely to lead to partnership and implementation at a later stage.

There are two approaches used for listing options: selection of options consistent with scenario storylines and preliminary assessment of options.

Selecting options consistent with scenario storylines

Starting from a long list of possible options, shorter lists of options associated with each scenario are typically created. These shorter lists are generated by considering options from typical elements of green energy plans and strategies, and from an extensive consultative process with local and/or national stakeholders. **The criteria for choosing options for a particular scenario include the following:**

- **Sectoral coverage.** Does the option fit with the energy sector/subsectors included in the overall scenario? For example, a scenario focusing on just supply-side changes toward low-carbon development might not include demand-side energy efficiency, while a broader scenario planner might look for options that span the range of demand-side and supply-side green energy options.
- **Consistency with policy storylines.** If a scenario is established — for instance, policies that can be implemented by the government, utilities, private-public partnerships, or some combination of the three — certain types of options and measures may be indicated.
- **Consistency with existing policies and past practice.** Particularly for scenarios based on existing initiatives or current plans, options or measures considered should be consistent with the overall storyline. For example, in a recent plan scenario for a partner country that traditionally has had little emphasis on demand-side energy efficiency improvement, the inclusion of such options would be limited. If, however, laws and regulations to increase the efficiency of local and imported appliances were under active discussion, higher appliance efficiencies might be part of a recent plan scenario.
- **Consistency with scenario goals and targets.** In some cases, green energy planning scenarios or pathways are driven by goals for energy savings, GHG emissions reduction, employment, or other factors. In those cases, options are chosen such that they are consistent with overall goals. For example, if employment in green energy industries is a key target, building energy efficiency, solar water heater installation, and solar photovoltaic and wind power deployment could be key features of the scenario with high rates of implementation.



Preliminary assessment of options

While considering green energy options and measures for various scenarios or pathways, it is necessary to carry out a preliminary assessment, usually both quantitative and qualitative, of the options and measures. This assessment takes place before options are assigned to scenarios, and sometimes after, with options added to or removed from scenarios in an iterative process.

The preliminary assessment of options is done in several ways:

- Formally, a matrix ranking is conducted on each option according to its score with respect to a range of attributes (e.g., for generation options, it would be capital cost per megawatt, fuel cost per kilowatt-hour, carbon emissions per kilowatt-hour, etc.).
- Informally, some basic parameters and/or criteria are considered.

The preliminary assessment classifies the options into two groups: demand-side options and supply-side options, which are elaborated next.

Assessment for demand-side options

Box 7 Evaluation methods for demand-side energy efficiency measures

- **Life cycle cost of energy efficiency measures versus standard alternatives.**
- **Benefit-cost ratio, which indicates the cost-effectiveness of measures, relative to standard practice in the case of replacement measures. Measures with benefit-cost ratios much greater than 1:1 are likely to be cost-effective, while those with ratios much less than 1:1 are not cost-effective. Those near 1:1 have questionable cost-effectiveness but might be worthy of implementation if they yield significant non-monetary benefits or complement other cost-effective measures.**
- **Cost per unit energy saved, sometimes referred to as net capital or operations and maintenance costs per unit electricity saved.**
- **Costs per unit carbon emissions avoided if GHG emissions reduction is an objective.**

Of the methods mentioned in Box 7, costs per unit energy saved and cost per unit carbon emissions avoided are relatively common metrics to evaluate. Values from similar countries are useful in assessing whether demand-side and supply-side options should be included in green energy or related scenarios. However, values from peer countries should be used with care to make sure that they have been calculated using the same methodology.



Assessment for supply-side options

For energy supply, particularly associated with electricity generation, an initial screening out of options that are clearly inferior on certain grounds (cost, resource availability, siting, technical, environmental, etc.) is useful. Specifically, screening calculations establish whether a supply option is clearly ruled out on economic grounds. However, for technologies where costs are expected to change rapidly, it is appropriate to include projections of future costs, which would markedly change the overall comparison of a candidate option relative to standard practice over time. **Some types of cost calculations often used in economic screening analyses include the following:**

- Life cycle cost to compare very different energy supply generation options. Capital, operation and maintenance, fuel, waste treatment, and decommissioning costs

(or salvage value) enter into the calculation of overall plant net present value (NPV) and NPV per kilowatt or kilowatt-hour. Sensitivity analysis is used to evaluate the impact of changes in key parameters on plant economics, such as discount rate and capacity factors.

- Simplified production cost analysis to estimate the cost of power from a supply option.
- Levelized “busbar” cost analysis to estimate the life cycle cost, a revenue requirement, of power from a supply option at the “busbar” — the point at which electricity leaves the plant. Busbar revenue requirements, calculated in cost per kilowatt-hour, is used as an indicator of overall costs when screening among supply options. A discussion and formula for cost levelization is highlighted in Box 8.

Box 8 Cost levelization

Supply-side economics screening requires comparing power plants with very different capital costs, operating costs, size, output, and lifetimes. One tool for preliminary economic comparison is to convert the life cycle cost of each power plant option into a uniform amount each year. This includes all the costs to produce electricity during the life of a plant, such as capital costs (including return on investment), taxes, depreciation, fuel costs, maintenance costs, the cost of expected repairs, and decommissioning. The plant’s real levelized value, A, is obtained as follows:

$$A = \frac{S*(1-R)}{1-(R^n)}$$

WHERE:

S = Present value sum of all life cycle costs

R = $1 / (1 + \text{real discount rate})$

n = the number of values summed (in S)

Dividing A by kilowatt-hour output provides the real levelized cost per kilowatt-hour produced. Since price inflation is removed in calculating the real discount rate, cost streams with different start and end dates can be compared.

3.3.5 Step 5. Conducting multi-attribute comparison and prioritizing development pathways

An important part of a country’s green energy planning process is determining which renewable energy and energy efficiency options to prioritize for investment. Prioritization is often based on climate change mitigation potential, costs, risks, national priorities and goals, political will, existing and projected regulations and policies, and implementation capacity.²³

Green energy scenarios or paths offer quantitative and qualitative descriptions of how an energy sector evolves to provide desired energy services required by the economy, as well as deliver social and environmental benefits. In a national or regional assessment approach, the relative costs and benefits of independent or

coordinated energy development are compared. In practice, the green energy pathways are assessed based on the cumulative extent or scale of economic, social, and environmental benefits they deliver and technology transfer to the partner country.

The use of a combination of tools to prioritize green energy pathways, such as cost evaluation tools in conjunction with multi-criteria analysis, is recommended. For instance, if the technology needs assessment (TNA), a tool which was developed by United Nations Development Programme (UNDP), has already been conducted in GGGI member countries, then these TNA reports provide a valuable complementary resource to start a review to support the prioritization process. In Mongolia, the development of its national strategy for green energy pathways was facilitated by the completed TNA and the LEAP energy modeling analysis through GGGI’s support (see Box 9).

²³ Climate Investment Funds (2014), *Knowledge Note on Prioritizing Renewable Energy Options*.

Box 9 Development of strategies for green energy systems through technical assistance on energy planning tool: GGGI's experience in Mongolia



Background

With an economy primarily rooted in mining and agriculture, Mongolia is vulnerable to volatility caused by global mineral price movements, and the long, harsh winters and scorching temperatures in the Gobi Desert. This relatively undiversified economy leaves the country susceptible to destabilizing boom-bust cycles.

From 2000 to 2009, Mongolia saw an average growth rate per year of 5.8 percent. In 2011, it set an incredible growth rate of 17.5 percent. This boom was a result of strong global energy prices and Mongolia's emergence as an energy provider, largely as a supplier of coal to China and other northeast Asian countries. But in 2014, Mongolia began to experience a downturn. Apart from a sharp drop in the price of global energy commodities, foreign investment plummeted. During the first three quarters of 2014, foreign investment fell by 82 percent, as foreign firms raised concerns about the lack of progress in several large mining projects.

Aware of its weakness, Mongolia is striving to mitigate the economic and environmental impacts of its energy production-based economy.

GGGI's support

• Technical assistance in energy planning

Mongolia joined GGGI in 2013. Energy is one of the three core thematic pillars of the GGGI country planning framework for the government of Mongolia for 2016-2020. The government has partnered with GGGI and the Stockholm Environment Institute to carry out a project titled "Strategies for Development of Green Energy Systems in Mongolia," which aims to define and describe green energy systems that would reduce GHG emissions, improve air quality, and facilitate other socio-economic benefits. GGGI carried out the project in conjunction with an advisory committee comprising 16 officials from the energy, environment and green development, and economic development ministries, and from the Renewable Energy Center and the Mongolian Energy Association.

The project team first gathered information about Mongolia's energy needs, resources, and infrastructure, and used the information to develop a quantitative computer model of Mongolia's energy use and GHG emissions. The team then used the model to develop four scenarios for Mongolia's potential energy future and GHG emissions through 2035. The recommendations were based on an analysis of the four scenarios forecasting Mongolia's energy supply and demand within the industry, transport, buildings, and agriculture sectors.

Clearly understanding the importance of political support to move forward with the project's report recommendations and outcomes for policy initiatives, GGGI engaged partners at the Ministry of Energy and other Mongolian institutions throughout the development of the report.

• Assistance in financing

GGGI helped facilitate discussions and actions on Mongolia's energy-related policies and projects where partners emphasized the need to bridge the current gap between renewables' potential and project finance. In a November 2016 forum, GGGI shared the challenges and opportunities in financing renewable energy and green growth, and briefed how the institute is helping to bridge the financing gap between capital providers and capital receivers in developing economies. GGGI's in-country program is supporting the government to: (1) prepare a pipeline of low-carbon and socially inclusive infrastructure projects; (2) drive critical regulatory changes for green energy and city planning; and (3) design a national financing vehicle for green development. In line with this, GGGI is supporting the government of Mongolia and the Mongolian Bankers Association in developing the National Green Credit Fund with technical assistance on the development of the fund's business plan, projects, and pipelines, and in facilitating seed financing. The National Green Credit Fund is a key mechanism for financing bankable projects envisaged in the areas of renewable energy, energy efficiency, and other green technologies under GGGI's country planning framework with the government of Mongolia for 2016-2020.

GGGI is also assisting the government in identifying public and private financing for near-term piloting and long-term project replication, and developing market-driven mechanisms to integrate renewables into infrastructure, such as subdistrict heating systems.

Implementation strategies for low-carbon, socially inclusive energy systems in Mongolia, developed with support from GGGI, have helped shape ambitious energy targets adopted by the government. GGGI's next phase of support is focused on finding innovative models for low-carbon infrastructure, particularly energy efficiency. To move from planning to action for achieving Mongolia's sustainable and green development ambitions, such as reducing GHG emissions by 14 percent from business as usual by 2030, GGGI needs to identify ways to improve energy efficiency and break down the financial barriers to enhance green technology penetration during this time of economic slowdown in Mongolia. GGGI is also assisting the government in implementing its green development policy and preparing bankable projects through public-private partnerships.

• Assistance in pre-feasibility studies

GGGI assisted in conducting analysis of alternative heating systems in Mongolia with a focus on the potential for efficiency and renewable energy solutions to reduce air pollution caused by the burning of coal. Additionally, GGGI is supporting a government pre-feasibility assessment of solid waste-to-energy options in the capital, Ulaanbaatar.

Source: GGGI and SIE (2014), <https://www.sei-international.org/mediamanager/documents/Publications/Climate/GGGI-SEI-2014-Mongolia-green-energy-systems.pdf>.

3.3.6 Step 6. Synthesizing and preparing green energy plans

Compiling analysis and findings from steps 1 to 5 enables the preparation of green energy plans. Green energy plan preparation must incorporate an implementation action plan. It also seeks to match policy, strategies, financial instruments and implementation arrangements identified for prioritized green options.

A green energy plan should:

- Outline pathways for a sustainable energy mix with the necessary enabling framework (e.g., targets, policy, and governance) for attracting investment in green energy supply and energy efficiency.
- Underpin frameworks and the way forward for designing, financing, and implementing bankable projects.
- Provide explicit policy recommendations relating to target setting; improvements in existing energy policy regime; harmonization of complementary policies, such as on renewable and land policy; fiscal reforms and investment policies; market development policies; and implementation guidelines or standards, for instance, in economic sectors.
- Identify mechanisms for cross-ministry dialogues toward integrated policy design and policy harmonization, specifically to locate and exploit energy sector synergies, such as mechanisms for engagement with local communities, the private sector, multilateral development banks, non-governmental organizations, academia, and financing entities. In addition, GGGI is able to develop recommendations on best practices to implement a green energy plan through engaging with its global network of partners in member countries.

3.3.7 Step 7. Conducting sectoral policy and market assessments

Once a green energy plan is prepared, energy sectoral policy and market assessments are undertaken by the GGGI operational team (led by the Investment and Policy Solutions Division or IPSD) in order to provide specific recommendations to expand green energy and energy efficiency in economic sectors²⁴ (residential, manufacturing, industrial, commercial, and agricultural).

The demand-side market assessment in economic subsectors seeks to identify and prioritize bankable projects, including those that meet latent or hidden demand. This includes assessing the technical feasibility and economic viability of these projects. In addition, policy assessments can help create an enabling regulatory environment.

Sectoral market assessment

To create and transform sustainable green energy markets, it is essential to first understand how the partner country's local market currently works and where opportunities exist to facilitate changes in the economic subsectors. The market assessments seek to identify the baseline, understand existing strategies and plans, consult with stakeholders, and develop a model that

includes the technical, financial, and economic aspects of how the market functions.

To conduct a green energy sectoral market assessment, a range of tools and techniques can be used, including structured barrier analysis, which can identify interventions that can remove barriers to market development; stakeholder mapping and capacity assessments; market models; problem trees; market size estimates; and scenario creation.

Sectoral policy assessment

Complemented and guided by the energy sector/subsector diagnosis assessments/study in Phase I and green energy plan development, the sectoral policy assessment aims to outline specific sectoral recommendations based on major policy, legal, institutional, and regulatory barriers to pursuing green growth in a partner country.

3.3.8 Step 8. Designing green energy deployment programs

Once sectoral policy and market assessments are conducted for the demand-side measures, a specific policy and implementation road map for **supply-side policies** in relation to different energy sources (and energy efficiency measures) are developed.

Therefore, the main task at step 8 is to create a plan to deploy a green energy program. The plan includes a strategy and details on how to implement the program while supporting an overall national green energy plan. The plan should include recommendations from the sectoral assessments conducted in step 7.

The major components of the green energy deployment program should comprise of the following:

- Dedicated national financing vehicles (NFVs) to mobilize and disburse private sector investment and domestic or international climate finance.
- Technical assistance ranging from project conceptualization to feasibility studies and project management.
- Guidelines on the types of projects that would qualify for support from dedicated funds.

At this step, GGGI supports member countries in developing complementary financing-related service offerings to address barriers challenges, particularly building and strengthening NFVs. NFVs serve as an instrumental means for countries to access international climate finance to blend public, private, bilateral, and other sources of funding to achieve sustainable development outcomes.

Developing NFVs can support country ownership, national development priorities, and wider strategies on climate change and sustainable development to meet each country's unique needs.

²⁴ Major economic subsectors can vary and depend on the specific partner country.

Having a dedicated fund to deploy a green energy program not only efficiently mobilizes and disburses funds, but also ensures that projects comply with the environment and inclusiveness-related standards, and minimize concerns by lenders or investors about the program's sustainability.

1 | DEVELOP CRITERIA

for identifying public institutions, financing vehicles, or funds with the potential to handle climate finance and/or other sources of green finance.

2 | PERFORM A COUNTRY REVIEW

by applying the criteria in-country and mapping existing or dormant national institutions or mechanisms that can perform the required functions.

3 | CARRY OUT A DIAGNOSIS

by assessing financing needs, the capitalization potential, project pipeline availability, the governance structure, and fiduciary risk management procedures, and by conducting a survey of complementary activities in the context of the partner country.

GGGI follows a six-step process in developing and operationalizing NFVs. This process serves more as general guidance than a prescription:

4 | DESIGN

financing mechanisms, including financial structures and instruments, at the national level, and propose demand-side interventions vis-à-vis project development, financial engineering, deal structuring, and options for blended finance at the project level.

5 | CAPITALIZE

the financing vehicle from public and private sources, domestically and internationally. GGGI assesses and targets relevant sources of financing, including the Green Climate Fund (GCF), as well as coordinates financing arrangements.

6 | SUPPORT IN MANAGING THE NFV.

GGGI builds the capacity of government personnel in managing the NFV; identifying, assessing, and approving projects; mobilizing resources; and monitoring and reporting the outputs.

Designing a green energy deployment program starts with developing a concept note that outlines objectives. This is followed by the establishment of an NFV or a dedicated national fund, the preparation of an implementation plan, and the design of implementation mechanisms.

The process of developing a green energy deployment program in a partner country needs to involve the following:

- Partnership with key stakeholders to implement the green energy program. Key stakeholders include governments (e.g., ministries and regulatory bodies), financiers from the public and private sectors, multilateral agencies such as donor funds and GCF entities, and other implementing agencies.
- Cooperation agreement with key stakeholders, such as memorandums of understanding on the development of a green energy program.
- Comprehensive financial arrangements involving relevant financial institutions.

In practice, based on GGGI's experience, approval or endorsement of dedicated funds by governments of partner countries constitutes one of the main positive and highlighted indicators for developing a deployment program, preparing an implementation plan, and designing implementation mechanisms.

GGGI offers services to increase the level of penetration of climate finance in partner member countries, both through financing vehicles and project finance, depending on the types of

green energy projects needed and the level of market maturity in partner countries. Box 10 briefs common service offerings in the areas of Phase I.

Box 10 Summary of GGGI's major service offerings in green energy planning, sectoral policy and market assessments, and development of green energy deployment programs

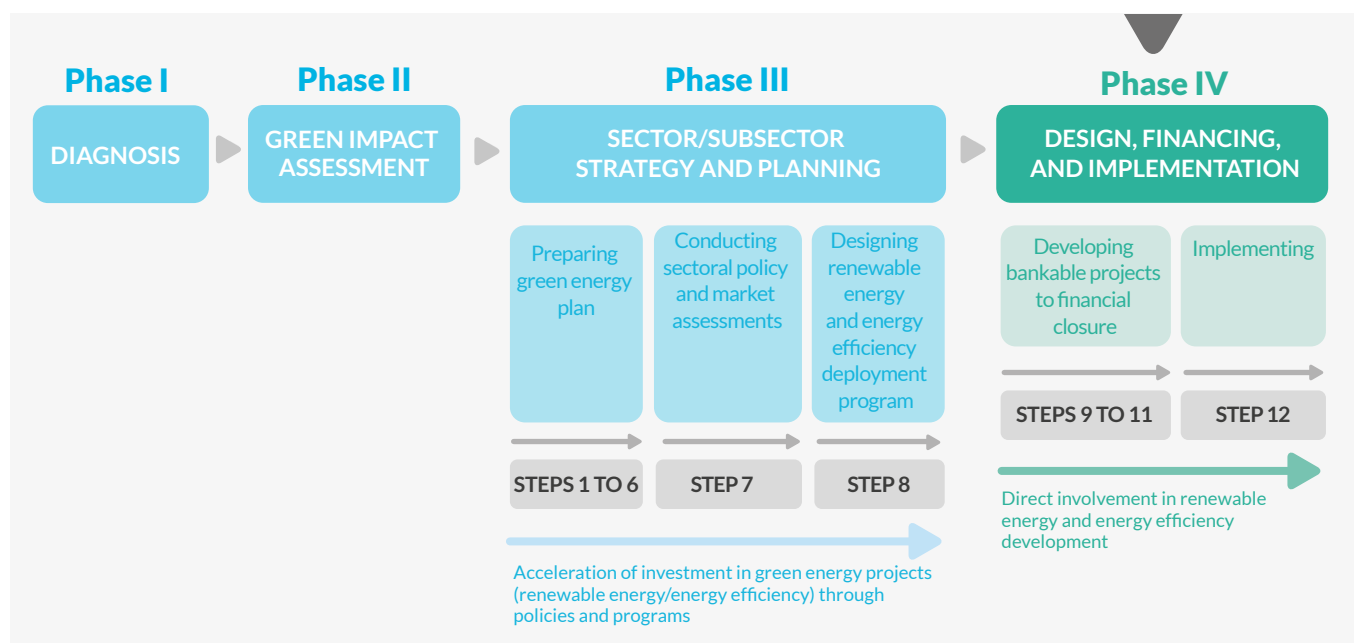
- **Support in mainstreaming policies, financial instruments, and implementation arrangements for the prioritized green energy projects options.**
- **Assist in building capacity related to green energy planning and implementation.**
- **Assist government in developing strategies and proposed actions to implement a green energy program, which supports a national green energy plan and acts on recommendations from the sector.**
- **Support in establishing a dedicated national green energy fund.**
- **Provide technical assistance to develop a business plan for a dedicated national green energy fund.**
- **Support in developing a pipeline of potential bankable projects under the national green energy deployment program.**
- **Build the capacity of personnel attached to the dedicated national green energy fund to support its effective management.**

3.4 Phase IV: Designing, financing, and implementing green energy projects

In this final phase, GGGI focuses on developing bankable projects, which involve new technologies, market structures, and financing, as well as foster institutional change for a more inclusive and efficient green energy market. The Green Investment Services Unit of GGGI specifically undertakes this work.

As indicated in Figure 7, while the blue line (Phase III of the GGGI value chain) corresponds to initiatives that entail designing and implementing policies to accelerate investment, the green line (Phase IV) corresponds to the design and implementation of individual projects.

Figure 7 Design, financing, and implementation of green energy projects



There is significant demand from partner countries for GGGI's support in preparing requests for proposals (RFPs), as the process of compiling the required information can be technically complex and expensive. GGGI's engagement involves detailing the green energy project components, including relevant environmental performance and social inclusion parameters. Prerequisite activities in finalizing an RFP include performing market analysis; carrying out site visits; preparing pro forma statements; determining project costs, schedules, and milestones; engaging off-takers, financiers, and developers; engaging communities; developing plans that uphold environmental and social protection safeguards; and examining relevant tax and regulatory provisions, among others.

In this phase, GGGI focuses on helping partner governments develop a pipeline of bankable projects²⁵, or those that should be able to attract funding from private sector financiers, multilateral development banks, and climate finance (e.g., GCF).

In case the government lacks the budget to conduct these preparatory steps or finance the latter part of the project, GGGI helps in securing appropriate funds by partnering with multilateral development banks and other relevant development and climate finance agencies.

Overall, Phase IV of the GGGI value chain (Figure 8) comprises four steps: pre-feasibility study, feasibility study, financing, and implementation.

²⁵ Guided by governments' green growth framework and stakeholders' consultation, developing a pipeline of bankable projects involves coming up with a pipeline of project ideas, writing concept notes that present the business cases and financing instruments for the project ideas, and facilitating financing.



Figure 8 Phase IV of the GGGI value chain



There are two distinct approaches used for conducting pre-feasibility and feasibility studies for renewable energy projects and energy efficiency projects. Box 11 defines these two approaches.

Box 11 Approaches to pre-feasibility and feasibility studies for renewable energy and energy efficiency projects

The pre-feasibility and feasibility studies for renewable energy projects and energy efficiency projects differ in nature.

Renewable energy projects

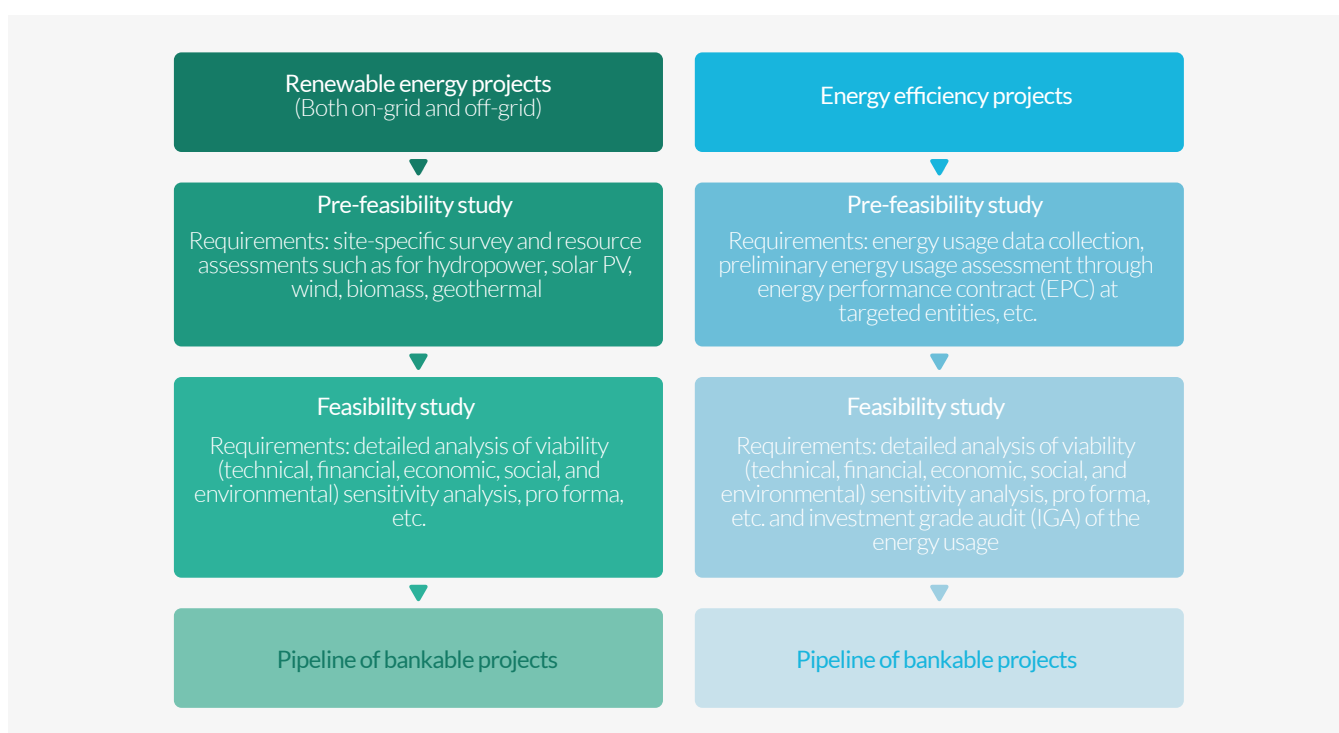
- A pre-feasibility study for renewable energy projects (both on-grid and off-grid) requires site-specific resource assessments and surveys, including wind speed for wind energy, water discharge for hydropower, solar insolation for solar energy, and biomass feedstock for bioenergy.
- The feasibility study requires a detailed analysis of technical and economic viability based on site-specific resource potential. It also involves assessing the social and environmental benefits and the impact of resource utilization.

Energy efficiency projects

- The pre-feasibility study for energy efficiency projects requires a preliminary energy audit assessment at the targeted utility's energy-using facilities such as water supply and treatment plants, public buildings, etc. A preliminary energy audit involves conducting existing baseline energy usage by energy service companies (ESCOs), in particular facilities/equipment within a given period of time, in order to make a baseline reference against energy usage improvement to be adopted. The outcome of the pre-feasibility study is an assessment report. The preliminary energy audit serves as input to the next stage – a feasibility study.
- The feasibility study requires a detailed analysis and involves another investment grade audit in order to ensure technical and economic viability of client utilities/facilities. ESCOs thereby participate through performance contracts, to generate revenue from energy savings in targeted facilities.

Figure 9 highlights the flow and requirements of the two approaches to pre-feasibility and feasibility studies for renewable energy and energy efficiency projects.

Figure 9 Approaches to pre-feasibility and feasibility studies for developing bankable renewable energy and energy efficiency projects



3.4.1 Step 9. Performing a pre-feasibility study

A pre-feasibility study aims to determine the merit of prioritized investment options and select the one that presents the best value for money with the greatest social and environmental impact. It also helps determine whether such an option would warrant scarce resources — time, capital, and skills — to move to the next stage of development, which is to perform a full feasibility study and secure access to finance. A pre-feasibility study includes initial scoping and costing of the investment project, as well as assessment of the social and environmental safeguards, and governance and financing structure. As a guiding rule, if the result of a pre-feasibility study is positive, the investment option will move to the next phase, where a full feasibility study is performed.

From the prioritized scenarios or pathways in the road map or action plan, project developers in a partner country will consider two or three projects to pilot and demonstrate sustainable and green energy development.

A pre-feasibility study requires assessment of the following major parameters:

- Project description
- Local climate, resources, and infrastructure
- Local policies and regulations
- Technical parameters
 - Surveys²⁶
 - Mapping
 - Methodologies
 - Data and measures
 - Economic model
- Social and environmental parameters
 - Social and environmental scoping study
 - Key input required for the social and environmental impact assessment
 - Baseline, impact identification, and evaluation methodologies
 - Stakeholder engagement methodology

3.4.2 Step 10. Carrying out a feasibility study

A feasibility study is an important step in developing a pipeline of bankable green energy projects, or projects that are technically and financially viable and can attract funding for implementation. It provides an overview of the context of investment, the social and environmental impact of such an investment, the NPV, and the economic internal rate of return. For guidance, refer to the Annex for an overview of the major types of assessments that need to be conducted as part of a feasibility study.

GGGI supports the development of a pipeline of bankable projects by drafting a list of proposed projects, crafting concept notes for business cases and financing instruments, and facilitating financial closure.²⁷

GGGI follows a disciplined approach to developing bankable projects, which goes through the following four stages:

1 | PROJECT CONCEPTUALIZATION

At this early stage, a project concept note is initiated and developed. GGGI provides support in conducting the market analysis, policy analysis, technology analysis, and project prioritization; establishing general project parameters; and securing financing for the pre-development phase.

2 | PROJECT PRE-DEVELOPMENT

Based on the outcome of conceptualization, the pre-development of projects is carried out. At this stage, GGGI supports key activities such as preparing the pro forma statement, collecting data, analyzing tax and regulatory issues, drafting a critical issues analysis, engaging potential off-takers/financiers/developers, and securing financing for the development phase.

3 | PROJECT DEVELOPMENT

At this stage, GGGI assists in determining the project cost, schedule, milestones, and procurement method; preparing RFPs; engaging private sector firms; facilitating financial closure; and securing financing for the implementation phase.

4 | PROJECT CONSTRUCTION/IMPLEMENTATION

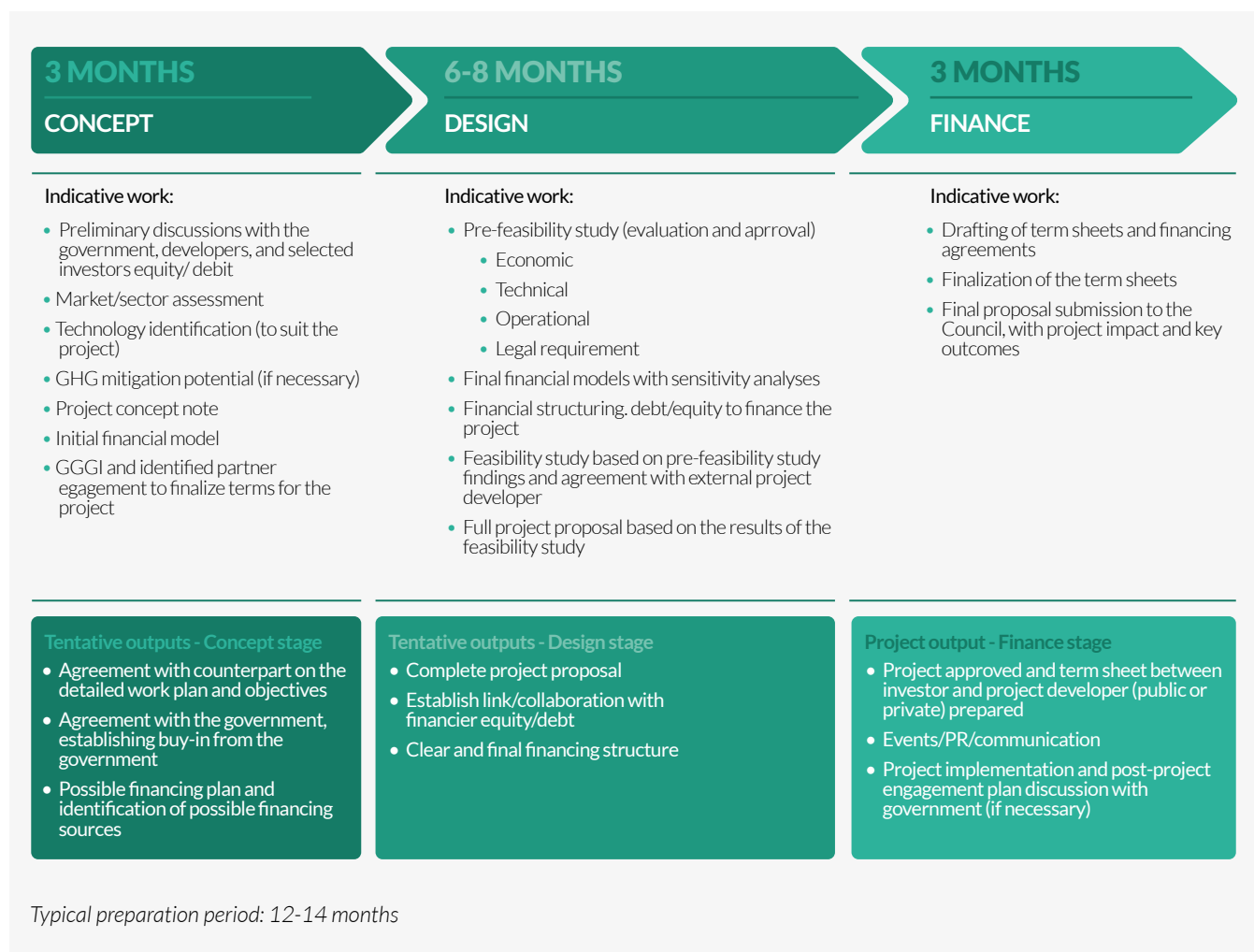
At this stage, GGGI provides support in conducting project evaluation and assessment, which serves as internal and external reference or knowledge product on lessons learned or best practice.

See Figure 10 that highlights major stages of developing bankable projects.

²⁶For renewable energy projects, a survey refers to specific site assessment of potential renewable energy sources. For energy efficiency projects, a survey refers to preliminary energy usage audit conducted by ESCOs.

²⁷Financial closure of the project is when the project and financing agreements have been signed and all the required conditions within the agreement have been met, enabling funds (e.g., loans, equities, grants) to start flowing so that project implementation can start.

Figure 10 Stages in developing bankable energy projects at GGGI



Under each stage of the workflow in developing bankable projects (see Figure 10 above), there are elaborated indicative activities. Each activity defined in the process largely depends on the kind of project being pursued. At various stages of the workflow, project viability is assessed and activities may differ. For example, the market/sector assessment may reveal that the projects are too small for consideration, or the initial financial model may not be viable. Results from such studies may raise a red flag at an early stage. Remember, not all projects are bankable. **Things to consider at each stage include the following:**

- **Tentative results at each stage**
 - For completion of each stage and to transition to the next stage, a few go/no-go type considerations have to be met. This is to reduce the risk that projects are developed without a financier or a project proponent.
- **Indicative funds needed under each stage**
 - Depending on the stage, the required budget can be assigned accordingly.
 - The budget estimates are to give a broad guideline for each stage of the project.
- **Timelines of the project**
 - The timeline mentioned in Figure 10 is a typical estimate for a project.
 - Since project timelines are lengthy, while considering the timeline for the work program and budget estimate, bear in mind that some of the projects may run for more than two years and slip over to the next cycle of the work program and budget.

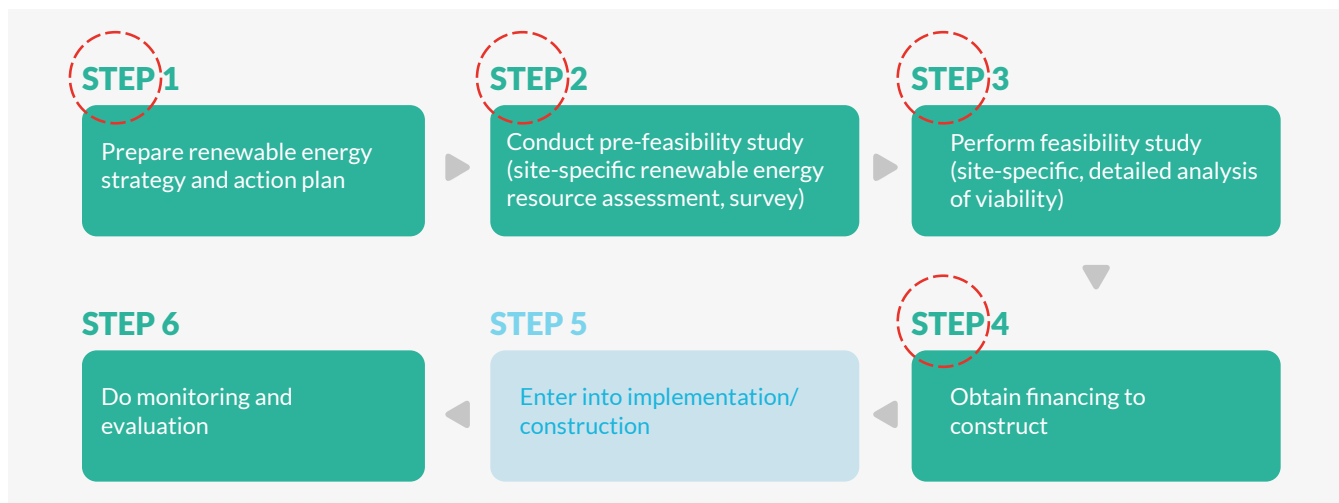
3.4.2.1 Renewable energy project cycle

The bulk of GGGI's work in relation to renewable energy projects relates to the technical and financial aspects, such as developing pre-feasibility and feasibility studies, preparing RFPs to encourage projects that are sufficiently attractive to developers and financiers, and helping projects reach financial closure.

GGGI offers support at various stages of the project cycle, depending on the requirements of partner governments. Figure 11 shows the stages of the project cycle where GGGI can provide support (steps that are in green).

Figure 11 depicts the project cycle for renewable energy projects.

Figure 11 Renewable energy project development cycle (on- and off/mini-grids)



3.4.2.2 Energy efficiency project cycle

To examine and evaluate the cost-saving potential of energy efficiency measures,²⁸ an energy performance evaluation and system optimization study of targeted facilities needs to be undertaken by the project developer at the feasibility study stage. The feasibility study is carried out through efficiency tests on key energy-consuming equipment.

In contrast to the project cycle of renewable energy projects, the energy efficiency project cycle exclusively involves an ESCO that implements energy efficiency measures. An ESCO enters into a performance contract with the government or any other entities to undertake steps optimizing energy usage and reducing energy expenditure in a technically and commercially viable manner.²⁹

The government or other entities could engage the services of an ESCO in a single- or two-step process. In case of the single-step process, the ESCO does the investment grade audit

of the agreement and energy-saving benefits of implementing recommended measures. In the two-step process, the government or host utilities first sign a contract with an ESCO to carry out an investment grade audit. Measures are then prioritized based on the audit report by calculating time, capital investment, and payback period, before proceeding with the implementation of the prioritized measures.

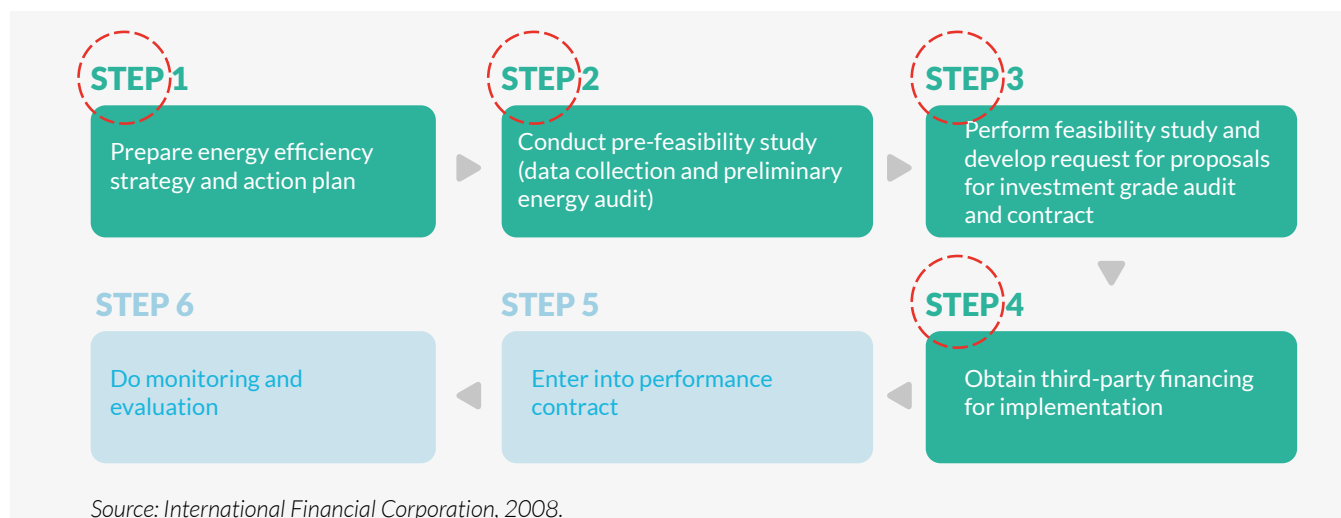
As marked in red ovals in Figure 12, GGGI provides support during steps 1 to 4 of the energy efficiency project development cycle. Its support ends once the energy efficiency project reaches financial closure. The bulk of GGGI's support is in the technical and financial aspects of the process, such as preparing RFPs that are sufficiently attractive for ESCOs (while aligned with the government's objectives) and securing loans from financial institutions.

GGGI plays a key role in preparing energy efficiency strategies, drafting proposals, securing finance, and conducting data collection and preliminary energy audits.

²⁸ Energy efficiency measures mainly in sectors such as buildings, water supply utilities, wastewater treatment plants, and agriculture.

²⁹ https://www.ase.org/sites/ase.org/files/ee_development_manual.pdf.

Figure 12 Energy efficiency project development cycle



According to the International Finance Corporation, data collection and RFP preparation (steps 2 and 3) require the following:

- Energy performance evaluation and system optimization study of targeted facilities.
- Investment grade audit report of targeted facilities, financial analysis of investment requirements, internal rate of return, expected savings, payback period, etc.
- Risk analysis and mitigation plan.
- Monitoring and evaluation plan.

In an energy efficiency project, GGGI assists ESCOs or governments in obtaining funding by working with them to develop a project presentation package that can be submitted to potential funders.

In implementing green energy projects, the following GGGI divisions/units play major roles:

- GGGI's in-country team serves as focal point for organizing meetings and manages the overall work progress, stakeholder engagement, and consultations with the government to identify follow-up engagement.
- IPSD assists in most of the technical work required to achieve financial closure, such as preparing RFPs, as well as facilitating and securing loans from financial institutions.
- The Knowledge Services Division and its thematic leads focus on upstream, high-level analysis of policies and regulations with IPSD's support in developing the financial component.



3.4.2.3 Preparing a log frame

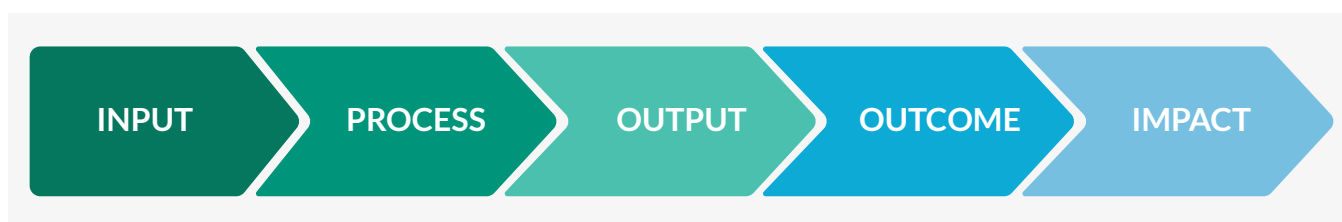
In designing and developing green energy programs or projects, it is important to set out a clear process to monitor and evaluate interventions, as it helps determine ways to provide information to the relevant audience and make necessary adjustments.

A logical framework (log frame), in the GGGI intervention context, is a design and monitoring framework. A key

component of any program or project, a log frame is results-oriented and helps conceptualize, design, implement, monitor, and evaluate projects. It uses a matrix to clearly explain the program or project impact, outcome, and outputs. The results of processes or interventions aim to achieve the impact, using inputs such as funding.

A log frame is an expression of a “results chain” (see Figure 13), which is the framework setting out what the program or project is expected to achieve.

Figure 13 Results chain for green project design

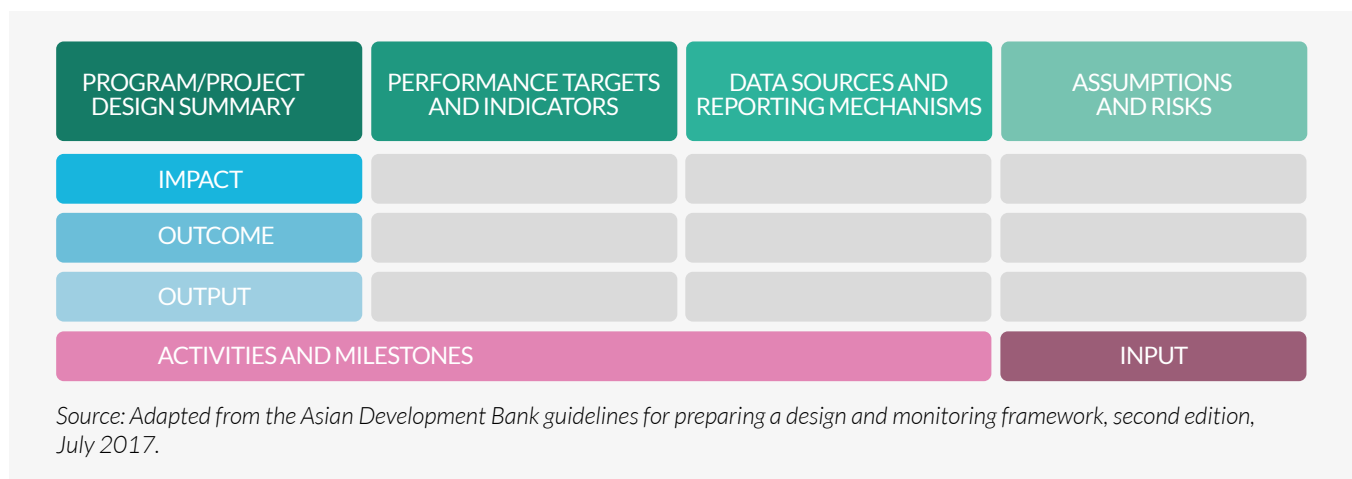


Monitoring and evaluation are essential for measuring the progress of the project according to agreed indicators. These indicators may be quantitative or qualitative, describe a reality, and indicate degrees of change. Ideally, they are measured at the beginning, during implementation, at the end of the project, and perhaps several years thereafter. Documenting conditions at the beginning of the project is important because it provides a baseline from which to measure progress.

Completing a design and monitoring framework matrix may follow a problem tree analysis (end of step 1). The matrix, as shown in Figure 14, articulates what a project sets out to achieve and how to do so. As completing it is iterative, a log frame evolves as a program or project design moves forward or following evaluation at various points of a project's lifetime. It is based on a cause-and-effect relationship and a good way to ascertain if a project is logical.



Figure 14 Matrix for the design and monitoring logical framework



3.4.2.4 GGGI's policy on sustainability, social, and environmental safeguards assessments

As an important and integral part of project design for bankability, GGGI assesses whether projects meet social and sustainability standards.

GGGI is committed to ensuring the social and environmental sustainability of the activities it supports in partner countries. Its Sustainability and Safeguards Policy³⁰ has put in place a mechanism to promote best practices while preventing or mitigating adverse impacts of GGGI's programs, projects, and operations on people and the environment.

The assessments that GGGI carries out as part of its commitment to social and environmental sustainability include the following:

- Social and environmental safeguards.** The assessment ensures the social and environmental soundness of programs and projects from the outset and throughout their cycles. This entails performing a social and environmental review during the program or project's initial stage and monitoring follow-up activities during the implementation stage. GGGI screens a comprehensive list of social and environmental impact triggers in each project for relevance.
- Corporate social responsibility.** The assessment reflects GGGI's commitment to "walk the talk" by improving the organization's own environmental footprint and staff well-being. In reducing GGGI's environmental footprint, focus is given to building management and air travel where the greatest impact is expected. GGGI promotes environment-friendly procurement practices through purchasing green products where possible and encouraging its suppliers to align with GGGI's Sustainability and Safeguards Policy. As an initial step, GGGI calculated GHG emissions from travel and electricity use at headquarters in 2013. The findings serve as a baseline for reducing GGGI's internal environmental footprint going forward. Box 12 highlights GGGI's main service offerings in the area of project design and bankable project preparation.

Box 12 Summary of GGGI service offerings in project design and bankable project preparation

- Support in conducting pre-feasibility and feasibility studies for green energy projects.
- Assist in preparing ideas and concept notes to develop a pipeline of bankable green energy projects.
- Assist in preparing a pipeline of bankable green energy projects.
- Support in developing business/financing models/cases for renewable energy and energy efficiency projects.
- Support in developing mechanisms to strengthen the capacity of ESCOs to implement energy efficiency measures.

³⁰ GGGI (2014), *Discussion paper: GGGI's Sustainability and Safeguards Policy*.

3.4.3 Step 11. Financing

At this step, GGGI supports governments in overcoming financial barriers by providing specialized investment services for renewable energy and energy efficiency programs and projects. This step focuses on identifying policy, planning, and regulatory barriers for scaling up renewable energy and energy efficiency interventions, and helps governments develop financial investment instruments, including de-risking actions.

3.4.3.1 What makes a project bankable?

A project proposal is considered bankable when:

- There is sufficient future cash flow.
- Related risks are mitigated.
- There are necessary permits from national licensing agencies.
- Authorization of the proposed project by licensing agencies and the contract is in place.
- Lenders or investors are willing to finance it.

Figure 15 presents basic characteristics of bankable green energy projects.

Figure 15 Characteristics of a bankable project



A well-developed green energy project proposal is a result of extensive consultations with stakeholders on the rate of financial gain from pursuing the project. As a result, it is essential for partners to develop strategies and proposals that are backed by evidence showing that projects will have a good return on investment. A modeling exercise can provide the evidence. Funders of green energy projects, such as the GCF, donor windows, development banks, private equity, and commercial financial institutions, require that proposals show strong evidence that their investments will reduce GHGs, contribute to SDGs, and/or enhance resilience.

3.4.3.2 Who contributes to the bankability of green energy projects?

There are several actors whose actions influence the bankability of green energy projects:

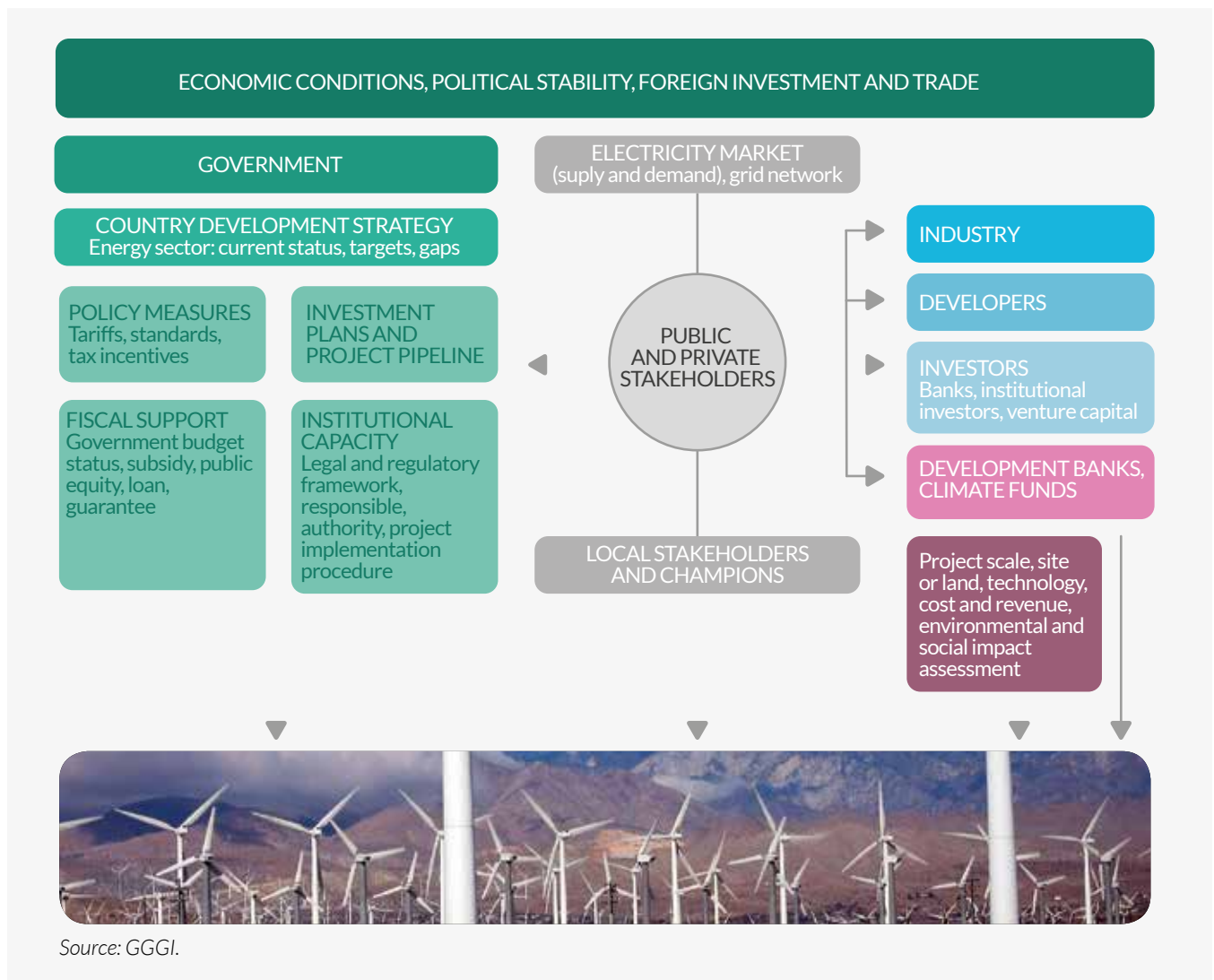
- **Partner governments** can craft development strategies, identify and implement supportive policy and fiscal measures, and develop investment plans and project proposals that serve as financing avenues.
- **Local stakeholders and champions** can signal to investors whether local communities support or oppose projects. Having local champions, thus, improves prospects for project success.

- **Private sector investors** put up finance for project development and/or indicate their willingness to invest in a project, whether technically or financially.
- **International climate finance donors** can bridge gaps in project financing. Securing their support, however, hinges on several elements, namely a solid proposal from the government, support of local stakeholders, and private investors' interest in the project.

Other factors that influence bankability include geographic location of the resource for electricity grids, location of power demand, social and environmental impacts inherent in project development, and the cost of developing a resource.

Figure 16 highlights factors contributing to the bankability of green energy projects.

Figure 16 Factors contributing to the bankability of green energy projects



3.4.3.3 Indicators of project bankability

To be bankable, a project should:

- **Be attractive to financiers.** Funders must want to fund the project, and the proposal should be tailored to their goals. For the private sector, an economic opportunity may be the main source of attraction. For climate finance sources, it may be environmental benefits. For international development programs, proving the project's social benefits may be key.
- **Be feasible and efficient.** The budget should be grounded on what the project can realistically deliver (e.g., the local terrain is favorable for investment, or access to energy markets is available). Also, the project should promote the efficient use of funds. For example, for a climate fund, dollars spent in relation to GHGs avoided should be reasonable.
- **Show economic, social, and environmental benefits.** Can the project show that economic, social, and environmental improvements are achieved through it?
- **Be low-risk or show measurable risks for mitigation.** Different funders have different risk tolerances, and it is incumbent on the proponent to lower this risk as much as possible by, for instance, diversifying funding sources instead of relying on a single funder.
- **Have the support of government and other key stakeholders.** Having the support of all key stakeholders is a major benefit to carrying out a project and lowers risks. Policy advocacy and awareness campaign on the benefits of green energy to key stakeholders could gain buy-in.

Table 6 outlines indicators of bankability specific to green energy projects.

Table 6 Requirements for green energy project bankability

REQUIREMENTS FOR BANKABILITY	MAIN DESCRIPTION
Having a clear impact to improve the environment	GHG reduction is a key parameter for governments in order to access global climate financing (e.g., GCF) to address climate change impact and achieve their NDCs.
Contributing to national development goals	Alignment of green energy projects with national strategies, plans, poverty reduction initiatives, and SDGs is important for project bankability.
Contributing to national energy security and social development	It is crucial that a bankable energy project improve energy access and security, generate income and employment, improve health conditions (e.g., improved air quality), etc.



3.4.3.4 Securing finance

Any sound financial proposal includes a business model, which focuses on long-term management and funding of the project.

Developing a business model not only enables a partner country to make its proposals attractive to international funders, but also helps sort out domestic financial processes.

Costing carried out as part of pre-feasibility and feasibility studies can identify the scale of required project financing. In addition, it can provide cost per unit of energy potential (e.g., USD per kilowatt-hour) compared to alternative energy sources.

At the planning process, it is advisable to look at funds based on their potential and requirements. That way, countries can prioritize financing sources that they would have more success in accessing.

Business models for off-grid projects differ from those for on-grid projects.

The business model for an off-grid project incorporates an expected return on investment focused on greater non-economic indicators such as social development and environmental improvement. It could entail determining the

level of subsidies in the form of feed-in-tariff or financial assistance to end users that develop their own projects tapping energy sources, such as solar photovoltaic, as a way to promote inclusive development.

The business model for an on-grid project outlines the relationship among key actors – the power provider, purchasers, and international funders. Since the relationship between a purchaser and a seller is crucial for the project's success, the business model must outline economic, social, and environmental benefits for both, including GHG reduction, job creation, poverty alleviation, and/or public health improvement. The benefits should be sufficient to justify a higher economic cost. The business model must also identify how much producers should be paid for the power they provide to the grid to maximize the benefits from the amount of energy provided.

A contract between the selling and purchasing parties signals the start of the project. The nature of the power sector defines the role of the government in the project – if private entities dominate the power sector, the government may facilitate international financing, but if the government controls the sector, it may take a direct role in implementing the project. Box 13 summarizes major service offerings in the area of finance.

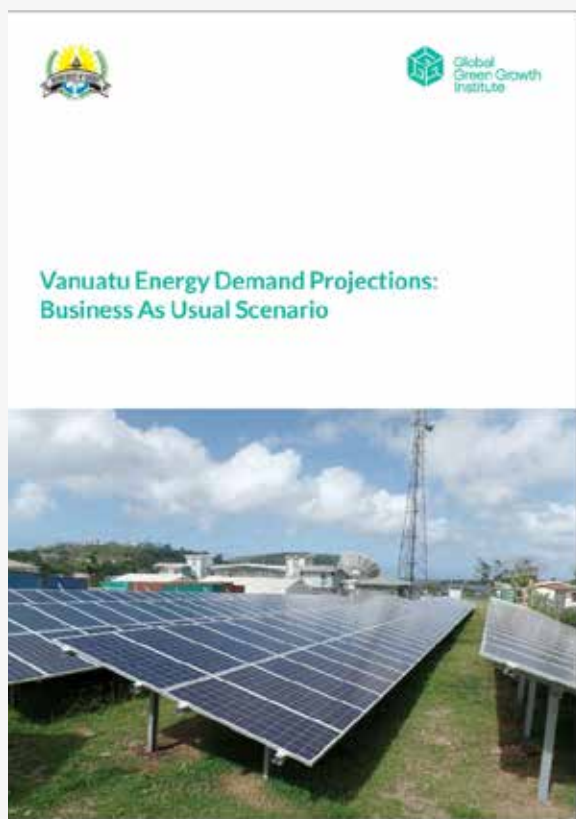
Box 13 Summary of GGGI service offerings in the area of financing

- **Incentivize green energy projects by engaging government partners at the policy level. The in-country team supports scaling up of projects by facilitating a national dialogue with government ministries, financiers, and project developers.**
- **Facilitate and develop financial proposals for a national green energy fund. The fund serves as a key mechanism for financing bankable projects envisaged in the areas of renewable energy, energy efficiency, and other green technologies under the country planning framework developed by GGGI in partnership with its government partners.**
- **Develop financial de-risking instruments for the financing vehicle that will be used to implement renewable energy and energy efficiency projects.**
- **Develop business models/cases for green energy projects.**
- **Offer technical assistance to develop a national green energy fund.**

3.4.4 Step 12. Implementing

At this step, GGGI monitors and evaluates the implementation of green energy projects. The results serve as knowledge products, such as best practices and/or lessons learned, which are incorporated into regional and global knowledge-sharing platforms and networks for greater replication and impacts. Box 14 offer one of the example of GGGI support in the energy sector in Vanuatu.

Box 14 GGGI's experience providing energy intervention in Vanuatu



Challenges

Driven by traditional agriculture, fishing, and a fast-growing tourism industry, Vanuatu has achieved strong economic performance over the past decade. Vanuatu encounters unique economic challenges due to its distance from major markets, lack of infrastructure, and vulnerability to natural disasters and climate change. Vanuatu's energy insecurity is also a barrier to achieving inclusive green growth, with key challenges including an unbalanced supply of energy to remote rural locations, the high cost of electricity, dependence on fossil fuels, and a lack of energy efficiency standards.

Membership and GGGI support

Originally endorsed by the Council of Ministers in 2013, the National Energy Road Map (NERM) has served as the policy framework for developing the energy sector in Vanuatu. Since the launch of NERM, Vanuatu's economy and energy sector have continued to develop, and external events, such as Cyclone Pam in early 2015, have shaped the conception of energy sector policies and priorities.

GGGI, in collaboration with the World Bank, provided technical assistance to Vanuatu's Department of Energy for the revision of NERM, which is based on a 15-year (2016-2030) strategic vision and identifies five strategic areas for policy intervention in the energy sector: accessible energy, affordable energy, secure and reliable energy, sustainable energy, and green growth. GGGI analyzed business-as-usual energy demand scenarios and developed an action plan for energy efficiency in the electricity, buildings, cooking, and transport sectors.

GGGI consulted with a wide range of stakeholders, and the consultations informed a policy briefing on energy and green growth. It also assisted the Department of Energy in developing energy and green growth targets, with the objective of increasing the use of renewables in several sectors, including water, fisheries, and tourism.

Based on an analysis conducted by GGGI and the Department of Energy, the government of Vanuatu approved the establishment of the National Green Energy Fund to address the issues around financial resources for energy access. This fund will be used as a tool to realize the objectives of NERM – to achieve 100 percent rural electrification and promote business and income-generating activities in the rural areas.

Support summary

- Assisted in the revision of NERM.
- Assisted in drafting energy efficiency goals and provided recommendations for implementing energy efficiency measures.
- Conducted green growth analysis of the energy sector, which involved collecting up-to-date data on energy consumption by end user, identifying energy usage data gaps, analyzing baseline data, reviewing the status of ongoing and planned and/or financed energy projects, and analyzing the potential impacts of non-achievement of NERM targets on projected energy consumption.
- Identified climate adaptation and mitigation funds for financing the implementation of NERM.
- Developed recommendations for establishing a green growth financing mechanism.
- Supported the establishment of the National Green Energy Fund.

Sources: GGGI (2015), <http://gghi.org/vanuatu-energy-demand-projections-business-as-usual-scenario>.



References

- 1 | Asia Development Bank. 2015. *Business Models to Realize the Potential of Renewable Energy and Energy Efficiency in Greater Mekong Sub-Region*.
- 2 | Climate Investment Funds. 2014. *Knowledge Note on Prioritizing Renewable Energy Options*.
- 3 | Global Green Growth Institute. *Strategies Development for Green Energy Systems in Mongolia*. <https://www.sei-international.org/mediamanager/documents/Publications/Climate/GGGI-SEI-2014-Mongolia-green-energy-systems.pdf>.
- 4 | Global Green Growth Institute. 2015. *Vanuatu Energy Demand Projection: Business-as-Usual Scenario*. <http://gggi.org/vanuatu-energy-demand-projections-business-as-usual-scenario>.
- 5 | Global Green Growth Institute. 2015. *GGGI Vanuatu Fact Sheet: Green and Inclusive Energy Reform*. <http://www.greengrowthknowledge.org/sites/default/files/GGGI%20Fact%20Sheet%20Vanuatu%20-%20Green%20and%20Inclusive%20Energy%20Reform.pdf>.
- 6 | Global Green Growth Institute. 2015. *Renewable Energy: A Green Growth Assessment for the Government of Kalimantan Province, Indonesia*. http://greengrowth.bappenas.go.id/en/program/download/20151019121653.eCBA_4_Renewable_Energy_Kalimantan_Technical_Report.pdf.
- 7 | Global Green Growth Institute. 2017. *Accelerating the Transition to a New Model of Growth*. <http://gggi.org/wp-content/uploads/2017/11/GGGI-Refreshed-Strategic-Plan-2015-2020.pdf>.
- 8 | International Energy Agency. 2016. *Energy Poverty*.
- 9 | International Energy Agency. 2012. *Plugging the Energy Efficiency Gap with Climate Finance*.
- 10 | International Energy Agency. 2015. *Energy and Climate Change (World Energy Outlook Special Report)*. <https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>.
- 11 | International Finance Cooperation. 2007. *Manual for the Development of Municipal Energy Efficiency Projects*. https://www.ase.org/sites/ase.org/files/ee_development_manual.pdf.
- 12 | International Renewable Energy Agency. 2017. *Third International Off-grid Renewable Energy Conference (IOREC) Workshop – Key Recommendations for Accelerating Off-grid Renewable Energy*. https://www.irena.org/DocumentDownloads/Publications/IRENA_Accelerating_off-grid_renewables_2017.pdf.
- 13 | RECP-Africa EU Renewable Energy Cooperation Program. 2014. *Mini-Grid Policy Toolkit: Policy and Business Framework for Successful Mini-grid Roll-outs*.
- 14 | REN 21. 2014. *Renewables Global Status Report*. http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf.
- 15 | The White House. 2016. *Catalyzing Global Markets for Off-grid Energy Access*. https://obamawhitehouse.archives.gov/sites/default/files/docs/catalyzing_global_markets_for_off-grid_energy_access_final_cover.pdf.
- 16 | World Bank Group. 2016. *Fostering the Development of ESCO Markets for Energy Efficiency*. <http://documents.worldbank.org/curated/en/709221467753465653/pdf/103932-BRI-LW54-OKR-PUBLIC.pdf>.





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Annexes

Needs assessment matrix

ENERGY AND CROSS-SUBSECTORS	POLICY AND GOVERNANCE	FINANCIAL CONDITION	IMPLEMENTATION STRUCTURE	ENVIRONMENTAL MANAGEMENT
Energy in households				
Energy in transport				
Energy in agriculture				
Energy in water supply and wastewater treatment				
Others as relevant, depending on local partners' needs				

Typical objectives of green energy planning

OBJECTIVES	MAIN DESCRIPTION
Provide reliable and affordable access to energy service	<ul style="list-style-type: none"> • Providing reliable, affordable, and sustainable energy access is a primary objective of green energy interventions. • Reliable access to energy is crucial to a country's economic development.
Increase energy security	<ul style="list-style-type: none"> • Green energy planning will reduce the vulnerability of a county to economic shocks due to distorted energy supply, which is often caused by global fluctuation in fossil fuel price. • Proper green energy planning facilitates development and use of local energy resources such as renewable energy (e.g., solar, hydropower, biomass, and wind).
Minimize environmental impacts	<ul style="list-style-type: none"> • A proper green energy project contributes to reducing GHG emissions to meet global climate change commitments (such as NDCs to the Paris Agreement) to combat climate change impacts at global, regional, and local scales.
Provide social benefits	<ul style="list-style-type: none"> • Green energy intervention creates off-grid energy access, promotes local economic development and income generation, contributes to poverty reduction, and increases access to health services and education. • Green energy planning creates local jobs and employment, and overall, assists in achieving a country's SDG targets.

Major types of assessments when undertaking feasibility studies

TYPES OF ASSESSMENTS	MAJOR UNDERLYING PARAMETERS/ISSUES THAT NEED TO BE ASSESSED
Poverty and social assessment	<ul style="list-style-type: none"> • Public consultation • Gender assessment • Social action plan • Monitoring indicators
Initial environmental examination	<ul style="list-style-type: none"> • Description of the environment • Screening of potential environmental impacts and mitigation measures • Environmental management and monitoring plan • Public consultations and information disclosure • Findings and recommendations
Environmental assessment review procedure	<ul style="list-style-type: none"> • Assessment of legal frameworks and institutional capacity • Anticipated environmental impacts • Environmental assessment of subprojects and/or components • Consultation, information disclosure, and grievance redress
Social impact assessment	<ul style="list-style-type: none"> • Livelihood of vulnerable groups • Gender and women
Mechanism	<ul style="list-style-type: none"> • Institutional arrangement • Monitoring and reporting
Engineering (technical investigation and project design)	<ul style="list-style-type: none"> • Technical field investigation • Technical design standards and guidelines • Bio-engineering measures • Climate change adaptation • Proposed upgrading alternatives • Cost estimate and contract packaging • Detailed technical engineering appendices
Economic evaluation	<ul style="list-style-type: none"> • Cost estimates of alternative scenarios • Unit costs and operating data • Savings resulting from project implementation • Other quantifiable benefits • Multiplier and retainer local share of investment/maintenance costs • Proxy for social benefits and affected population • Alternative economic analysis • Sensitivity analysis • Distribution of benefits and risk analysis

GGGI and partners' roles and responsibilities in green energy development

NO	KEY ACTIVITY	MAJOR SUBACTIVITIES	RESPONSIBLE DIVISION OR UNIT
1	Diagnosis	Assess legal, institutional, and regulatory frameworks	<ul style="list-style-type: none"> IPSD (PS & GIS) to provide technical and policy support TL to contribute GGP&I to liaise with government counterpart Consultant to provide data support and assist in translation
2	Step 1: Sector baseline assessment and demand projection	Perform baseline study of the energy sector/subsectors and energy modeling analysis	<ul style="list-style-type: none"> PS to lead TL to contribute Key sector to lead
3	Step 2: Setting of objectives and identification of measures for green energy planning	Identify measures and consult with governments and other stakeholders to align/mainstream green energy into national development strategies (poverty reduction, SDGs, NDCs)	<ul style="list-style-type: none"> IPSD (energy team to lead in setting the target) GGP&I to coordinate with government partner/s TL to contribute Government partner/s to coordinate between GGGI and relevant ministries and counterpart
4	Step 3: Description of alternative green energy pathways for green growth	Analyze and describe identified pathways for green energy options	<ul style="list-style-type: none"> PS to lead (PS energy experts to provide guidance and review) GIS to contribute to developing bankable projects TL to contribute to developing the concept of green growth in energy sector and review Consultants to provide data assessment and translation support
5	Step 4: Screening of green growth components from defined alternatives pathways	Carry out screening analysis to identify green growth components of green energy	<ul style="list-style-type: none"> In-country team (GGP&I) Key sector/subsector partners TL
6	Step 5: Multi-attribute comparison and prioritization	Undertake analysis to compare pathways	<ul style="list-style-type: none"> In-country team (GGP&I) Key sector/subsector partners TL
7	Step 6: Synthesis of green energy plans	Prepare a green energy plan incorporating strategy and an implementation action plan	<ul style="list-style-type: none"> In-country team (GGP&I) Key sector/subsector partners TL to review the perspective of GGGI, particularly the concept of green growth
8	Step 7: Sectoral policy and market assessment	Conduct sectoral policy and market assessment on economic subsectors, and forward specific recommendations to policymakers based on findings	<ul style="list-style-type: none"> In-country team (GGP&I) Key sector/subsector partners IPSD (GIS)
9	Step 8: Design of green energy deployment program	<ul style="list-style-type: none"> Prepare concept note to develop the deployment program Prepare concept note to develop national green energy fund Develop project ideas and prepare concept notes (project conceptualization) 	<ul style="list-style-type: none"> In-country team (GGP&I) Key sector/subsector partners GIS to contribute to developing fund and designing bankable projects

NO	KEY ACTIVITY	MAJOR SUBACTIVITIES	RESPONSIBLE DIVISION OR UNIT
10	Step 9: Pre-feasibility study for renewable energy and energy efficiency projects	<ul style="list-style-type: none"> Conduct preliminary site- and source-specific study for renewable energy projects Conduct preliminary utility/facility-specific study for energy efficiency projects 	<ul style="list-style-type: none"> In-country team GIS PS Energy theme lead
11	Step 10: Feasibility study for renewable energy and energy efficiency projects	<ul style="list-style-type: none"> Conduct detailed analysis of the technical and financial viability of renewable energy and energy efficiency projects Prepare RFPs Undertake project pre-development (business models, off-takers/financier/developers) Create a pipeline of bankable projects 	<ul style="list-style-type: none"> In-country team GIS PS IPSD Energy theme lead TL
12	Step 11: Financing	Facilitate financial closure	<ul style="list-style-type: none"> GIS to lead Finance team OED legal team
13	Step 12: Implementation	Engage in construction (renewable energy) and energy-saving performance (energy efficiency)	<ul style="list-style-type: none"> GIS to lead PS to monitor, evaluate, and document the outcome knowledge product In-country team to support and monitor the project Government partner

Note: Focus on partnerships

Effective partnerships underpin GGGI efforts to support partner countries in mainstreaming green growth energy development and climate change actions. GGGI prioritizes engagement with diverse international partners to leverage GGGI experience and expertise, build on the strengths of others, and enhance synergies. Key effective partners include international and regional organizations, the private sector, and academia.



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