Climate Investment Funds

SREP/SC.13/4
April 29, 2015

Meeting of the SREP Sub-Committee
Washington D.C.
Wednesday, May 13, 2015

Agenda Item 4

SREP INVESTMENT PLAN FOR GHANA

PROPOSED DECISION

The SREP Sub-Committee, having reviewed document SREP/SC.13/4, *SREP Investment Plan for Ghana*,

a) endorses the investment plan as a basis for the further development of the projects and programs foreseen in the plan and takes note of the request for USD 40 million in SREP funding. The Sub-Committee requests the Government of Ghana, in the further development of the proposed projects and programs, to take into account comments made at the meeting and any additional written comments submitted by Sub-Committee members by May 29, 2015, and to respond in writing to questions raised during the meeting and in subsequent written comments;

b) reconfirms its decision on the allocation of resources, adopted at its meeting in November 2010, that all allocation amounts are indicative for planning purposes and that approval of funding will be on the basis of high quality investment plans and projects;

c) approves a total of USD 1,510,300 in SREP funding as preparation grants for the following projects to be developed under the investment plan:

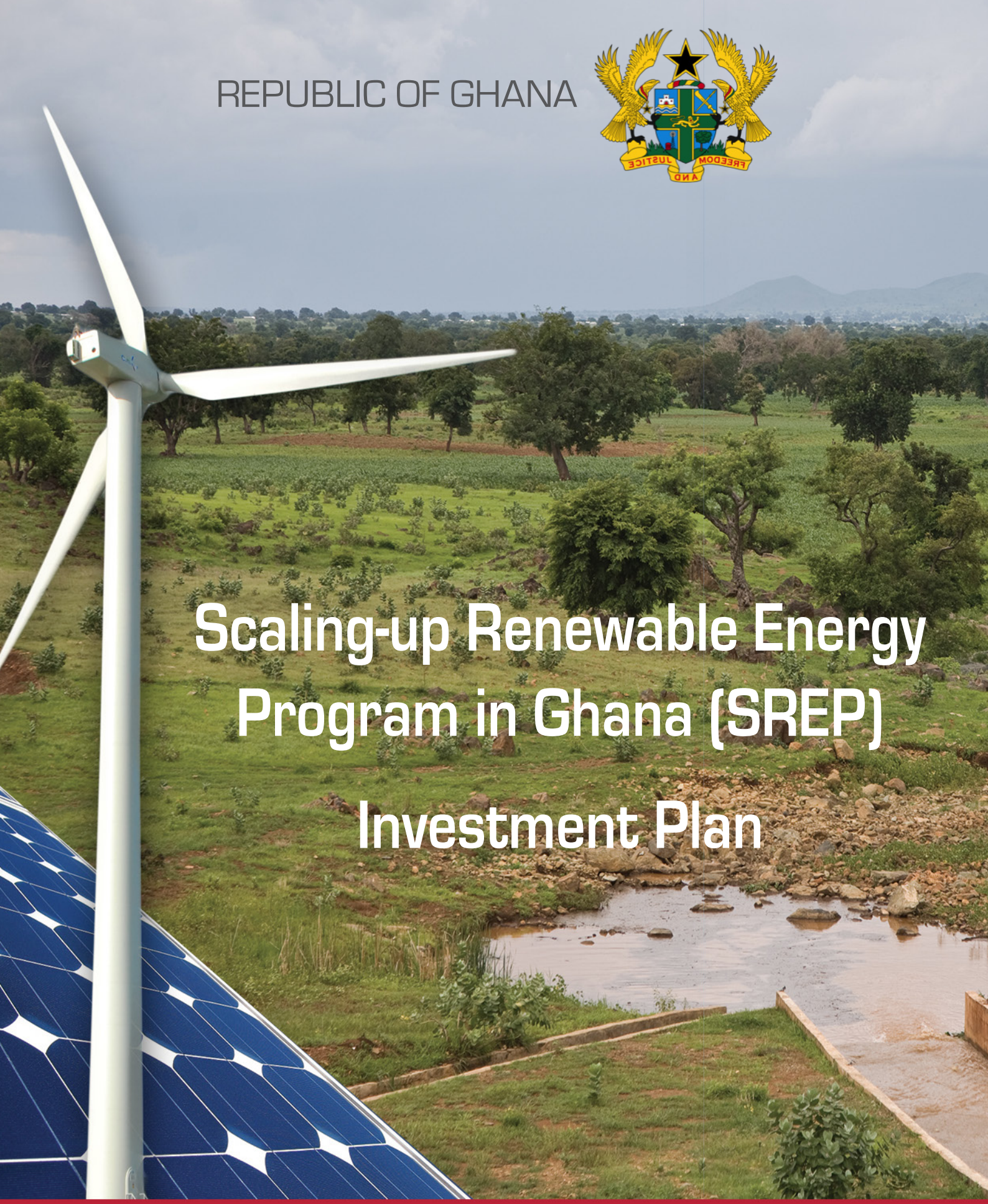
   i. USD 899,800 for the project entitled, *Renewable Mini-grids and Stand-alone Systems* (AfDB);
   ii. USD 610,500 for the project entitled, *Net Metered Solar PV for SMEs and Lighting Project* (AfDB);

d) takes note of the estimated budget of USD 400,000 for MDB project preparation and supervision services for the project entitled, *Renewable Mini-grids and Stand-alone Systems* (AfDB), and approves USD 200,000 as a first tranche of funding for such services;

e) takes note of the estimated budget of USD 400,000 for MDB project preparation and supervision services for the project entitled, *Net Metered Solar PV for SMEs and Lighting Project* (AfDB), and approves USD 200,000 as a first tranche of funding for such services;

f) further takes note of the estimated budget of USD 450,000 for MDB project preparation and supervision services for the project entitled, *Utility-scale Solar PV/ Wind Power Generation* (IFC).

REPUBLIC OF GHANA



Scaling-up Renewable Energy Program in Ghana (SREP)

Investment Plan

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ACRONYMS AND ABBREVIATION

AA	Action Agenda
AAF	Automatic Adjustment Formula
AEI	African Electrification Initiative
AFD	Agence Française de Développement
AfDB	African Development Bank
AREED	African Rural Energy Enterprise Development
AUSAid	Australian Agency for International Development
BMZ	German Federal Ministry for Economic Cooperation and Development
BPA	Bui Power Authority
CIF	Climate Investment Funds
CL&BCP	Community Lighting & Battery Charging Facility Project
CWE	China Water Electric
DFID	UK Department for International Development
DP	Development Partner
DSA	Debt Sustainability Analysis
DSO	Distribution System Operators
E&S	Environmental and Social
EC	Energy Commission
ECG	Electricity Company of Ghana
ECOWAS	Economic Community Of West African States
EHS	Environmental, Health and Safety
ENDEV	EnerGIZing Development Program
EP	Enclave Power
EPA	Environmental Protection Agency
EPRAP	Poverty Reduction Action Plan for Ghana
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
FiT	Feed-in Tariffs
GCSA	Government consent and support agreement
GDP	Gross Domestic Product
GEDAP	Ghana Energy Development and Access Project
GHS	Ghanaian cedi currency
GIS	Global Information System, then later Geographical Information System
GIZ	German Agency for International Cooperation
GOG	Government of Ghana
GRA	Ghana Revenue Authority
GRIDco	Ghana Grid Company
GSGDA	Ghana Shared Growth and Development Agenda
HSAP	Hydropower Sustainability Assessment Project
IFI	International Finance Institution

ILS	Information and Lessons Sharing
IP	Investment Plan pg 31, then later Investment Program
IPP	Independent Power Producers
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
KITE	Kumasi Institute of Technology, Energy and Environment
LPG	Liquid petroleum gas
M&E	Monitoring and evaluation
MCC	Millennium Challenge Corporation
MDB	Multilateral development bank
MFA NL	Dutch Ministry of Foreign Affairs
MFA NO	Norwegian Ministry of Foreign Affairs
MOP	Ministry of Power
NCCP	National Climate Change Policy
NEDco	Northern Electricity Distribution Company
NFI	National Finance Institution
NIB	National Investment Bank
NMIMR	Noguchi Memorial Institute for Medical Research
PPA	Power Purchase Agreement
PPBME	Policy Planning, Budgeting, Monitoring and Evaluation
PPMED	Policy Planning Monitoring and Evaluation Directorate
PSR	Power Sector Reforms
PRG	Partial Risk Guarantee
PUE	Productive use of energy
PURC	Public Utility Regulatory Commission
PV	Solar Photovoltaics
RAP	Resettlement Action Plans
RAED	Renewable & Alternative Energies Directorate
RE	Renewable energy
REA	Renewable Energy Authority
REF	Renewable Energy Fund
RE-FiT	Renewable Energy Feed-in Tariffs
RET	Renewable Energy Technology
RPF	Resettlement Policy Framework
SDC	Swiss Agency for Development and Cooperation
SECO	Swiss Economic Development Cooperation
SE4ALL	Sustainable Energy for All Initiative
SHS	Solar home systems
SLAP	Solar Lanterns Promotion Program
SME	Small and Medium sized Enterprises
SNV	Netherlands Development Organization
SREP	Scaling-up Renewable Energy Plan
TA	Technical assistance
TSO	Transmission System Operator
UNDP	United Nations Development Program
VRA	Volta River Authority
WB	World Bank
WRA	Wind resource assessment

MAP OF GHANA


BURKINA FASO
BENIN
TOGO
CÔTE D'IVOIRE
GHANA
UPPER EAST
UPPER WEST
NORTHERN
BRONG-AHAFO
ASHANTI
EASTERN
VOLTA
WESTERN
CENTRAL
GREATER ACCRA
Bolgatanga
Wa
Tamale
Sunyani
Kumasi
Koforidua
Accra
Cape Coast
Sekondi-Takoradi
Lomé
Gulf of Guinea
Atlantic Ocean
© Nations Online Project
GHANA
National capital
Regional capital
Town, village
Airport
International boundary
Regional boundary
Main road
Secondary road

FOREWORD

Ghana is endowed with a wealth of renewable energy sources. When exploited sustainably, these resources can provide much needed additional energy capacity through the creation of solar, wind, biomass, hydro, wave and tidal power. The financing required to harness this potential in order for the country to become an "energy economy" however, is substantial. The Scaling-up Renewable Energy Program in Ghana Investment Plan (SREP-Ghana IP) is therefore key to the Government's strategy aimed at unlocking financing opportunities to accelerate the development of a sustainable renewable energy sector.

The projects to be identified for financing in this IP are expected to significantly contribute to the Government's goal of universal access to electricity by 2020. The IP is aligned with national and regional policy benchmarks such as the Strategic National Energy Plan, the National Energy Policy, the Energy Sector Strategy and Development Plan, and the ECOWAS Renewable Energy Policy. This alignment, coupled with the ability to work in tandem with other partners that similarly encourage a low-carbon pathway, such as the Sustainable Energy for All initiative, increases the likelihood of demonstrable impact in the daily lives of ordinary Ghanaians.

Anchored around three prioritized investment areas and a programmatic technical assistance component, the SREP-Ghana IP is expected to yield the following impacts:

1. Expanded electricity access to over 600,000 women, men, businesses and community services, the majority of whom/which reside in the remotest parts of the country;
2. Increased annual electricity output from renewables by 115 GWh;
3. Reduced greenhouse gas emissions by 76,664 tons of CO2 per year;
4. Increased productive uses of renewable energy in SMEs; and
5. Streamlined and enhanced sector policies by identifying and addressing key barriers to ensure the scaling-up of renewable energy.

Continuous dialogue and thoughtful comments and suggestions received from partners DFID, GIZ, KITE, NORAD, SE4ALL, SECO, SNV, and UNDP, among others, demonstrate the level of stakeholder engagement and the relevance of the IP to the coordination and implementation of renewable energy initiatives in Ghana. Achieving the targets of the program must be a collective effort among all public stakeholders in conjunction with the private sector. The Ministry of Power is committed to providing the required leadership and prioritizing the realization of the SREP-Ghana IP.

I wish to convey my gratitude to the SREP National Taskforce, the multilateral development banks and the Ministry of Finance for actively contributing to the development of the SREP-Ghana IP. I further commend this plan which sets the stage for the fast-tracking and scaling-up of renewable energy initiatives in a pragmatic and sustainable manner

Dr. Kwabena Donkor
Minister, Ministry of Power

EXECUTIVE SUMMARY

"Climate variability and change constitute a major threat to national development. […] It leads to increased financial cost of provision of economic and social infrastructure, as well as resettlements of people […]. The challenge is to turn climate change and variability into an opportunity to expand national output and productivity and embark on systemic protection programs."

Ghana Shared Growth and Development Agenda II (2014-2017)

INTRODUCTION

Ghana is already experiencing the impacts of climate variability. The mean annual temperature has risen 1°C per decade since 1960. Monthly rainfall has decreased 2.4% per decade during the same period. These climate-induced changes are stressing the country's vulnerable sectors: agriculture, coastal zones/marine ecosystems, water resources and energy production. Climate projections show that Ghana will become hotter and wetter during the wet season and drier during the dry season. Economy-wide, it is estimated that by 2050, annual real GDP is projected to be 1.9 to 7.2% lower than if there was no anthropogenic climate change.

Ghana contributes little to global emissions of greenhouse gases with CO_2 emissions a mere 0.4 tons per capita in 2010. Nevertheless, as a responsible member of the global community and as a means of diversifying the energy mix and providing modern energy service to its populace, Ghana is committed to investing in renewable energy (RE) sources. Clearly, business-as-usual is not an acceptable option in making its energy

systems climate resilient while concomitantly meeting the rapid growth in electricity demand. Therefore the Ghana National Climate Change Policy (NCCP) issued in 2013, stated that "The NCCP will ensure a climate-resilient and climate-compatible economy which addresses a low-carbon growth path for Ghana while achieving sustainable development." The Scaling-up Renewable Energy Program in Ghana (SREP-Ghana) support and the co-financing it will leverage is crucial in achieving this important national policy goal.

ENERGY SECTOR CHALLENGES

Ghana's energy sector is heavily dependent on biomass and oil, which account for close to 90% of the country's primary energy supply. In addition to oil and gas, hydropower is an important source of electricity. The generation capacity is currently about 3,000 MW of which 54% is hydropower. Electricity demand growth has been about 10% per annum. Expansion planning studies estimate that through 2026, electricity demand will need to increase nearly three-fold to 28,000 GWh compared to 2010 consumption. And, according to studies, the generation capacity needs to increase to about 4,200 MW by 2026 to meet this demand.

Rapid electricity demand growth and the highly variable hydropower production, has caused severe electricity shortages that has led to load shedding and forced the Government to shift to oil-fired generators. The World Bank (WB) assessment, "Economics of Adaptation to Climate Change" indicates that losses in hydropower due to climate change could be up to $70 million per annum.

In Ghana, about 70% of the population has access to electricity, among the highest connection rates in sub-Saharan Africa. The remaining 30%, or about 5 million people, will be exceedingly difficult and costly to connect through a grid network as many are in remote, inaccessible areas, including islands and lakeside communities. Off-grid and mini-grid options are expected to be the technology of choice for meeting electricity needs of the majority of the unserved population.

Ghana's energy sector vision is a developed "energy economy" with reliable high quality energy services. The following national energy policy goals were therefore established by the Government of Ghana (GoG) in order to achieve this vision:

- • Universal access to electricity by 2020 (recently moved forward to 2016) from 70% today (though access in rural areas is only 40%);
- 5,000 MW of generation capacity by 2020 (recently moved forward to 2016);
- Ten% contribution of renewable energy (excluding hydro 100 MW or larger) in the electricity generation mix by 2020; and
- Access to liquid petroleum gas (LPG) by 2020 for fifty% of the population.

The GoG has set renewable energy targets to contribute to the 2020 national goals, among which are: 50-150 MW utility-scale solar; 150-250 MW utility-scale wind; 20-26

MW utility-scale biomass/waste; 30-42 mini-grids; 30,000 solar home systems and 2 million solar lanterns; and 150-300 MW small and medium hydro.

RENEWABLE ENERGY ACHIEVEMENTS

The country's policy commitment towards renewable energy is strong and has been translated into actions to support renewable energy development.

The Renewable Energy Act 2011, Act 832 was approved to scale-up Ghana's renewable energy capacity. The Act calls for the creation of an enabling investment climate; indigenous technology capacity building; enhanced public education; and regulation of the production and supply of wood- and bio- fuel. In order to realize these goals, necessary regulatory and policy instruments were established, most notably: a grid code for renewable energy; renewable energy feed-in tariffs (FiT); guidelines for a renewable energy purchase obligation; a draft renewable energy Power Purchase Agreement (PPA); a bioenergy and policy strategy; and a framework for the Renewable Energy Fund (REF). Import tax exemptions were also granted for solar photovoltaics. Meanwhile, in 2012, the GoG redirected existing kerosene subsidies towards solar lighting.

The Ministry of Power (MoP) is working with the Public Utility Regulatory Commission (PURC) and the Energy Commission to develop the regulatory framework for mini-grids and stand-alone electrification interventions. Nevertheless, significant barriers with respect to financing, regulatory and in-house capacity exist, impeding the ability to fully harness the country's renewable energy potential.

Private and public sector support for renewable energy is emerging, however much of it is at a nascent stage of development or implementation:

- *Solar photovoltaics*. Twenty-five net-metered systems with a capacity of 7 MW have been constructed and there are plans to scale this up to 200,000. The Solar Lanterns Promotion Program expects to distribute two million solar lanterns by 2020, 80,000 of which were procured in 2013, while over 50,000 were subsidized and sold at 50% of the cost. The Energy Commission has issued licenses and permits to thirty utility-scale solar projects with a total capacity of 1,835 MW and a construction permit to a 20 MW project which is under construction. Pending success of the aforementioned initiatives, the country's solar capacity would reach about 60% of today's peak demand.
- *Wind*. Wind resource assessments are ongoing at 15 sites with a potential of about 1100 MW power generation.
- *Small hydropower*. Ghana is estimated to have 17 medium and 22 mini/small hydropower sites with most sites exceeding 10 MW. The total capacity is estimated to be at 800 MW. Feasibility studies are ongoing for a total capacity of 800 MW at 19 sites.
- *Biomass*. TThe Ministry of Energy and Petroleum commissioned a report,

entitled, “Assessment of the Financial Landscape for Biomass Power and Mini-grids in Ghana” that revealed that there are numerous clustered agro and wood processing sites generating a large amount of biomass waste. A local biomass energy developer has now acquired environmental and siting clearance permits for a 6 MW biomass power project. Municipalities also generate large quantities of waste which could be used.

- *Wave and tidal energy*. A Ghanaian company is installing a pilot 14 MW tidal wave power plant at the confluence of the Volta River and the Gulf of Guinea, Ada Foah.

CONSTRAINTS TO RENEWABLE ENERGY DEVELOPMENT

In spite of strong policy commitments and the move to establish regulatory and contractual frameworks and undertake feasibility studies and resource assessments, actual investments in the sector have been limited. Ghana is committed to overcoming the remaining barriers needed to transform its vision and commitment to power. SREP support will be instrumental in overcoming many of these barriers and permitting the enormous renewable energy potential to be realised.

Principal constraints to renewable energy development include:

- *Inadequacies in the regulatory, contractual and tariff frameworks*. contractual and tariff frameworks. One of the greatest hindrances is the necessity to renegotiate the feed-in-tariff every other year after the initial ten year period. This is risky to investors as most renewable energy projects have lifespans which exceed 20 years, while debt financing alone may require more than ten years. **Incentives to negotiate tariffs that are lower than the gazetted FiT but for a longer term will address this problem**.
- *Challenging investment climate*. The financial sector and financing terms and conditions currently available, as well as the macroeconomic challenges, make renewable energy investments challenging. High commercial interest rates, limited tenor loans, high inflation, and currency depreciation are all deterrents to potential investors. **Supporting the financial sector to provide packages that are more attractive is therefore key**.
- *Uncertainty of available resources*. Inadequate credible data on available renewable resources at prospective sites impedes potential investors from selecting such sites. **Ongoing resource monitoring programs are expected to provide the necessary information to eliminate this uncertainty**.
- *Limited technological capacity*. There are limited experienced personnel to complete technology and feasibility assessments, as well as invest, construct, operate and manage renewable energy power plants. **The MoP is obtaining**

technical assistance to build critical middle level manpower for the industry.

- *Insufficient renewable energy experience*. National institutions have little or no experience in renewable energy. As a result, power sector entities, regulators, financiers, domestic investors, and national technology and service providers are all entering a sector which is virtually unknown to them. As more sector-related projects develop, experience and confidence in renewable energy will increase. **Targeted knowledge transfer, capacity building and partnerships with experienced international counterparts are therefore imperative to introduce the sector to the relevant institutions so they may properly leverage its benefits**.

PROGRAM DESCRIPTION

The GoG, represented by the MoP and supported by the African Development Bank (AfDB) led a participatory process involving many stakeholders to formulate the SREP-Ghana Investment Plan. The process took into account preparatory work done by the SREP National Task Force (NTF) on key barriers, bottlenecks, and opportunities as well as the conclusions of several technical consultations and various meetings with the stakeholders in December 2014 and February 2015. A SREP NTF retreat in March 2015, as well as an independent review and on-line consultation in April 2015, helped further perfect the Investment Plan.

The GoG applied both SREP and national screening criteria to prioritise the renewable energy technologies and investments. Two broad categories of technologies were considered: grid supply and off-grid electrification. The technology options were solar, wind, small hydro, biomass, and wave and tidal power. The screening resulted in the following ranked order of renewable energy options: (1) Renewable energy mini-grids and stand-alone solar PV; (2) Utility-scale biomass; (3) Solar PV net metering with storage; (4) Utility-scale solar and wind; (5) Small hydropower; (6) Tidal/wave power.

SREP support was initially considered for the four highest ranked options—mini-grids and stand-alone renewable-based electrification, utility-scale biomass, net-metered photovoltaics, and utility-scale solar and wind—with complementary technical assistance. However, after further consideration driven by the SREP funding limit of USD 40 million, the GoG decided to seek alternative funding from the Green Climate Fund or request supplemental SREP funding for the utility-scale biomass option. Consequently, SREP support is sought for the following four projects:

1. Project 1 - Renewable energy mini-grids and stand-alone solar PV systems;
2. Project 2 - Solar PV based net metering with battery storage;
3. Project 3 - Utility-scale solar PV/wind power generation; and
4. Project 4 - Technical assistance to scale-up renewable energy.

PROGRAM DEVELOPMENT OBJECTIVE

The program objective is to assist the GoG in meeting its 10% renewable energy target by 2020 and contribute to meeting its universal electricity access goal. The SREP funds will help create the enabling and sustaining environment for renewable energy scale-up and leverage additional private and public financial resources to the renewable energy sector. The program will mainstream approaches that have proven successful in scaling-up renewable energy investments in Ghana and adopt best international practices. It will overcome the key barriers that have constrained renewable energy development in Ghana.

In accordance with SREP modalities, the goals will be achieved through a coordinated approach which is essential for transformational change. The SREP support will lead to increased investments in renewable energy including leveraging financing from other sources; catalysing strong private sector engagement; creating the necessary enabling environment, especially by overcoming the weaknesses and uncertainties in the regulatory and financial environment; supporting gender inclusive development; and engendering an informed and supportive community.

EXPECTED RESULTS

The SREP Investment Plan expects to achieve the following principal outcomes:

- Increased access to affordable and reliable electricity services, in particular for island and lakeside communities, to achieve the universal access to electricity goal;
- Greater supply of electricity from renewable energies to contribute to goal of obtaining 10% of electricity from renewable energy sources by 2020;
- Improved legal and regulatory frameworks and capabilities of key institutions to reduce financial and commercial risks, thereby welcoming substantive private sector participation in all aspects of renewable energy development;
- More gender-equitable access to modern energy services and to employment opportunities in renewable energy enterprises;
- Additional financial resources mobilized following improvements in the investment climate for renewable energy; and
- Reduced GHG emissions compared to the business-as-usual case.

DESCRIPTION OF THE INVESTMENT PROJECTS

The SREP-Ghana IP will focus on the following three investment projects:

Project 1: RE mini-grids and stand-alone solar PV systems: The objective of this project is to encourage sustainable public and private financing for scaling-up renewable energy mini-grids and stand-alone PV systems to achieve the GoG's universal access policy by electrifying lakeside and island communities in Ghana, with a special focus on gender. Specifically, the project will result in public sector investment in 55 renewable mini-grids and private sector investment in stand-alone solar PV systems to benefit 33,000 households, 1,350 schools, 500 health centres and 400 communities. There will be associated technical assistance and implementation support. The AfDB will be the lead multilateral development bank (MDB) for the implementation along with the MoP on behalf of the GoG.

Project 2: Solar PV based net metering with battery storage: The objective of this project is to develop a comprehensive net metering program and the deployment of at least 15,000 units of roof-mounted solar PV systems to reduce the economic cost of power on small and medium-sized enterprises (SMEs) and households and increase renewable energy contributions in the electricity generation mix by 25-30 MW. There will be associated technical assistance and implementation support. The AfDB will be the lead MDB for the implementation along with the Energy Commission on behalf of the GoG.

Project 3: Utility-scale solar PV/wind power generation: The objective of this project is to assist the GoG overcome key barriers that prevent the growth and expansion of the utility-scale solar PV and wind market in Ghana by catalyzing the first project-financed utility-scale renewable energy plants, demonstrating the Ghanaian RE sector potential to financiers and helping attract further investment in the future. IFC (the World Bank Group's International Finance Corporation) will be the lead MDB for the implementation. This project is expected to leverage additional sources of co-financing from the private sector and from the AfDB private sector window.

TECHNICAL ASSISTANCE

Technical assistance is required for the implementation of the investment projects supported in this investment plan. In addition, broader sector-wide assistance is needed. Sector-wide technical assistance is provided through a stand-alone technical Assistance Project.

Project 4: Technical assistance to scale-up RE: The objective of this project is to assist the GoG and its key partners in the private and financial sectors to overcome key technical, financial, regulatory and institutional barriers that inhibit the scaling-up of renewable energy investments in the country and more specifically could constrain the successful implementation of the flagship renewable energy projects financed under this program. The AfDB will be the lead MDB for the implementation of this project, while the Energy Commission will be the implementing agency on behalf of the GoG.

FUNDING SOURCES AND USES

The total estimated cost of the SREP-Ghana Investment Plan is USD 230 million with a SREP contribution of USD 40 million. The Investment Plan program seeks contributions from the GoG, AfDB, IFC, other development partners, private sector investors, financiers and beneficiaries. The financing plan detailing sources and uses of funds is shown below:

SREP Program Financing Plan (in USD million)							
PROJECT	**SREP**	**GoG**	**AfDB***	**IFC**	**DPs**	**PI&B****	**Total**
RE Mini-grids and stand-alone solar PV systems	17.5	8.0	27.0	0.0	12.0	18.5	**83.0**
Solar PV based net metering with battery storage	12.5	8.0	15.0	0.0	12.0	45.5	**93.0**
Utility-scale solar PV/wind power generation	10.0	0.0	10.0	10.0	0.0	20.0	**50.0**
Technical assistance	0.0	0.0	1.5	0.0	2.5	0.0	**4.0**
TOTAL	**40.0**	**16.0**	**53.5**	**10.0**	**26.5**	**84.0**	**230.0**

* *Including the AfDB private sector window and the Sustainable Energy Fund for Africa (SEFA) Trust Fund*

** *Private, financiers, beneficiaries*

RATIONALE FOR SREP FUNDING

Given the importance of energy to Ghana's economic growth and the achievement of its development goals, the country must expand its power supply to meet growing demand. It is committed to do so by mobilizing its dynamic private sector and by diversifying its energy portfolio in a manner that addresses both global and local environmental concerns.

The Government has explicitly acknowledged that a strategy that utilises indigenous sources of renewable energy has the potential to reduce the risk of supply disruptions, avoid price shocks, reduce pressure on the local and global environment and improve socioeconomic development outcomes. As a result, the GoG has enacted a number of high level policy reforms and is in the process of transforming policy intent into reality. SREP support will be a cornerstone of the country's ability to achieve its national renewable energy goals.

Increases investor confidence. SREP's endorsement of the Government's commitment towards renewable energy is an important signal to both the development and private sector communities that the country is not only serious about embracing RE, but is also capable of making it beneficial to all parties involved. It therefore provides confidence and encouragement to other development and private sector partners to provide counterpart and/or investment funding. Its resources will be essential to

mitigate the financial risks and leverage funds necessary for RE investment at a scale not contemplated previously.

Reduces regulatory, institutional and contractual barriers. SREP resources are also necessary to ensure a coordinated approach in addressing the remaining regulatory, institutional and contractual barriers to permit the private sector to partner with the Government and/or other development partners in achieving the RE goals.

Provides necessary technical support and builds capacity. Given the country's limited information about its total available renewable resources, as well as technical expertise to make its own assessments, the SREP will also work with its partners to attract the necessary technical expertise to undergo and/or complete necessary RE assessments to fill the current information void. It will further build off international best practices to enhance human and institutional capacities necessary to create a sustainable sector.

CONCLUSION

Ghana has an opportunity to propel its future socioeconomic development following a low-carbon pathway as it is estimated that excluding large hydropower, modern RE systems currently contribute to only an estimated 0.3% of the country's total installed capacity despite the country's significant potential. The GoG is therefore committed to achieving its development goals while fulfilling the SREP intent of scaling-up deployment of RE solutions to increase energy access and economic opportunities. Their appropriate exploitation has a great potential to contribute to achieving the national goals of universal access to modern energy services and 10% share of renewables in the country's energy mix. In order to successfully do this however, it requires an adequate understanding of the country's total potential available renewable energy, an enabling investment and regulatory environment and increased RE-specific capacity. SREP support will help the country overcome these barriers.

PREAMBLE: THE ENERGY & CLIMATE NEXUS IN GHANA

The SREP-Ghana Investment Plan (SREP-Ghana IP) is in line with the nation's strategy for renewable energy (RE) development as stipulated in the following documents: Ghana Shared Growth and Development Agenda (GSGDA) II for 2014-2017, National Energy Policy of 2010, and Ghana National Climate Change Policy of 2013. The SREP-Ghana IP brings various power sector, renewable energy and climate change policies together into a single cohesive document and proposes a strategic development path leading to greater utilization of renewable energy.

Ghana has already experienced an increase in mean annual temperature of 1°C per decade since 1960. Monthly rainfall decreased about 2.4% per decade during the same period[1]. Increased climate variability is already affecting the country's economy and households. The impacts place stress on the country's vulnerable sectors: agriculture, coastal zones/marine ecosystems, water resources, and energy production. Such impacts are expected to become greater as climate change effects increase. Climate projections show that Ghana is projected to become even hotter and wetter during the wet season and drier during the dry season. If nothing is done to help mitigate the effects of such climate changes, by 2050, annual real GDP is projected to be 1.9 to 7.2% lower than it would be otherwise[2].

The GoG recognizes that climate change could hinder the ambitious development goals set forth in the Ghana GSGDA II and states that: "*Climate variability and change constitute a major threat to national development. […] It leads to increased financial cost of provision of economic and social infrastructure, as well as resettlements of people […]. The challenge is to turn climate change and variability into an opportunity to expand*

[1] Ghana Strategy Support Program, Policy Note. International Food Policy Research Institute, 2012.
[2] Economics of Adaptation to Climate Change, Ghana. World Bank, 2010.

national output and productivity and embark on systemic protection programs"[3].

The GoG is therefore committed to mainstreaming climate change into key planning processes on the national, regional and local level. The National Climate Change Policy (NCCP) 2013, notes that "*Ghana has demonstrated impressive economic development over the past decades, attaining the status of a middle-income country. However, future growth is still threatened by its high vulnerability to climate change. […] The NCCP will ensure a climate-resilient and climate-compatible economy which addresses a low-carbon growth path for Ghana while achieving sustainable development. […] There is a need to increase the country's energy security and "climate-proof" infrastructure, to effectively adapt to the impacts of current climate change variability and withstand any future impacts.*"[4]

Ghana's energy sector has already shown signs of susceptibility to climate variability, particularly the effect of highly variable precipitation patterns on hydropower production. About two-thirds of electricity generation in the country is from hydropower, which puts the sustainability and stability of electricity production at stake. The drought of the early 1980s (1980 to 1983) called into question the nation's continued dependence on hydroelectric power. Reduced hydro generation resulting from recent decreasing levels of rainfall have led to severe power shortages, which culminated in load shedding. Blackouts and power rationing caused by low water levels in hydropower electricity forced the GoG to shift to fossil fuel thermal generation and increasingly turn to thermal projects to compensate for reduced current capacity and to increase future capacity. The general equilibrium modelling used in the World Bank document titled "Economics of Adaptation to Climate Change" indicates that losses in hydropower due to climate change could be up to $70 million per annum[5]. This situation calls for diversifying the energy mix—tapping into renewable energy sources such as wind, solar, tidal waves, waste to energy and biomass.

Currently, Ghana contributes little to global climate change, with CO_2 emissions at just 0.4 tons per capita in 2010[6]. However, the NCCP acknowledges that "*emissions from the energy and transport sectors represent the fastest growing source of greenhouse gas emissions. With a growing rural and urban population, associated energy requirements will lead to an increased use of wood fuels, electricity and oil products, the main energy sources in Ghana. […] The inefficiency of infrastructure associated with energy and industrial processes, especially energy conversion systems, results in the emission of unnecessary amounts of GHGs, thereby increasing total national emissions."* Clearly, business-as-usual is not an acceptable option. Hence, the NCCP's 10th focal area focuses on "minimizing greenhouse gas emissions" with the following principle*:*

[3] Ghana Shared Growth and Development Agenda II (2014-2017). Ghana National Development Planning Commission. www.ndpc.gov.gh. 18 April 2015.

[4] Ghana National Climate Change Policy. Ministry of Environment Science, Technology and Innovation, 2013.

[5] Economics of Adaptation to Climate Change. World Bank, 2011. http://www.worldbank.org/en/news/feature/2011/06/06/economics-adaptation-climate-change. 18 April 2015.

[6] World DataBank. World Bank. http://databank.worldbank.org/ddp/home.do?Step=1&id=4. 15 April 2015.

"Recognizing that efficient energy use and cleaner energy technologies contribute towards economic development, as well as result in green development and optimal national emission rates."

Given the importance of energy to Ghana's economic growth and ambitious development goals, the country must continue to expand its power-generation capacity to meet growing demand; but it must do so in a sustainable manner that diversifies the energy portfolio. The Government recognises that a strategy that utilises indigenous sources of renewable energy has the potential to reduce the risk of supply disruptions, avoid price shocks, reduce pressure on the local and global environment, and improve socioeconomic development outcomes.

Ghana has an opportunity to propel its future socioeconomic development following a low-carbon pathway. Low-carbon development can be facilitated by dynamic public and private sectors that are active in renewable energy development. Given that Ghana is endowed with an abundant array of renewable energy resources, their appropriate exploitation has a great potential to contribute to achieving the goal of universal access to modern energy services.

1

COUNTRY CONTEXT

1. INTRODUCTION

Ghana has a surface area of 228,539 km^2 and a total population of approximately 25.8 million people, with a population growth rate of approximately 2.2%. Almost half of the Ghanaian population live in rural areas. An important proportion of this rural population live in scattered and remote areas, some in isolated islands. The diffused nature of rural communities justifies, to a large extent, the need to consider a decentralized energy approach as an important cost effective option for meeting energy requirements in those areas. While the rural population remains important, the urban population is growing rapidly at a rate of 3.5%. This calls for equal attention to be paid to a rapidly growing energy demand in urban areas[7].

Ghana has a surface area of 228,539 km^2 and a total population of approximately 25.8 million people, with a population growth rate of approximately 2.2%. Almost half of the Ghanaian population live in rural areas. An important proportion of this rural population live in scattered and remote areas, some in isolated islands. The diffused nature of rural communities justifies, to a large extent, the need to consider a decentralized energy approach as an important cost effective option for meeting energy requirements in those areas. While the rural population remains important, the urban population is growing rapidly at a rate of 3.5%. This calls for equal attention to be paid to a rapidly growing energy demand in urban areas.

The political situation is stable and the country continues to consolidate democratic governance, characterized by an open society, vibrant media and strong public dialogue

[7] The World Fact Book. Central Intelligence Agency. https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html. 15 April 2015.

that has been, in part, instrumental in creating an exceptionally strong bottom-up push for large-scale electrification of communities across Ghana. As a result, more than 70% of Ghanaian households have access to electricity, a significantly higher%age than most sub-Saharan African countries.[8]

Ghana's relatively strong economy benefited from a quarter century of relatively sound management, competitive business environment and sustained reductions in poverty levels. The country's strong performance culminated in Ghana being re-categorized as a lower middle-income country in late 2010. In 2013, Ghana's Gross Domestic Product (GDP) real growth rate was estimated to reach 7.9%, while the GDP per capita was USD 3,500. GDP growth rate is projected to have expanded at the same rate in 2014. As expected, economic growth translates to growing demand for modern services, which accounts for 50% of GDP. Agriculture and industry account for 22% and 29% of GDP, respectively.[9] Gold and cocoa production as well as individual remittances, and more recently, oil & gas, are major sources of foreign exchange. Finally, the rise in incomes and growing entrepreneurial class provide the basis for a vibrant private sector.

Over the last two decades, Ghana has managed to decrease the proportion of its residents falling below its poverty line. In 1998/99, it is estimated that 39.5% of Ghanaians were below the national poverty line. By 2005/06, this proportion decreased to 28.5%,[10] which still constitutes more than a quarter of the total population. While Ghana is on track to meet its Millennium Development Goals, poverty among its subsistence farmers, particularly in the northern parts of Ghana, continues to be a source of concern. Enhanced access to modern energy services will significantly contribute to addressing the poverty challenges facing the bulk of Ghana's subsistence farming community.

If Ghana is to achieve both significant poverty reduction and accelerated economic growth, a number of road blocks to the development of energy and transport infrastructure, human capital, and natural resources must be removed. Infrastructure bottlenecks are a serious constraint to growth and private sector investment.

Indeed, as a middle-income economy, Ghana faces challenges of infrastructure deficits and an unstable currency regime, which is partly driven by an imbalance between imports and exports. The growing oil export earnings and expanded use of lower cost gas in electricity generation are expected to contribute to closing the imports/exports gap. The Government through its Ministry of Power is pursuing aggressive policies to address the energy sector infrastructure deficit to make energy services universally accessible and readily available in an environmentally sustainable manner; increase generation capacity; and achieve universal access by 2020.[11]

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[8] Ministry of Power, Ghana.

[9] World Development Indicators (2013) http://databank.worldbank.org/data/views/reports/tableview.aspx

[10] Poverty in Ghana. The Borgen Project, July 2013. http://borgenproject.org/poverty-in-ghana/. 15 April 2015.

[11] The current administration intends to achieve this target by 2016.

2. ENERGY SECTOR BRIEF

2.1. Overview

According to the International Energy Agency (IEA), Ghana consumed a total of 10.13 million tons of oil equivalent (MTOE) in 2012, of which 0.4 MTOE consisted of net imports. Total primary energy consumption in Ghana was 0.4 tons of oil equivalent (TOE) per capita in 2012, among the lowest in the world and about two-thirds of the average consumption in sub-Saharan Africa (0.68 TOE per capita in 2012).

Ghana's energy sector is characterized by heavy reliance on biomass and oil, which in combination account for close to 90% of the country's primary energy supply. Biomass is primarily used to meet household energy requirements while oil is largely consumed in the transport and power generation sub-sector. Average daily oil production from the Jubilee field increased from about 81,000 barrels in 2012 to around 91,000 barrels in 2013 (i.e. about 12% increase).[12] In addition to oil and gas, hydropower constitutes an important source of electricity for the country. The total installed generation capacity stood at about 3,000 MW at the end of 2014, 54% of which came from hydropower.[13]

In order to sustain its current economic performance, Ghana's energy sector vision is to develop an "energy economy" to secure a reliable supply of high quality energy services for all sectors of the Ghanaian economy. In this regard, the GoG has defined the following national policy goals for the energy sector:

- Universal access to electricity by 2020 (recently moved forward to 2016);
- 5,000 MW of generation capacity by 2020 (recently moved forward to 2016);
- Ten% contribution of renewable energy (excluding large hydro which has an installed capacity of more than 100 MW) to electricity generation mix by 2020; and
- Access to liquid petroleum gas (LPG) by 2020 for fifty% of the population.

Ghana has a national average electrification rate of more than 70%. However, this national average masks striking urban-rural disparities as only 40% of rural households have access to electricity, significantly impacting productive activities and local economic development.[14] Extension of the grid to some of the remaining remote un-electrified communities such as those on islands or otherwise isolated is difficult due to geographical and financial constraints.

Furthermore, the country is currently experiencing its worst power crisis in many years, with frequent load shedding seriously affecting its population, businesses and industries. The main reasons for the power crisis are: (i) continuous low rainfall in the catchment area of the Akosombo Dam reservoir, forcing the power plant to operate at a much lower capacity than the installed capacity of 1,020 MW; and (ii) lack of sufficient

[12] 2014 Energy Outlook for Ghana, Energy Commission.
[13] Ministry of Power Annual Report 2014.
[14] Ministry of Power Annual Report 2014.

gas to power the country's thermal power plants. In the face of these challenges, the Ministry of Power is procuring approximately 1,000 MW of emergency power to tackle the crisis in the short term.

Renewable energy development is expected to contribute towards meeting the ambitious national policy goals for the energy sector and resolving the power crisis in a sustainable way.

2.2. Electricity Demand And Supply

Demand for electricity across all sectors has been growing on average by 10% annually over a decade. In 2014, the installed generation capacity available for grid supply reached 2,942 MW with renewable energy (excluding large hydro) accounting for only 0.3% (see Table 1).

Table 1. Installed Grid Electricity Generation Capacity as of September 2014[15].

Generation Plant	Fuel Type	Installed Capacity/MW	Share%
Hydropower Plants			
Akosombo	Hydro	1020	
Bui	Hydro	400	
Kpong	Hydro	160	
Subtotal		***1580***	53.7%
Thermal Power Plants			
Takoradi Power Company (TAPCO)	LCO/NG/Diesel	330.0	
Takoradi Intl. Company (TICO)	LCO/NG/Diesel	220.0	
Sunon-Asogli Power (SAPP)	NG	200.0	
Tema Thermal Plant 1 (TT1P)	LCO/NG/Diesel	126.0	
Tema Thermal Plant 2 (TT2P)	NG/Diesel	49.5	
CENIT Energy Ltd (CEL)	LCO/NG	126.0	
Takoradi T3	NG	132.0	
Mines Reserve Plant	NG/Diesel	40.0	
Osagyefo Power Barge	NG	125.0	
Subtotal		***1348.5***	45.8%
Renewable Energy Plants			
VRA	Solar	2.50	
Noguchi	Solar	0.72	
Juabeng Oil Mill	Biomass	1.20	
Others (off-grid & net-metered installations)	Solar	3.80	
Subtotal		**8.20**	0.3%
Embedded Generation			
Genser Power	LPG	5	
Subtotal		5	0.2%
Total		**2941.72**	**100%**

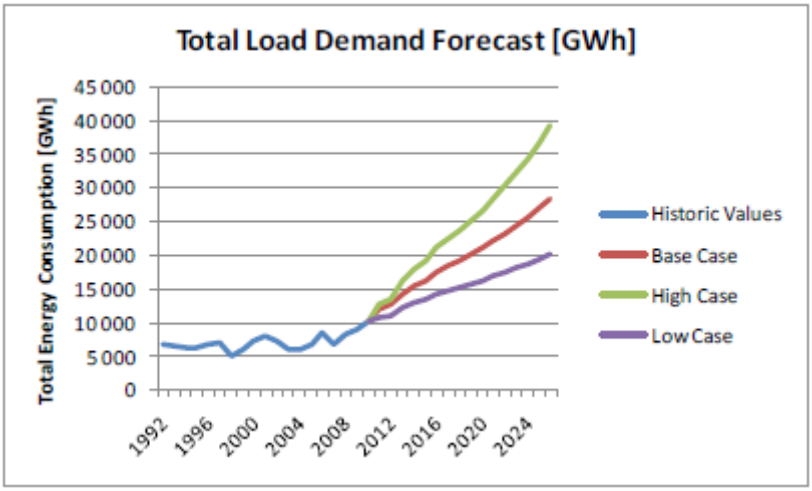
[15] Ministry of Power Annual Report 2014.

In 2013, the total grid electricity generated in the country was 12,874 GWh.[16] The projected electricity demand within the constraints of the limited available supply means that there is bound to be significant supply shortfalls any time a power plant is turned off for scheduled maintenance or technical fault, resulting in significant load shedding. Based on calculations, unmet demand in 2013 was between 1,700 and 2,480 GWh, which could have otherwise been met with the installation of a supplemental 240 to 330 MW operational thermal plant.[17] Moving forward, a total of about 700-800 MW additional generation capacity equivalent is needed to cover the shortfall in addition to a minimum 20% reserve margin for 2015 alone. Investments in renewable energy can contribute to reducing the shortfall in installed power generation capacity while ensuring a more sustainable energy mix for the future.

The Ghana Generation Master Plan (November 2011) analysed and estimated the evolution of the energy load demand from 1992 up to 2026 using different scenarios. Figure 1 below presents the results of the energy demand forecast using these various scenarios.

For the base case scenario, the total energy load demand is estimated to increase from 10,000 GWh in 2010 to 28,000 GWh in 2026, representing an average growth of 6.7%. The projected load demand for the base case scenario translates into an increase in peak load from 1,531 MW in 2010 to 4,161 MW in 2026, representing an average growth of 6.5%.

Figure 1. Energy Load Demand Forecast[18].

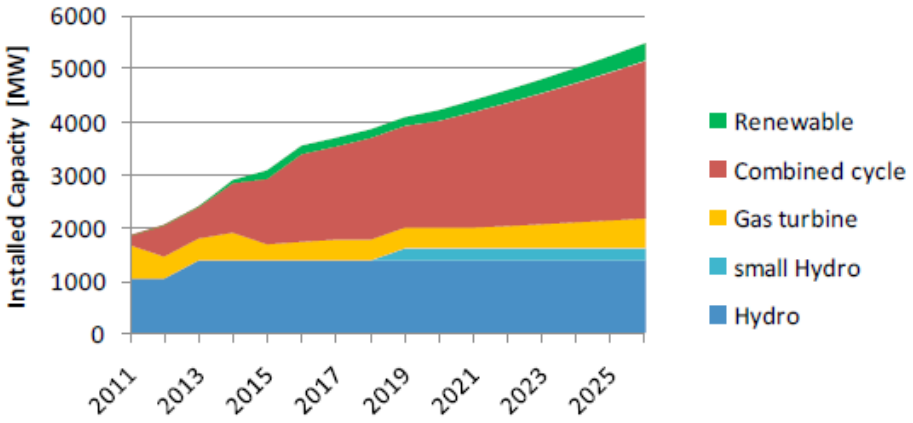


The evolution of the installed capacity per type of unit according to the same Generation Master Plan for Ghana (2011) is shown in Figure 2 as projected at that time. Investments were expected to be made in combined cycle units while those in hydro generation were expected to decrease significantly during the study period. Meanwhile, renewable energy systems and small hydro were foreseen to be commissioned first with the installation of photovoltaic panels and wind farms from 2012 and 2014 and small

[16] 2014 Energy Outlook for Ghana, Energy Commission.
[17] 2014 Energy Outlook for Ghana, Energy Commission.
[18] Generation Master Plan for Ghana, Tractebel Engineering GDF Suez, November 2011.

hydro in 2019. Beginning in 2020, investments in wind parks were anticipated thereby increasing the share of renewable energy amounts to be 10% of the total installed capacity aligned with GoG's policy goals. In reality, the development of renewables has been much slower with only 8.2 MW developed so far.

Figure 2. Evolution of the Installed Capacity[19]



The country's voltage levels range from 69 kV to 330 kV for power transmission. The transmission infrastructure is composed of about 5,100km lines and 54 transformer substations and is interconnected with neighbouring countries: Togo and Benin in the east; Burkina Faso to the north; and Cote d'Ivoire in the west. Inadequate investment coupled with power generation constraints have resulted in an overall low power factor and increases in transmission losses, most recently of which have been above 4% (see Table 2). The integration of renewable energy solutions especially dispatchable renewable energy into the national grid would contribute to a reduction in long line transmission losses.

Table 2. Transmission System Losses[20].

Year	2008	2009	2010	2011	2012	2013
Transmission losses as % of gross transmission	3.7	3.8	3.7	4.7	4.2	4.5

2.3. Electricity Tariffs

The Public Utility Regulatory Commission (PURC) determines the tariffs of electricity in consultation with key stakeholders within the regulated electricity market based on the rate-setting provisions of PURC Act 538. Electricity tariffs in Ghana have gone up over 90% across all customer categories in the last 3 years in an effort to allow the utilities to recover their costs and operate in a sustainable manner without recourse to any form of government subsidies. With the application of the Automatic Adjustment Formula (AAF) policy, electricity tariffs were adjusted upward by 6.54% on average

[19] Generation Master Plan for Ghana, Tractebel Engineering GDF Suez, November 2011.
[20] Ghana Grid Company Limited, Annual Report 2013.

above the 90% increment as of end December 2014.[21]

The PURC, in accordance with the provisions of the Renewable Energy Act 2011, Act 832, set the first Renewable Energy Feed-in Tariffs (RE-FiT) in September 2013. The RE-FiT was reviewed less than a year after and gazetted on 1 October 2014. The new RE-FiT is similar to the first RE-FiT but introduces a new guideline for the integration of utility-scale variable renewable energy technologies such as solar PV and wind. The main principles of the new guideline are:

- The total nationwide capacity for solar PV and wind plants without grid stability/ storage systems are limited to 150 MW and 300 MW respectively.
- A maximum of 10 MWp (Megawatts peak) per solar PV plant without grid stability/storage systems is allowed to be connected to the distribution system at any generation site.
- A maximum of 20 MWp per solar PV plant without grid stability/storage systems is allowed to be connected to the national transmission system (161 kV or 330 kV) at any generation site.

The new approved rates for utility-scale renewable energy technologies, as gazetted by the PURC on 1 October 2014 are presented in Table 3 below.

Table 3. Feed-in Tariffs for Utility-scale Renewable Energy Technologies

Schedule		
Electricity Generated from Renewable Energy Technologies	**FiT (GHp/kWh) Effective 1 October 2014**	**Maximum Capacity (MW)**
Wind with grid stability systems	55.7369	300MW
Wind without grid stability systems	51.4334	
Solar PV with grid stability systems	64.4109	150MW
Solar PV without grid stability systems	58.3629	
Hydro ≤ 10MW	53.6223	No Limit
Hydro (10MW> ≤100MW)	53.8884	No Limit
Biomass	56.0075	No Limit
Biomass (enhanced technology)	59.0350	No Limit
Biomass (plantation as feed stock)	63.2891	No Limit

[Note: The approved rates indicated in the schedule above are based on the average Interbank Selling Rate as of 30 September 2014 obtained from the Ghana Association of Bankers which was GHS 3.1986 to USD 1.0000.]

Despite the fact that these RE-FiT are among the highest in recent times, the RE sector is still not attracting the desired level of investments due to the poor financial standing of the country's primary power purchasing utility, the Electricity Company of Ghana (ECG). The GoG's decision not to provide risk mitigation support further increases investors' perceived risk. Finally, the RE-FiT is yet to be contracted and paid to an

[21] Public Utilities Regulatory Commission (PURC) Gazette Tariffs http://www.purc.com.gh/purc/node/178

operational RE project almost 2 years after its first introduction. In fact, at the time of finalizing the SREP-Ghana IP, only one 20 MW solar PV plant, being developed by a Chinese company, has received a construction permit. That company is developing its plant with its own resources, without any debt leveraging. Until a few RE projects are successfully constructed and can therefore demonstrate the effectiveness of the RE regulatory regime, investors and project financiers will remain risk averse to the country's RE incentive framework.

Though the PPAs are typically for a duration of 20 years, the GoG has decided to fix the validity period for the FiT to 10 years because the cost of renewable energy technologies (RETs) is expected to decrease as they mature. Unfortunately, private investors perceive it as a commercial risk that could affect their revenues projection over the lifetime of their investments.

2.4. The Rural Electrification Challenge

With more than 70% of the Ghanaian population able to access electricity, Ghana has one of the highest electricity access rates in sub-Saharan Africa. However, the remaining portion of the country's population (approximately 5 million people) with no access to electricity are mostly located in remote areas that are difficult to reach and are unlikely to be connected to the national grid. This is due to the prohibitive cost of extending the transmission and distribution network to those areas often requiring expensive underground cabling and/or crossing national parks and reserves.

Island and lakeside communities constitute a significant proportion of the population with no access to electricity. The preliminary findings of an ongoing World Bank-funded Geographic Information System (GIS) based assessment estimated a population of 2.9 million people in those island and lakeside communities. Out of this number, about 350,000 people residing in some 400 communities have been identified to benefit from decentralized renewable mini-grid systems.

Decentralized RE technologies are, in many cases, the most competitive electrification option for these communities. However, some of these communities have a poor understanding of the advantages of decentralized RE systems and request grid-connected power. This has raised some issues in the past, but as communities start benefiting from the implementation of the GoG's renewable mini-grid electrification programs, others are now interested in benefiting from such technology. More awareness will need to be raised in these communities in the coming years to ensure efficient scaling-up of RE powered off-grid electrification (stand-alone and mini-grid schemes) on island, lakeside and other remote communities.

Recognizing this situation, to complement grid-based electrification, the GoG has identified the need to aggressively support renewable energy–based mini-grids and stand-alone renewable energy initiatives as a priority. With support from a wide range of development partners, including the AfDB, Switzerland's State Secretariat for Economic Affairs (SECO) and the WB, a number of initiatives are being piloted. Key

notable initiatives are presented in the ensuing sections under the investment briefs in Annex 1.

To ensure the energy sector policy objectives are on course especially those related to rural electricity access and intensification, the GoG is implementing the Ghana Energy Development and Access Project (GEDAP). GEDAP is: (i) supporting the creation of an enabling environment; (ii) developing performance-based financing instruments; and (iii) providing capacity building. The enormity of the country's electrification challenge demands innovative solutions. Lessons from the GEDAP and other off-grid electrification solutions are important inputs to the nationwide planning exercise and the SREP-Ghana IP (viewed by stakeholders as the RE-sector flagship program).

Box 1 Lessons Learnt from GEDAP

Experience with rural electrification using small-scale solar home systems (SHS) under the Global Program on Output Based Aid component of the multi-donor funded Ghana Energy Development and Access Project yielded a number of lessons which provided valuable information for the SREP Investment Plan. Some lessons relevant to small-scale solar activities are listed below:

- **Limited Impact of Subsidies**: The project made use of a subsidy set as a fixed%age of the value of lanterns and solar home systems of various sizes. While this subsidy was initially meant to increase the affordability of lanterns and systems to consumers, in retrospect, it served instead as an incentive to the solar dealers to actually engage in remote, rural areas where none had actually done business before. Unfortunately, while it became more of a transport-cost subsidy for the service providers, it failed to drive the cost down, increase affordability and successfully penetrate the market.
- **Willingness to Pay for Solar Home Systems**: The willingness to pay for energy services from SHS in remote, rural areas of Ghana is high. This is particularly well illustrated by the high demand for large SHS that can supply an LED colour TV, reflecting consumer aspirations for modern energy services. Sales of these large SHS exceeded all targets and expectations established at the beginning of the project.
- **Financing Packages for Solar PV Suppliers**: The relatively limited expertise and experience of solar PV suppliers constrains their ability to obtain sustainable financing. Support was therefore provided to those suppliers to help them obtain trade financing and working capital to be able to purchase solar PV systems in bulk and to build up their capacity and retail networks up-country.
- **Sustainability and Maintenance**: Ensuring that repairs and maintenance are done correctly is key for the sustainability of the project. Default on the payments of the loans was strongly associated with deficient SHS, therefore maintenance services are key for the sustainability of these types of programs. A sustainable model whereby consumers are charged a maintenance service fee could be explored.

- **Capacity Building of Rural Banks*:*** The dedicated rural bank solar project officers were critical to the process as they made a strong, positive impact on the operation of the project. They improved sales, accelerated the processing of paperwork, enabled loan recovery and established working relationships with local dealer representatives. Working closely with project officers in the rural communities to build relevant capacity was therefore imperative to the overall success of the initiative.
- **Non Replicable Business Model:** Despite the success of the project which exceeded its sales targets and served more rural households than anticipated, the ARB-APEX Bank decided not to continue working in this sector post project due to internal restructuring and new policy focus. As a result, it was more difficult to successfully scale-up the business model. Working through other grassroots financing establishments could however ensure model replicability and overall project sustainability. While a program has no control over the internal operations of a finance institution, moving forward, alignment of strategic direction will be more closely reviewed and targeted training will be provided to ensure potential for long-term sustainability.

2.5. Gender and Energy

Overall, the regulatory framework in Ghana promotes gender equality, which is enshrined in the country's 1992 Fourth Republic Constitution prohibiting gender-based discrimination (Act 17-3). In addition to ratifying key major treaties related to women's rights (such as the 1986 Convention for the Elimination of all Forms of Discrimination Against Women), the Government of Ghana has led many initiatives promoting gender equality, including the Affirmative Action Guidelines that encourages a 40% representation of women at all levels of governance and administrative leadership positions. The Ministry of Women and Children (MOWAC), established in 2001, is responsible for promoting the development and welfare of women. In 2012, the MOWAC adopted and launched the National Plan of Action for Women, Peace and Security, designed to ensure that the rights, interests and special needs of women and girls are integrated in policy formulation and implementation.

While the entire population is affected by the country's energy challenges, women are particularly impacted due to their regular contact with, and household management of, energy, particularly, renewable energy sources. For example, statistics show that many households in the rural areas rely on biomass, primarily wood fuels and charcoal, for cooking. Women and children are most affected by the use of these energy sources as they are the ones burdened with the collection of wood fuels and charcoal and exposed to the associated hazards. In spite of their relevance to the future direction of the sector however, there is increasing concern that female participation is low in policy decision making.

In this context, the Government's policy objective – as set by the GSGDA II - is to ensure that the energy sector is gender sensitive through mainstreaming gender concerns into the sector and aligning them with proper health, safety and environmental standards. This is expected to be achieved through the implementation of the following strategies which support capacity development of women in the energy sector: promoting increased access to modern forms of energy by women in order to reduce the tedium in their activities; securing participation of women in the formulation and implementing energy sector interventions; and ensuring that concerns of women and children are taken into account in every aspect of energy production and distribution.

3. NATIONAL ENERGY POLICY AND INSTITUTIONAL FRAMEWORK

3.1. Energy Policy & Strategic Framework

The aforementioned Ghana Shared Growth and Development Agenda (GSGDA II) for 2014-2017 is the medium term national policy framework for the country and builds on the lessons learnt from the performance of the previous GSGDA for 2010-2013. The GSGDA II identifies power as the major binding constraint to the accelerated economic growth and development of the economy. The loss in GDP growth, as a result of insufficient and unreliable power supply, is estimated to reach 5.6% by 2017. The GSGDA II highlights that: "*In the medium-term, Government policy will focus on increasing the proportion of renewable and other sources of energy in the supply mix, particularly solar, wind, mini- hydro and waste-to energy. The strategies to be implemented will include: accelerating the implementation of the 87 provisions of the Renewable Energy Act 2011, Act 832; providing access to waste-to-energy technologies; and facilitating access to the grid for stand-alone renewable energy power plants*."

The development and management of Ghana's energy sector is guided by the 2010 National Energy Policy. The Energy Sector Strategy and Development Plan (February 2010) sets a vision for the sector, which is to guarantee the availability of an adequate level of energy supply meet the country's internal demands and ensure universal access to modern energy by 2020 (recently moved forward to 2016 by the current administration) as well as provide surplus energy for export. To realize that vision, Ghana will need to overcome the key challenges in the sector by:

1. Developing infrastructure for the production and supply of adequate energy services to meet national requirement and for export;
2. Expanding the requisite infrastructure to ensure universal access as well as the efficient and reliable supply of energy services;
3. Ensuring energy is produced and supplied in a form that has no adverse health, safety and environmental impact; and

4. Guaranteeing the efficient production, transportation and use of energy.

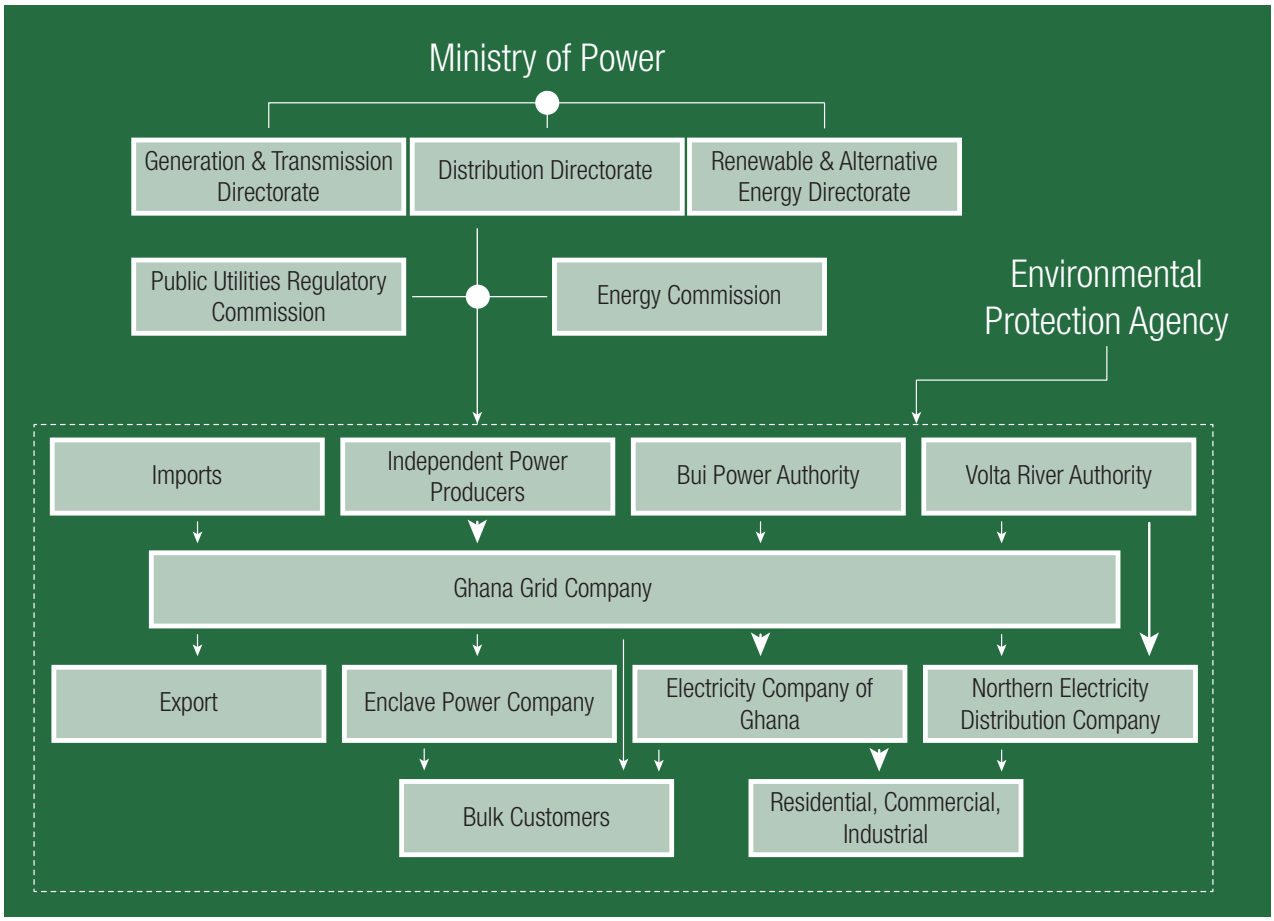
Renewable energy development can contribute to overcoming the aforementioned challenges. In fact, the National Energy Policy states that "the goal of the renewable sub-sector is to increase the proportion of renewable energy, particularly solar, wind, mini hydro and waste-to-energy in the national energy supply mix and to contribute to the mitigation of climate change." The Energy Sector Strategy further mentions that for the wind, solar and mini-hydro technologies, the GoG will focus on: (i) promoting the exploitation and use of mini hydro, solar and wind energy resources; (ii) supporting indigenous research and development aimed at reducing the cost of renewable energy technologies; (iii) providing tax incentives for all equipment imported for the development of renewable energy projects; and (iv) supporting the use of decentralized off-grid alternative technologies (such as solar PV and wind) where they are competitive. Indeed, increased usage of RE is likely to lead to substantial additional energy supply infrastructure that can meet national energy requirements, as well as increase the country's level of access to modern energy. Renewables are, in most cases, also environmentally benign with virtually no adverse health impacts on consumers.

The Government of Ghana is keen to meet the Sustainable Energy for All initiative (SE4All) objectives by 2020. It is currently well positioned to do so as the country has made impressive gains in expanding electricity access across the country which has resulted in the Government's revision to the timeline for the universal access goal down to 2016. Ghana is also developing its SE4All National Action Agenda (SE4All-AA) and investment prospectus to increase its renewable energy capacity and extend reliable energy access to all of its citizens. In this context, the SREP Investment Plan is considered one of the implementation tools of the SE4All investment prospectus, part of which focuses on RE-powered mini-grids and stand-alone SPVs for off-grid communities.

3.2. Institutional Framework

The following graphic (Figure 3) provides an illustration of the key players in Ghana's energy sector:

Figure 3. Key Players in the Energy Sector[22]



3.2.1. National Institutions

Ministry of Power: The Ministry of Power (MoP) oversees the energy sector, and is responsible for energy policy formulation and implementation. There are three mainline technical directorates: the Generation and Transmission Directorate, the Distribution Directorate, and the Renewable and Alternative Energy Directorate (RAED). In line with provisions of the Renewable Energy Act 832, the MoP established the RAED, which has the legal mandate to coordinate all efforts and manage the development and promotion of renewable energies in Ghana. More specifically, the RAED oversees the implementation of RE initiatives; executes RE programs and projects initiated by the State, or in which the State has an interest; and finally, manages the RE sector assets on behalf of the State until such a time when the Renewable Energy Authority is established. The MoP has eight technical agencies or departments.

Energy Commission (EC): The Energy Commission is the technical regulator of Ghana's electricity, natural gas and renewable energy industries, and the advisor to Government on energy matters.

Public Utility Regulatory Commission (PURC): The Public Utilities Regulatory Commission was set up as a multi-sectoral regulator by the Government of Ghana

[22] Ministry of Power.

in October 1997 as part of the utility sector reform process to regulate the provision of utility services in the electricity and water sectors. The PURC also has regulatory responsibility over charges for supply, transportation and distribution of natural gas services. The PURC is responsible for setting and approving rates chargeable for the purchase of electricity from conventional and renewable energy sources including min-grids.

Environmental Protection Agency (EPA): The EPA is the leading public body for protecting and improving the environment in Ghana. It is responsible for regulating the environment and ensuring the implementation of Government policies on the environment.

Electricity Generation & Transmission: The bulk of the generation assets are owned by state-owned utility companies and Independent Power Producers (IPPs). The Volta River Authority (VRA) and Bui Power Authority (BPA) are the main public generation companies that operate Ghana's hydropower plants and some thermal power plants. A number of IPPs have been licensed to build, own and operate power plants. The Ghana Grid Company (GRIDCo) owns and operates the transmission network.

Distribution Utilities: The distribution utilities are the Electricity Company of Ghana responsible for distribution services within the southern zone, Enclave Power Company for the Free Economic Zone and the Northern Electricity Distribution Company (NEDCo) responsible for distribution services in the northern belt.

3.2.2. Development Partners' Support and Coordination

Ghana has received significant energy-sector support from its development partners, whose harmonized assistance is aligned with national priorities and strategies. Ghana has a well-coordinated working group of Development Partners (DPs) involved in the energy sector which is currently being co-chaired by the AfDB on the DPs side and the chief directors of the ministries of petroleum and power on the GoG side. The energy sector working group comprises many DPs assisting the country through various financing instruments such as: the AfDB, the World Bank Group (WBG), the European Union (EU), the United Nations Development Program (UNDP), the Agence Française de Développement (AFD), the Kreditanstalt für Wiederaufbau (KfW), the Millennium Challenge Corporation (MCC) and the State Secretariat for Economic Affairs (SECO). The group meets regularly to discuss key sector issues and challenges, as well as development partners' approaches and interventions to address them.

As previously mentioned, Ghana is a participant in the Sustainable Energy for All (SE4All) initiative. The initiative, launched in September 2011 by the United Nations Secretary-General, aims to: (a) achieve universal access to energy services in particular electricity services and clean cooking solutions; (b) double the global rate of improvement in energy efficiency; and (c) double the share of renewable energy in the global energy mix by 2030. The SE4All Investment Prospectus for Ghana is currently being prepared and a draft version should be available by the end of the second quarter of 2015.

The AfDB, SECO and the WB are supporting the Ghana Energy Development and Access Project (GEDAP) in which one component promotes a mix of RE-based models including four pilot mini-grids to serve nearly 10,000 people in selected deprived communities. Building on the success of the GEDAP mini-grid initiative, the GoG is envisaging scaling it up.

KfW is working with the VRA to develop a 12 MW solar PV project. The VRA will own and manage the solar plant, which is expected to be constructed in early 2016. KfW is keen to continue investing in the RE sector in the coming years as their new programming cycle starts in 2017.

GIZ's work on RE focuses on technical assistance for the implementation of the RE Act and implementation of productive use of energy for on-grid and off-grid operations, as well as financing for small-scale projects with successful results-based-evidence schemes, such as:

- Productive use of energy in agriculture: grid electrification and solar PV pumping for irrigation, and productive use of electricity in 18 light industrial zones in five regions (EnDev):
- Improved cooking stoves for gari (processed cassava) processing in partnership with the Dutch NGO SNV(EnDev); and
- Advisory services on capacity for successful implementation of the RE Act on RE scenarios including a preliminary grid impact study, the FIT scheme including tariffs, purchase obligations and connection, net metering, standardized RE PPAs, pilot tenders for variable RE, credit support and technical and organizational development training (Ghanaian-German cooperation).

Managed by GIZ, the EnerGIZing Development Program (EnDev) is supporting a range of pilot small-scale renewable energy activities promoting access to energy and productive use of energy. It is funded by:

- Dutch Ministry of Foreign Affairs (MFA NL),
- German Federal Ministry for Economic Cooperation and Development (BMZ),
- Norwegian Ministry of Foreign Affairs (MFA NO),
- Australian Agency for International Development (AusAID),
- UK Department for International Development (DFID), and
- Swiss Agency for Development and Cooperation (SDC).

InfoDev, a global multi-donor program in the World Bank Group, supports growth-oriented entrepreneurs through creative and path-breaking venture enablers. InfoDev is supporting the establishment of a climate innovation centre (CIC), with support from the Danish Ministry of Foreign Affairs and led by the Asheshi University College in Ghana. CICs are designed to provide climate technology entrepreneurs with the mentorship, financing, networks, and business services they need to scale-up their innovations, driving down carbon emissions and creating sustainable, inclusive jobs.

3.2.3. Role of Private Sector and Non-Governmental Organizations in Developing RE

Ghana's open economy and free democratic space has created an enabling environment for the growth of a dynamic private sector and civil society community.

In 1994, the Government of Ghana (GoG) launched the Power Sector Reforms (PSR) to catalyze the rapid expansion of infrastructure in line with its socio-economic development agenda. The PSR thus sought to enhance transparency in the regulation of the sector and to open up the industry to private sector participation by dismantling the vertically integrated utility structure and availing the generation and distribution aspects of the industry to market competition. The implementation of the reform process has resulted in the current unbundled structure with separate operational functions in respect of power generation for the Volta River Authority (VRA), transmission for the Ghana Grid Company (GRIDCo) and distribution for the Electricity Company of Ghana (ECG). As a result of the PSR, the sector has, since 1997, been regulated by the Energy Commission (EC) which is the technical regulator responsible for licensing and advising the Ministry of Energy on policy issues; and the Public Utility Regulatory Commission (PURC) which is the independent economic regulator responsible for approving and setting tariffs. The reformed structure is expected to encourage the participation of Independent Power Producers (IPP) in a competitive generation market as well as bi-lateral contracts with bulk customers in a deregulated market. As a result of the reform, there is now substantial private sector participation in the sector with a growing portfolio of private sector driven IPPs. The growing renewable energy sector has attracted a wide range of private sector players, ranging from solar PV distributors and associated investors to agro-industries that use biomass by-products for process-heat generation. Recent private sector entrants include a budding solar PV assembler and a number of potential wind-farm developers and dedicated energy plantation developers. The vast potential of private investment and engagement in RE in Ghana can be further catalyzed by SREP activities and investments in the sector. In the biomass sector, the private sector has traditionally been active mainly through informal sector enterprises and entrepreneurs involved in key stages of biomass energy transformation and distribution, as well as biofuel stove manufacture and sales.

The Netherlands Development Organization (SNV) is an international not-for-profit development organization. In Ghana, SNV contributes to poverty reduction with the implementation of several renewable energy projects including: activities on the role of gender in agro-processing, improved cook-stoves / fish-smoking and small-scale energy enterprises.

Kumasi Institute of Technology, Energy and Environment (KITE) is a Ghanaian NGO and a leading actor in the Energy, Technology and Environment sectors in Ghana and the West Africa Sub-Region. Since its inception in 1996, KITE has built a unique capacity in the development and implementation of public benefit projects. KITE is the product of extensive capacity that has been built through a broad range of project and program experiences, partnerships with key national and international actors and the

development of efficient internal management, governance and reporting capabilities. KITE developed the Energy for Poverty Reduction Action Plan for Ghana (EPRAP) and the business development services package for African Rural Energy Enterprise Development (AREED) to promote private partnerships in the clean energy sector.

SNV and KITE are already active partners in the MoP's renewable energy initiatives such as the multi-donor GEDAP project.

NewEnergy is a non-governmental organization located in Tamale in the Northern Region of Ghana. Founded in 1994, NewEnergy's main areas of activities are renewable energy services, environmental conservation, enterprise development training, micro-credit support, water and sanitation services as well as policy advocacy.

3.2.4. Role of Financial Sector in Financing RE

Ghana's financial sector is vibrant and competitive, but has not yet engaged in financing RE. In fact, macroeconomic factors such as inflation, high interest rates and foreign exchange volatility largely hinder local banks' ability to provide long-term financing beyond 3-5 years. Project financing is also still a nascent product in Ghana's financial sector. Private developers report bank rate quotes in the range of 27-32% for 5 year corporate loans. Thus, there is a wide gap between available local financing options and the specific financing demands of RE projects (non-recourse financing, longer tenors, lower rates).

As a result, in the short-term, Ghana must rely on international financing for most of its RE development. Given the nascent stage of the RE sector's development, it can be reasonably expected that the market is perceived as relatively risky by international commercial banks and project financiers. Lenders will therefore need the support of international finance institutions to participate in the first RE projects. Reputable international developers and equity investors, whilst demonstrating significant interest in the development of RE in Ghana, are also cautious partly because of the still untested regulatory framework for RE and unknown ability of RE projects to attract debt financing. This translates into developer expectations of relatively high returns to compensate for the high perceived market and financing risk.

3.2.5. Stakeholders' Consultations and Feedback on Renewable Energy

The Ministry of Power employed a broad-sector stakeholder consultation approach in the preparation of the SREP IP. The process included a scoping mission, a joint mission, one-on-one meetings, circulation of the draft IP to relevant stakeholders, and public disclosure on the MoP's website.[23] Through this process, the MoP obtained many invaluable suggestions and comments regarding the priorities to be addressed, types of activities to be undertaken, and policy and regulatory directives to be followed.

The MoP invited experts from the ECOWAS Centre for Renewable Energy & Energy Efficiency (ECREE) to a three-day retreat workshop of the SREP National Task Force at

[23] Ghana Ministry of Power. http://www.energymin.gov.gh/Power/?page_id=37.

Senchi in the Eastern region of Ghana to discuss and solicit their inputs. This was to ensure that the SREP Ghana IP was not only aligned with the national policy objectives, but more broadly with the ECOWAS Renewable Energy Policy (EREP) as well.

The feedback received during the consultation provided clarity on the renewable energy strategy and the role of the private sector within the regional context. It also underlined the need to streamline the processes for renewable energy project development, clarify current renewable energy feed-in tariffs, and ensure more effective and expeditious implementation of the existing regulatory framework. It also stressed the need to improve access to and coverage of renewable energy resource data and finance on affordable terms.

The key development partners consulted view the SREP as an opportunity for Ghana to accelerate RE development because it is closely aligned to their interventions in the country and provides an opportunity to crowd-in additional resources for scale-up of RE investments.

Stakeholders also acknowledged the need to strengthen current institutional capacities in order to handle the increased workload expected during the SREP implementation, which can only succeed if a broad group of stakeholders is effectively engaged. Finally, they noted the vital need for knowledge generation and lesson sharing among stakeholder groups in order for sustainable, transformative changes to occur (Annex 3).

2

RENEWABLE ENERGY SECTOR CONTEXT

1. RENEWABLE ENERGY POTENTIAL AND DEVELOPMENT STATUS

Ghana is endowed with renewable energy resources. The proven renewable energy resources currently being developed are biomass, solar, wind, waste-to-energy, small and medium hydropower and tidal wave energy. To date, only a miniscule portion of the renewable energy potential has been exploited. Excluding large hydropower, modern renewable energy systems contribute a little above 0.3% to the country's total installed capacity (see Table 1). The development of renewables is constrained by a number of challenges, notably:

- High upfront capital cost
- Inadequate, unaffordable and unsustainable financing solutions
- Challenging and relatively new regulatory and legal frameworks
- Limited capacity to operate, maintain and manage renewables
- Theft and high replacement cost of major components

The MoP is committed to the sustainable development and utilization of renewable energies to address energy access issues, contribute to the fight against climate change, resolve environmental problems, and create sustainable green jobs for Ghanaians. The goal set by the National Energy Policy is to reach 10% contribution of renewable energy (excluding large hydro which has an installed capacity of more than 100 MW) in the electricity generation mix by 2020.

1.1. Hydropower

There are about 17 medium and 22 mini/small hydropower sites with exploitable capacities ranging from 15 kW to 100 MW which meet the definition of renewable energy resources under the Renewable Energy Act 2011, Act 832. The estimated exploitable capacity of these sites is 800 MW. The main barriers preventing the development of this resource have been climate variability and the unavailability of the data needed to assess the viability of the sites.

Recently, the GoG launched a number of initiatives to assess the viability of these hydropower sites:

- The Swiss Government through SECO is funding a Hydropower Sustainability Assessment Project (HSAP) on six hydropower sites on the black and white Volta Rivers. These sites are Lanka, Ntereso, Koulbi, Daboya, Kalpawn, and Jambito with aggregated exploitable capacity of 362 MW. The results of the assessment are expected in May 2015, however the size of the hydropower plants being considered are above the 10 MW capacity threshold for SREP consideration.
- The Agence Française de Developpement (AFD), the World Bank (WB) and the Volta River Authority (VRA) are jointly funding various aspects of ongoing feasibility studies on the Pwalugu (40 MW) and Juale (90 MW) hydropower sites.
- China Water Electric (CWE) and Bui Power Authority have funded the full feasibility study of Hemang (60 MW) hydropower project.
- The AfDB and the MoP/GEDAP are in the process of commissioning pre-feasibility studies on 10 additional small and medium hydropower sites with aggregated exploitable capacity of 248MW.

The MoP is aggressively studying the viability of these sites for potential development in order to increase the share of renewable energy in the mix, improve the robustness of the transmission network and allow for the integration of smaller hydro-power projects. Under SREP, mini-hydroelectricity is considered to be below 10 MW (versus 100 MW for the case of the GoG). As per available data, the mini-hydro capacity below 10 MW in Ghana is very small. Most hydro capacity is actually above 10 MW, therefore not a viable option under the SREP framework.

1.2. Solar

The solar irradiation level in Ghana ranges from 4.5 to 6.0 kWh/m^2/day with the highest irradiation levels occurring in the northern half of the country. By the end of 2014, a total of 38,200 solar systems and lanterns were deployed in more than 120 communities throughout the country for off-grid applications. Twenty-five grid-tied installations with total installed capacity (including stand-alones) of 8 MW were operational as of end

2014. Interest in utility-scale solar PV is very high but so far only a 20 MW solar PV project is under construction. Nevertheless, more than 30 utility-scale solar projects for a total generation capacity in excess of 1.8 GW have been issued at least one provisional license by the Energy Commission.

The main barriers preventing the rapid development of this resource are the high initial investment costs as opposed to conventional (non-renewable) energy sources, limited experience and track record of utility-scale solar development, high perceived risk by private developers of a largely untested new FiT regime, and limited access to affordable financing.

The Government is piloting a number of initiatives to improve the learning curves for scaling-up renewable energy. For instance:

- The Energy Commission has issued Siting Clearance Permits to fifteen IPPs for utility-scale solar projects. However, only one utility-scale solar PV project (20 MWp) is under construction to date.
- The MoP and Energy Commission are developing a new private sector led framework to promote the installation of about 200,000 solar home systems.
- The Solar Lanterns Promotion Program (SLAP) is working toward its goal of distributing 2 million high quality solar lanterns in deprived remote/off-grid communities by 2020 through various subsidy schemes. Since the launch of the SLAP in 2013, a total of 80,000 have been procured through the GoG budget and over 50,000 have been sold at a 70% subsidy to target beneficiaries. Funds that once made up the kerosene subsidy were used for this program.
- A 715kWp solar PV net-metered installation at the Noguchi Memorial Institute for Medical Research of the University of Ghana with funding support from the Japanese Government.
- An additional 25 grid-tied PV were installed at the end of 2014 through private sector initiatives bringing total national capacity to 8 MW.
- The launch of the Ghana Renewable Energy Fair to promote the rapid utilization of renewable energy resources in the country, especially through net metering was among the key publicity initiatives to make the industry visible.
- A net metering code was developed with technical assistance from the German Government.

1.3. Wind

Ghana has moderate wind energy potential. Average annual wind speeds along the coast and some islands range from 4.0m/s to 6.0m/s at 50m hub height. This potential is proven and could support utility-scale wind power and hybrid micro/mini-grid development. Similar to solar, the main barriers to the development of this resource and involvement by the private sector are lack of credible data, high initial investment

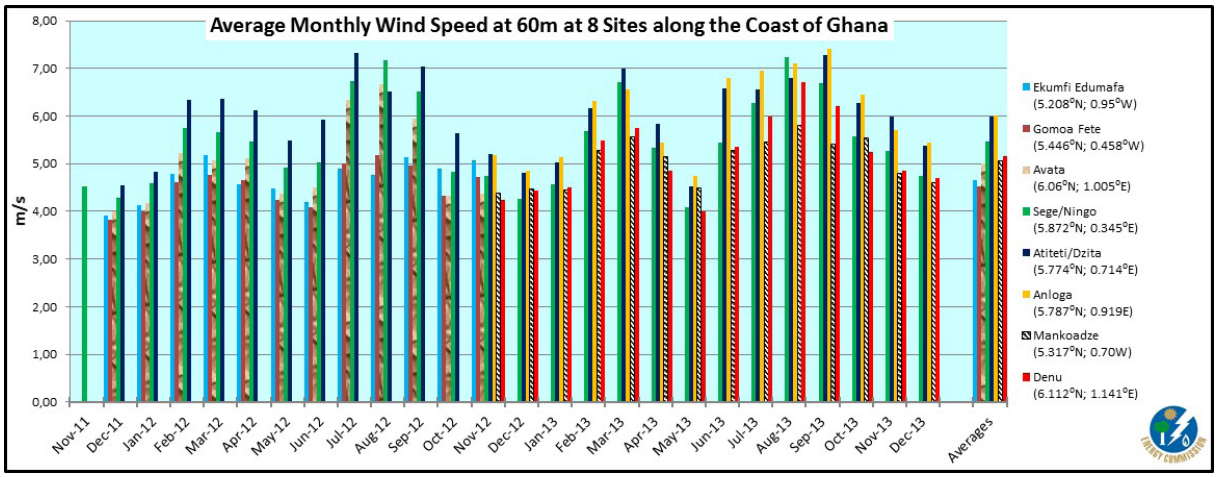
costs as opposed to conventional (non-renewable) energy sources, limited experience and lack of track record of wind projects, high perceived risk of a new regulatory regime, and limited access to long-term cost-effective project financing.

In order to address some of these issues, the MoP, with support from the WB, has been conducting a number of wind resource assessments to provide credible data for early stage planning. The private sector has complemented this initiative by conducting detailed feasibility studies on potential wind project development. The following initiatives show the efforts to develop the country's wind energy resource:

- WB/MoP/GEDAP have been conducting wind resource assessments (WRA) at 60 m above ground in more than eight sites since 2012. The aim is to obtain bankable wind data for planning and support wind IPPs.
- The Volta River Authority (VRA) plans to install up to 150 MW of wind farm by 2020 and commenced a WRA in 2013 at 80m above ground at eight sites across the country.
- The Swiss company NEK/Upwind Ltd. has already secured a provisional license for an aggregate 250 MW wind farm park and is conducting detailed feasibility studies for the same.
- EleQtra/InfraCo has acquired a site and is conducting WRA to develop a 30 MW to 50 MW wind farm by 2020.

The results of the WRA commissioned by the MoP/GEDAP for the eight sites are shown in the Figure 4 below. These results confirm that, with moderately high wind speed (from 6.0 m/s at Anloga to 4.5 m/s in Gomoa Fete), there is potential for commercial wind farm development in these areas.

Figure 4. Average Monthly Wind Speed at 8 Sites[24]



To date, four provisional licenses and one siting clearance permit have been issued. Although there has been strong interest from the private sector in investing in wind

[24] GEDAP Wind Resource Assessment Report, Energy Commission, 2014.

in Ghana, delays and lack of clarity in the approval processes may potentially derail progress. To date, no utility-scale wind project is under construction.

1.4. Biomass and Waste-to-Energy

Nearly 50% of the country's overall primary energy use is obtained from biomass. This energy is consumed mostly in the household sector in the form of charcoal or wood. The charcoal production process is inefficient and is largely an informal activity and a major contributor to Ghana's deforestation problem. The production of charcoal stoves is also an informal sector activity with the exception of improved cook-stoves that are promoted by NGOs and various development projects.

Industry and service/commercial sectors also use biomass energy. Biomass resources include supply from agricultural residues from maize, sorghum, rice and from agro-based industries such as shea butter, cocoa, rubber, sawmills, and palm oil. In the agriculture and wood processing sectors, waste is normally burnt as a form of disposal, denying the country the huge untapped potential for productive power and energy generation.

A recent World Bank-funded study, "Agro-Processing and Sawmill Wastes Assessment for Electricity Generation 2014" revealed that there are numerous clustered agro and wood processing sites in Ghana generating a large amount of waste. The EPA, in collaboration with the Ghana Cocoa Board, is undertaking detailed studies on cocoa waste for power generation. A local biomass energy developer has now acquired environmental and site clearance permits to develop a 6 MW biomass power project.

Municipalities also generate large quantities of liquid and solid waste. For example, Kumasi and its suburbs generate up to 1,600 tonnes daily while Accra and its environs generate up to 2,500 tonnes. Additionally, Accra generates over 800m^3 of liquid waste per month. This could be a good feedstock for biogas production for cooking and electricity generation.

The main barriers hindering the development of this resource are the high start-up costs, limited local expertise in utility-scale biomass power production, feedstock composition and supply risks. The feedstock could come from agriculture, household and industrial waste. However, in most cases, the waste has limited supply potential for utility-scale energy generation, and hence, production of specific crops (or wood) might be necessary. In such case, the environmental and social impacts are tremendous and food security could be negatively impacted. Furthermore, the preservation of tropical forests has highest priority among measures to mitigate climate change (and to safeguard biodiversity).

1.5. Wave & Tidal Energy

Tidal energy is produced using tidal energy converters. These huge underwater

turbines are placed in areas with high tidal movements and are designed to capture the kinetic motion of the receding and rolling ocean tides to produce electricity. Tidal power has abundant potential for future power and electricity generation because of the enormous size of the oceans. Ocean waves contain significant energy density and have substantial commercial potential if the energy can be extracted using a reliable, environmentally friendly and cost-effective technology. Wave energy, which is a renewable, sustainable and a free source of energy, would have significant impact on electricity production in the world if feasible solutions in terms of technology, economy and ecology were provided.

A local Ghanaian company, TC Energy, in collaboration with Swede Energy, is in the process of installing a pilot 14.5 MW Tidal Wave Power Plant at the confluence of the Volta River and the Gulf of Guinea, Ada Foah. This company will utilize sea based wave energy converters for the generation of power. The company has signed a PPA with ECG for 1,000 MW at a tariff of around 9 cents per kWh. Although the technology has the advantage of being scalable, it is relatively new with limited number of commercially proven plants.

2. LEGAL AND REGULATORY FRAMEWORK FOR RE-NEWABLES

Ghana's energy strategy set a goal for renewable energy to constitute 10% of the national energy generation by 2020. To reach that goal, Parliament passed the aforementioned Renewable Energy Act 2011, Act 832, providing the legal and regulatory framework necessary for developing and expanding the country's RE sector.

The Renewable Energy Act 2011, Act 832 calls for:

- A framework for the utilization of RE energy sources,
- An enabling environment to attract investments in RE sources,
- The building of indigenous capacity in technologies for developing RE sources,
- Public education on RE production and utilization, and
- Regulation of the production and supply of wood fuel and bio-fuel.

There are additional regulatory and policy instruments in place that promote RE development in Ghana, notably:

- A National Electricity Grid Code (2009) for renewable energy,
- Renewable energy feed-in tariffs,
- Guidelines for a renewable energy purchase obligation (under which power distribution utilities and bulk electricity consumers are obliged to purchase a certain%age of their energy required from electricity generated from RE sources),

- A RE Power Purchase Agreement draft template,
- A 2014 Bioenergy and Policy Strategy which calls for modernization of the supply and use of bioenergy on a sustainable basis,
- A framework for the establishment of the Renewable Energy Fund (REF) with European Union support to provide long-term financing for the promotion, development, sustainable management and utilization of RE resources, especially the extension of electrification access to remote off-grid communities using RE technologies, and
- An import tax exemption for solar PV system.

In 2012, the GoG introduced an innovative approach of redirecting existing kerosene subsidies for solar lighting options. The rational for the new GoG policy was based on the logic that both kerosene and solar lighting would help meet the end-user need for lighting. The GoG has also successfully implemented off-grid community lighting projects driven by PV-power energy centres that generate sufficient revenue through mobile phone charging to support operations and maintenance of solar streetlights for streets, social centres and markets in these communities. And, in communities targeted by the project, there has been an additional benefit of improved security in remote areas whereby outdoor lighting is helping protect against female harassment as they no longer must return from their daily activities under the dark of night.

The MoP is working with the PURC and the Energy Commission to develop the regulatory framework to address the challenges of mini (and micro) grids and off-grid stand-alone electrification interventions. Procurement of expert(s) to develop the framework is in an advanced stage. The World Bank, through the African Electrification Initiative (AEI), will be providing expert technical review of the draft regulations. This would pave the way for the development of the relevant tariff mechanism and improve the business model for mini-grids that is being considered under the mini-grid component of this program.

In order to provide a critical mass of RE installations that would lay the groundwork for scale-up, the MoP has set ambitious renewables targets listed in Table 4 below. However, the regulatory framework for RE in Ghana remains relatively uncertain and untested. For instance, the new RE-FiT (indicated in Table 3) are offered for a maximum of 10 years, which is considered too short a period to attract the long-tenor private financing necessary to make utility-scale projects cost-effective and financially sustainable. The processes for RE project development is also cumbersome with the implication of many stakeholders in the absence of a streamlined approach such as the establishment of a one-stop shop.

Table 4. MoP Renewables Targets by 2020[25]

Potential RE Projects	Target	Required Investment USD million
Development of utility type wind farms	50-150 MW	300-550
Development of grid-connected solar parks	MW	400-700
Solar lantern promotion	2 million units	150-200
Medium – small hydro	150-300 MW	450-900
Modern biomass /waste to energy	20-50 MW	60-150
Development of mini-grid	30-42 units	21 - 38.5
Off-grid RE project	30,000 units	10-25
Sustainable energy for cooking	2.0 million units	10-50
TOTAL Investments		USD 1.4 - 2.6 billion

3. BARRIERS TO RENEWABLE ENERGY DEVELOPMENT AND MITIGATION MEASURES

The main barriers hindering the scaling-up of RE-based electrification in Ghana and hampering the achievement of the MoP renewables targets discussed above are presented in Table 5 below. The response measures taken to date are also discussed.

Table 5. Barriers and Measures Taken

Barrier	Measures taken to date
Technical/Skills	
Limited capacity of the utilities, regulators and financial institutions and project developers to structure and negotiate bankable PPAs	- Bilateral arrangements with the Governments of China, Japan and India, as well as the EU, to provide technical assistance to build short- and long-term capacities for utilities. - Current stock of skilled RE personnel still insufficient.
Limited capacity in appropriate selection of RE technology options and inefficient operation and maintenance of complex RE technology machinery and equipment	- MoP supporting Ghana Standards Authority and The Energy Centre (TEC) of Kwame Nkrumah University of Science and Technology (KNUST) to develop capacities for testing RETs. - MoP and the Chinese Government providing TA to selected polytechnics and technical/vocational institutions to build critical middle level manpower for the industry. - German government assisting in the development of RE curricula for technical and vocational training under the Council for Technical and Vocational Education and Training. - Number of trained RE specialists is still not high enough to meet current and future demand.

[25] Ministry of Power

Barrier	Measures taken to date
Insufficient RE resource data	- With support of The World Bank, comprehensive wind and biomass resources assessments are ongoing to reduce development risks of utility-scale RETs. - SECO and AfDB financing various aspects of hydro studies. - Wind and solar data obtainable from Energy Commission at very low cost. - The data on other renewables is still inadequate nor is there sufficient site specific wind and solar data for all viable locations in Ghana.
Renewables such as mini-hydro susceptible to adverse effects of climate change (e.g., drought)	- GoG actively pursuing several mitigation and adaptation measures including the use of the International Hydropower Association (IHA) early stage risk assessment protocol. -Reforestation of the catchment areas of the country's major river systems.
Institutional/Regulatory	
Regulatory burden for small-scale RE developers compounded by absence of a one-stop centre	- MoP and relevant regulatory institutions reviewing the option of developing light regulation and establishing a one-stop platform for processing and approving applications.
Absence of a clear criteria differentiating communities that would benefit from off-grid and grid-connected electrification	- MoP with support from The World Bank is conducting a comprehensive GIS-based study to establish and prioritize the suitable electrification options for the remaining nearly 20% of the country's population. - Preliminary results of the GIS work showed that island and lakeside communities are most likely to benefit from RE off-grid electrification due to the high cost of grid-extension.
Limited structural arrangement for operation and management of off-grid RE investments	- In the interim, the Renewable & Alternative Energy Directorate (RAED) is currently managing the assets. - Efforts underway to establish the Renewable Energy Authority with the mandate to own, operate and manage RE investments in which the state has an interest.
Lack of commitment to enforce approved regulatory and legal frameworks	- AAF (Automatic Adjustment Formula for RE FIT) system implementation ongoing. -GoG demonstrating political will to ensure less or no interference. Utilities are installing prepaid meters in all public facilities as a result, with the exception of essential public sectors such as hospitals, etc.
Financial	
Perceived investor risk related to RE sector in Ghana	- The AfDB and WB are examining the option of providing PRGs (Partial Risk Guarantees) to private investors in the power sector to mitigate the utilities credit risk.
High up-front cost of RE technologies supported by RE FiTs for a maximum of only 10 years	- EC developed relevant policy tools such as: RE tariff setting methodologies, licensing procedures and guidelines; RE purchase obligations; and standard PPA templates, etc. These are useful tools but cannot on their own overcome the problem of a short duration FiT (10 years).

Barrier	Measures taken to date
Inadequate financing and high cost of capital	- KfW has established an office in Ghana and is already providing financing for a 12 MW solar project to VRA. - Ecobank and National Investment Bank are two national financing institutions planning to establish RE portfolios to fund RE development.
Low end-user electricity tariffs increase FiT burden on utilities and GoG	- Upward adjustment of electricity tariffs to the tune of about 90% by 2013. - Implementation of the automatic adjustment tariff system which should strengthen utilities' balance sheets and enhance their capacity to absorb future FiT payments (current RE FiT payments are still low, reflecting the limited number of grid connected RE installations). - RE-FIT reviewed with revised rates gazetted in October 2014.
Weak balance sheets of current utilities	- Ongoing GoG efforts to enforce technical and revenue leakages reduction mechanisms/strategies including replacement of all credit meters with prepaid meters. - With the exception of essential departments, all government facilities to be prepaid metered.

3

CONTRIBUTION TO NATIONAL ENERGY ROADMAP

SREP will contribute to the achievement of the "Energy Sector Strategy and Development Plan" (February 2010) by increasing access to electricity as well as the proportion of installed generation capacity of RE in the energy mix. It will further help the country diversify away from its heavy reliance on hydropower and thermal energies.

The majority of the remaining population without access to electricity (about 5 million based on the 2010 Ghana Statistical Service population census report) live in deprived rural communities including those along Lake Volta and the islands created by the Akosombo Dam. It is difficult and uneconomical to electrify these communities through the national grid. The challenges posed by the electrification of these communities are now seen as a significant hurdle in the country's goal of achieving universal access by 2020.[26]

Renewable energy-based electrification options are strongly being pursued as the way forward for these communities. Many development partners, including the AfDB, SECO and WB are supporting the Ghana Energy Development and Access Project (GEDAP). One component of GEDAP promotes a mix of renewable energy based models including four pilot mini-grids to serve nearly 10,000 people in some of these deprived communities. The Ministry of Power is leveraging resources and lessons from the ongoing initiatives to develop the necessary frameworks and scale-up and accelerate rural electrification using renewable energy amidst resource constraints. The SREP intervention is therefore timely and would contribute to scaling-up these initiatives.

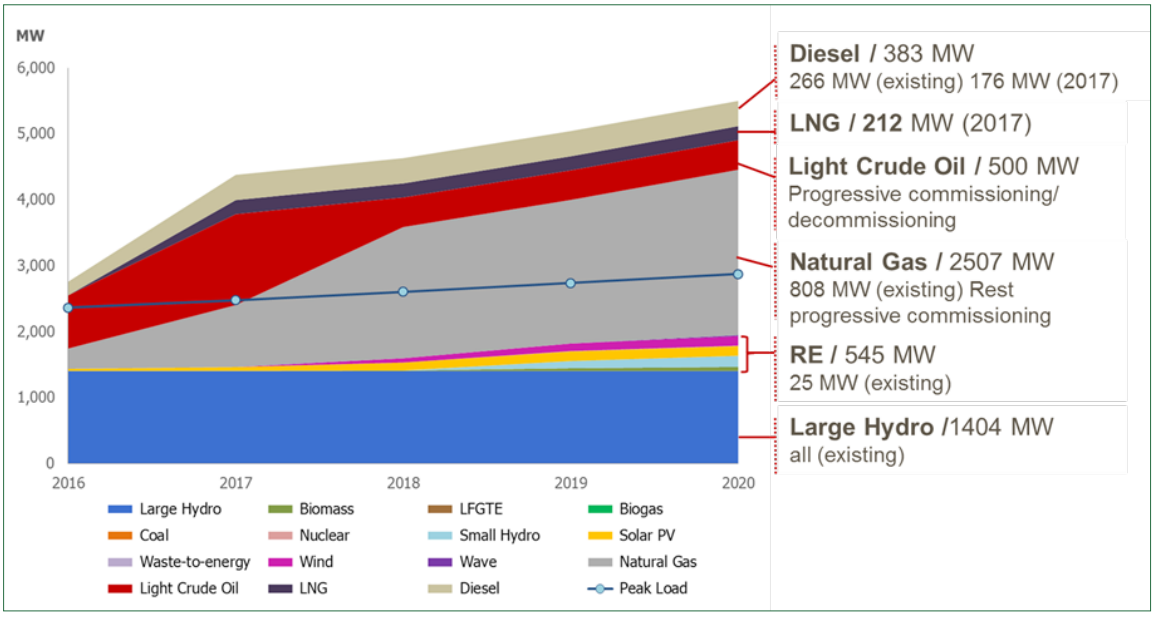
[26] In spite of this, the current administration intends to achieve this target by 2016, ahead of the original schedule.

The national goal for the renewable energy sector is to achieve up to 10% of RE in the overall generation mix by 2020. The policy focus is therefore to promote the development and management of renewable energy resources to increase energy access, combat climate change and contribute to the objectives of the:

- Ghana Shared Growth Development Agenda,
- ECOWAS White Paper for Energy Access,
- UN Millennium Development Goal, and
- Sustainable Energy For All Initiative.

According to a recent study undertaken by the Ministry of Power with assistance from GIZ,[27] it is technically and economically feasible for Ghana to reach the goal of 10% RE generation by 2020. Figures 5, 6 and 7 show the readouts from the model developed during the study. Technically feasible means that the cumulative installed capacity of variable RE technologies will not exceed the cap set by the GoG (maximum of 150 MW of solar and 300 MW of wind without backup storage) and will therefore not affect the system's stability. Economically feasible means that the impact of additional non-least cost RE (compared to conventional power which would be less expensive) on the tariff is reasonable. Indeed, the generation portion of the average electricity tariff from RE will be only 4.2% higher than conventional least cost generation.

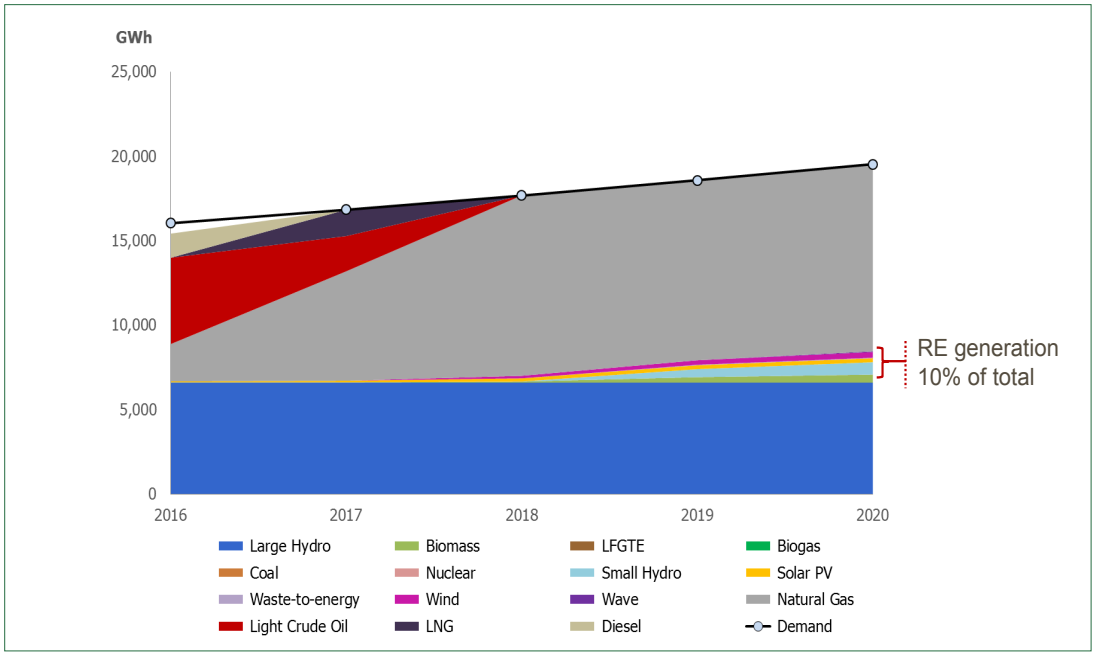
Figure 5. Installed Capacity in the Least Cost plus Renewables Scenario to Meet 2020 RE Target



Source: Castalia for GIZ and the Government of Ghana (2015)

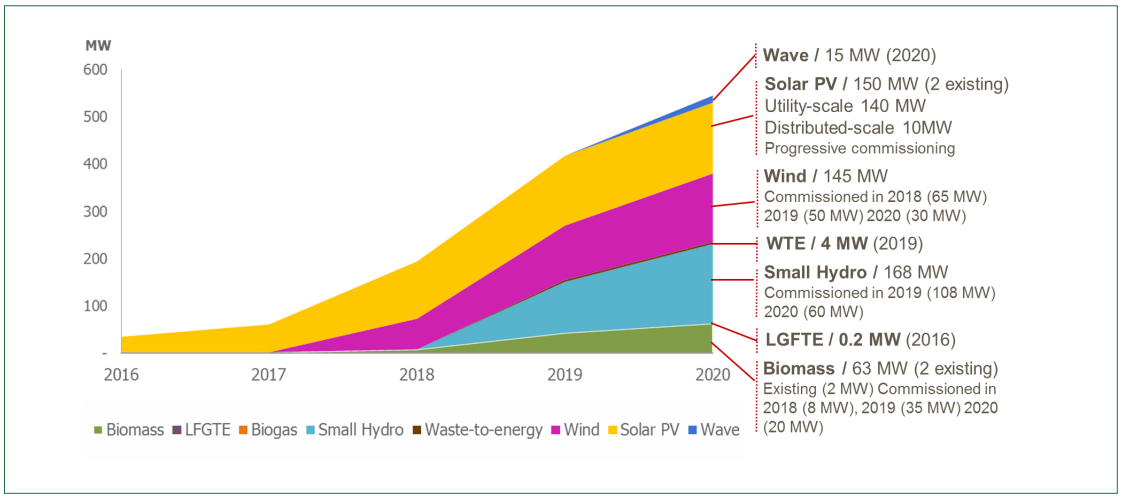
[27] Castalia Strategic Advisors, Capacity for a Successful Implementation of the Renewable Energy Act in Ghana, Results of Preliminary Grid Analysis and Revised Electricity Generation Model, March 2015.

Figure 6. Total Generation in the Least Cost plus Renewables Scenario to Meet 2020 RE Target



Source: Castalia for GIZ and the Government of Ghana (2015)

Figure 7. Installed RE Capacity in the Least Cost plus Renewables Scenario



Source: Castalia for GIZ and the Government of Ghana (2015)

However, in order for these RE projects to become a reality and for Ghana to achieve its 2020 goal, significant financing support is needed. SREP is timely and would provide part of the financing to speed-up RE integration, while other sources such as the Green Climate Fund may also be tapped into to address the large financing need. SREP would also address vital areas of the Renewable Energy Act 2011, Act 832, such as the establishment of the Renewable Energy Authority.

Due to the shortfalls in generation, grid electricity supply continues to be erratic making it nearly impossible for the nation to derive the maximum benefit of the national electrification program. On the other hand, pilot installation of net metering systems, which provides incentives for the integration of renewable energy into the distribution

network through own-consumption and export of the excess energy into the grid has not yielded the desired benefits as a result of grid unreliability. The impact on productivity cannot be overemphasized. SREP provides an alternative scheme that ensures uninterrupted supply of power under net metering to meet desirable loads and sustain productivity. Furthermore, SREP support for a first financing utility-scale grid-connected RE projects will help demonstrate the effectiveness of Ghana's new RE regulatory framework, thereby attracting further private investment and more attractive financing options.

Finally, the following actions related to key policy issues would be carried out by SREP:

- develop and implement tariff methodology for ancillary services (such as reactive power, voltage and frequency compensations, etc.) due to renewable energy generation and a policy framework and institutional arrangement for managing renewable energy waste would improve the market environment; and
- create the necessary conditions for increased private sector and government participation.

4

PRIORITISATION OF STRATEGIC INVESTMENT AREAS

A consultative and participatory process involving relevant stakeholders under the leadership of the GoG, represented by the Ministry of Power, with support of the Multilateral Development Banks, helped in identifying and selecting the priority renewable energy technologies for consideration in the SREP. The process took into account preparatory work done by the SREP National Task Force on key barriers, bottlenecks, and opportunities, as well as the conclusions of several technical consultations and various meetings with key stakeholders (Annex 3).

The CIF cross-cutting criteria, in addition to the national policy objectives, were used to identify the priority strategic investment areas for the SREP-Ghana Investment Plan.

The first set of criteria relate to *SREP priorities*, namely:

- Potential for scale-up - increased installed capacity from renewable energy;
- Potential for new direct beneficiaries - increased access to energy through RE;
- Contribution to low emissions development;
- Cost effectiveness - affordability and competitiveness;
- Productive use of energy – promotion of the use of RE for productive and income generating activities;
- Economic, social, and environmental benefits;
- Economic and financial viability;
- Leveraging of additional resources into the RE sector (target ratio of 1:4);
- Gender equity - contributing to mainstreaming of gender in RE sector; and
- Co-benefits of RE scale-up.

The second set of criteria pertains to the *GoG's policy priorities*, namely:

- Contribution to Ghana's universal access to electrification program with special emphasis on remote communities that have not yet benefited from grid electrification;
- Contribution to the 10% renewable energy target in Ghana's energy supply mix; and
- Readiness and availability of supporting documents.

A few other factors were considered to assess the readiness of the identified cluster of priority RE investments, namely:

- Ongoing efforts led by the GoG and other development partners for similar assignments or areas;
- Supporting the GoG's efforts to bridge the power supply shortfall and halt the related load shedding that is affecting many parts of the country;
- Presence of committed and capable investment promoters; and
- Availability of requisite expertise and skills required from the stage of conception to development, construction, commissioning and long-term operation and maintenance as well as subsequent scaled-up investments.

The GoG, private sector, civil society organizations, NGOs, development partners and MDBs worked together to apply the aforementioned criteria to RE technologies and delivery systems identified as having potential in Ghana, namely tidal wave, utility-scale solar, wind, mini-hydro, biomass, mini-grids and net metering. Table 6 below provides the scores for the RE technologies and delivery systems considered for SREP, while the detailed results of the assessment, evaluation and ranking are presented in Annex 4.

Table 6. Ranking of SREP Priority Renewable Energy Technologies & Delivery Systems

Criteria	Technologies & Delivery Systems						
	Tidal Wave	Utility-scale Solar	Utility-scale Wind	Small Hydro	Utility-scale Biomass	Mini grid/Stand-alone	Net metering
SREP	19	21	21	19	26	28	25
GoG	7	9	9	5	10	11	10
Grand total	26	30	30	24	36	39	35

The renewable energy technologies and delivery systems that scored the highest were:

- Mini-grids & stand-alone renewable-based electrification;
- Utility-scale Biomass;

- Net metering based PV; and
- Utility-scale solar/wind.

These RE technologies and delivery systems were validated during the consultations held with key stakeholders in the country during the preparation of the IP. The stakeholders consulted include national institutions, private sector, civil society organizations and development partners.

Based on those consultations and in collaboration with the MDBs, the GoG decided to prioritize these renewable energy technologies and delivery systems. However, after further consideration driven by the SREP funding limit of USD 40 million, the GoG decided to seek alternative funding from other sources such as the Green Climate Fund or eventually request supplemental SREP funding for the utility-scale biomass option. Consequently, SREP support is sought for the following three projects:

- Project 1 - Renewable energy mini-grids and stand-alone solar PV systems;
- Project 2 - Solar PV based net metering with battery storage; and
- Project 3 - Utility-scale solar PV/wind power generation.

To ensure successful implementation and scale-up of the three listed flagship renewable energy investments, the SREP-Ghana IP will include a parallel technical assistance initiative that will have two thematic threads which will be a stand-alone project:

- Project 4 - Technical assistance to scale-up renewable energy.

The first thread will focus on capacity building activities that will aim to mobilize and motivate existing skilled Ghanaian personnel to ensure their effective and committed participation in Ghana's SREP program. Such activities will further expand the talent pool of Ghanaian RE experts to address the twin-challenge of future scale-up of identified investments and the high-turnover of skilled staff that bedevils many RE development projects.

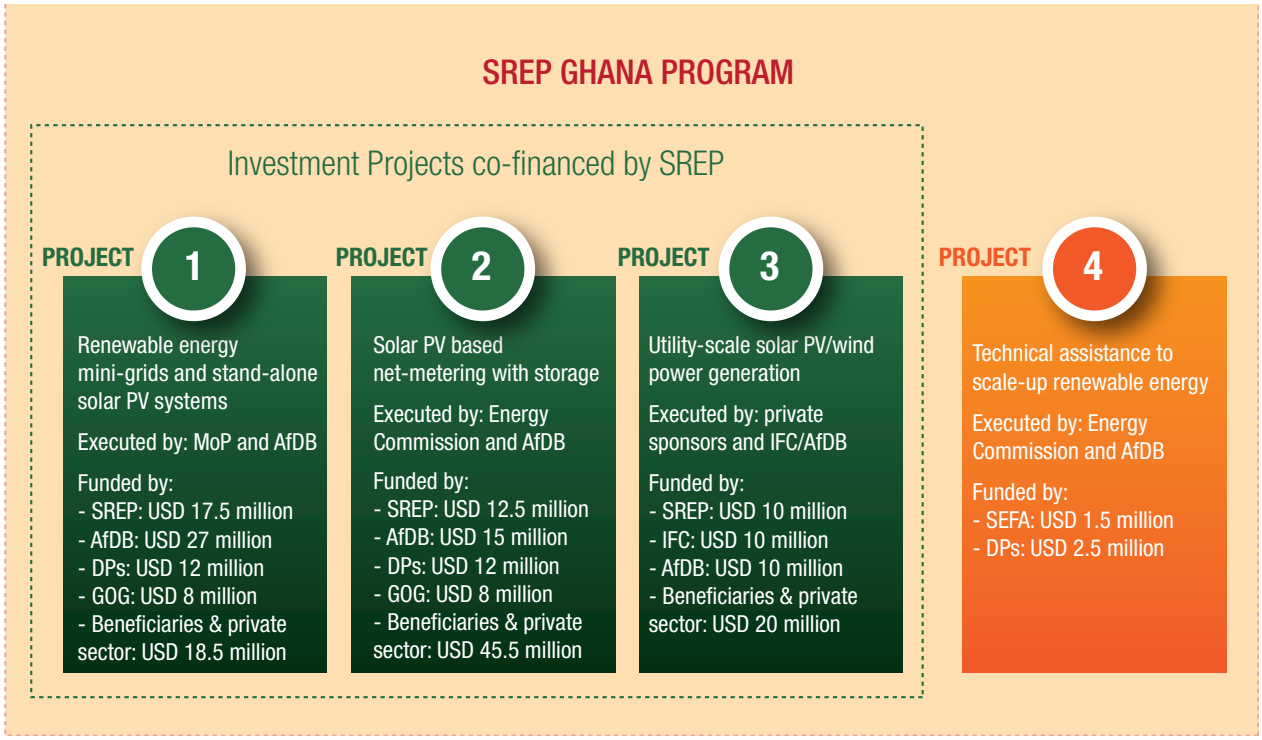
The second thread will focus on policy support activities and will be designed to enhance more effective and streamlined implementation of existing policy and regulatory instruments that support RE investments in Ghana, with a focus on facilitating the participation of the private sector. Where necessary, the policy support activities will complement the GoG's efforts to bring on board additional policy, regulatory and institutional instruments to facilitate scale-up of renewable energy deployment across the country. This TA project will be funded by the AfDB-managed Sustainable Energy Fund for Africa (SEFA).

5

PROGRAM DESCRIPTION

Based on the analysis of the Ghana RE sub-sector and the screening of various renewable energy options, summarized in the previous chapters, the MoP decided on the structure of the IP to be co-financed by the SREP. This section presents the general architecture of the SREP-Ghana IP, with its priority areas and investment projects, highlighting the roles and contributions of stakeholders and institutional arrangements for program implementation. Figure 8 presents a high level overview of the program. The project concepts for the priority investments, detailing how the MDBs and other partners will support the implementation of specific investments as well as the role SREP would play in those projects, are included in Annex 1.

Figure 8. SREP Ghana Program Overview



1. PROGRAM OBJECTIVE

The program objective is to assist the GoG in meeting its 10% renewable energy target by 2020 as well as its universal electrification goal through the implementation of flagship renewable energy investments that would provide models for scale-up and leverage additional private and public financial resources to the country's RE sector. The program will build on previous and ongoing GoG efforts in the sector and provide technical assistance that will build the capacity of the Ghanaian renewable energy players and ensure effective implementation of newly instituted policy, regulatory measures and incentives to accelerate RE deployment across the country.

The program will replicate innovative approaches that have proven successful in stepping up RE dissemination in Ghana. In accordance with SREP modalities, both IP goals will be achieved through an integrated approach that includes investments in renewable energies; capacity building for stakeholders; promotion of private sector involvement; gender inclusion; and provision of adequate technical assistance. In addition, the program will support the consolidation of the sector regulatory framework. The integrated program approach assumes that transformational change is only made possible by improving energy market conditions and financing, as well as improving the enabling environment for mobilizing private sector investors. These conditions are indispensable for any replication and scaling-up of public and private investments in renewable energy.

2. EXPECTED OUTCOMES

The main expected outcomes of the SREP-Ghana include:

- A minimum 2% contribution to the increased share of renewable energy in the country's energy supply mix to reach 10% by 2020 as per the GoG's objective by supporting the development of innovative RE options such as PV-based net-meters as well as utility-scale solar and wind power projects.
- At least a 20% contribution to the remaining unelectrified population in line with Ghana's efforts to realize universal access to electricity by 2020 by connecting communities that cannot be cost-effectively reached by conventional grid-based rural electrification.
- Expansion of private sector participation and investment in the country's RE sector by ensuring more effective implementation of existing renewable energy policies, regulatory and incentive measures.
- Expansion of the existing base of Ghanaian RE expertise.
- A mainstreamed gender dimension in RE development.

3. DESCRIPTION OF PROGRAM COMPONENTS

Ghana's SREP Investment Plan comprises the following four project components:

1. ***RE mini-grids and stand-alone solar PV systems:*** construction of 55 renewable energy-based mini-grids and 35,250 stand-alone PV electrification systems installed in 500 rural communities.
2. ***Solar PV based net metering with battery storage:*** installation of 15,000 solar PV net metering systems.
3. ***Utility-scale solar PV/wind power generation:*** providing finance to Ghana's first private sector utility-scale wind and solar plants that are expected to leverage substantial investments from the private sector.
4. ***Technical assistance to scale-up RE:*** capacity building for key renewable energy players and policy support to the GoG.

The following sections provide more comprehensive descriptions of each of the above projects. Detailed project concept notes are in Annex 1.

Although the SREP is unable to fund utility-scale biomass power generation at this time as addressed in the previous section, the GoG is seeking alternative funding from other sources such as the Green Climate Fund and eventually requesting supplemental SREP funding for this option. Detailed information on this option is therefore included as a potential project 5:

5. ***Utility-scale biomass power generation:*** *development of biomass energy power plants with the initial focus being on agro-industrial by-products/ wastes (palm oil cocoa, sugar, rice and wood industries).*

3.1. Project 1: RE Mini-grids and Stand-alone Solar PV Systems

About 20% of Ghana's total population (representing 5 million people, based on the 2010 Ghana Statistical Service population census report) do not have access to electricity, out of which about 2.9 million reside in lakeside and island communities created by the Akosombo Dam. These islands and lakeside communities are the most difficult and uneconomical areas to electrify through the national grid electrification scheme. The challenges posed by the electrification of these communities are now seen as a significant hurdle in the country's move to achieve universal electrification access (at least 90% of total population) by 2020.[28]

3.1.1. Objective

The main objective of this project is to encourage sustainable public and private financing

[28] In spite of this, the current administration intends to achieve this target by 2016, ahead of the original schedule.

for scaling-up renewable energy mini-grids and stand-alone PV systems to achieve the GoG universal access policy by electrifying lakeside and island communities in Ghana, with much focus on female-headed households and SMEs.

3.1.2. Project Components

Public sector-led renewable energy-based mini-grid component

- Procurement and installation of 55 mini-grids to service a total population of 137,500 (26,442 households including SMEs, public facilities such as schools, clinics, and community water schemes, etc., estimated load of 16,500 kW[29] at a cost of USD 37 million).
- Development of a framework for the integration of mini-grids into the existing grid-connected rural electrification model.
- Fine-tuning of proposed ownership, operation and management models under the ongoing seven pilot initiatives (4 pilots with GEDAP/WB funding, 1pilot with SECO funding and 2 pilots with Korean funding) and adoption of the most sustainable and scalable model.

Private-public sector led stand-alone solar PV component

- Installation of 20,500 stand-alone systems to meet desirable loads for households to serve an estimated 106,600 people using a partial subsidy and credit facility under the private sector-led initiative.
- Installation of 1,350 stand-alone systems for schools to serve some 243,000 students.[30]
- Installation of 500 stand-alone systems for health centres and 400 stand-alone systems for communities to service an estimated 215,000 people.[31]
- Review of the proposed models to restructure the financing scheme of the stand-alone component.
- Zoning and prioritizing communities for effective and efficient delivery.

3.1.3. Rationale for SREP Financing

Increased access to electricity and improved reliability of power supply that result from sustainable new mini-grids and the Solar-PV stand-alone systems is essential to bridge the socioeconomic disparities between Ghana's urban and rural population, including female headed households. To sustain reliable power supply to deprived rural

[29] An estimated 120 W per person based on data from ongoing mini-grid initiatives and rural electrification statistics from the utilities (ECG/NEDCo).

[30] Assumption of 180 students per school (least option from Ghana Education Service, number of students benefiting could increase significantly to about 45% more).

[31] On average (using GEDAP data, each health facility services about 350 people and the community lighting and energy service center benefits about 100 people per system (a system comprises a desirable energy service center and 4-10 solar streetlights for public lighting).

communities, investments must remain financially viable after project completion. To enable the development of mini-grids, the SREP will adopt an innovative mechanism to provide capital subsidies and long-term concessional facilities modeled along the conventional rural electrification scheme. Tariffs will allow the operators (community, private sector and the Ghana Renewable Energy Authority) to fully recover operation and maintenance costs of the investment to ensure long-term sustainability.

Furthermore, the SREP-Ghana will remove key barriers to providing solar-based stand-alone electricity to rural areas, including: technical problems; poor consumer perception and limited awareness of the advantages of the systems; and lack of available financing to make these systems affordable for low-income consumers. SREP will fine-tune the Bank/GEDAP ARB Apex Bank model for stand-alone solar systems, to bring on board a wider range of financing institutions (such as committed individual rural banks and those which focus on microfinance), private sector partners, MDBs and community-based institutions (NGOs and civil society organizations) to ensure sustainable scale-up under SREP.

To provide long-term consumer loan financing for the stand-alone component, a line of credit will be created and operated as a revolving fund for on-lend to credible private sector and community-based microfinance firms. The structure will be detailed out to ensure participating financing partners are able to refinance loans with reasonable terms of repayment over initial investment and major components replacement. Also, SREP will provide partial grants to customers or consumers to make stand-alone SPV systems affordable and create critical mass demand as an incentive to service providers and suppliers operating in these remote and relatively marginalized areas. This will also help improve energy access to remote communities, the most vulnerable including female-headed households.

Finally, SREP would mobilize additional concessional financing during implementation for both the renewable mini-grid and stand-alone components from other development partners and serve as the main flagship program for the sub-sector with which all partners must work.

3.2. Project 2: Solar PV based Net Metering with Battery Storage

In an effort to meet the 11% average electricity demand growth rate, the GoG's strategy exploits all the opportunities of power generation available to the country. This includes the use of conventional and non-conventional power generation systems such as renewable energy net metering technology.

Given the high electricity demand, GoG is unable, on its own, to cope with the magnitude of investments required. Key to the Government's strategy is the creation of an enabling environment to encourage private sector participation. This has however, not yet yielded the anticipated results. The expected investments from IPPs have not been forthcoming, while the energy sector continues to experience electricity supply challenges. This has led to frequent load shedding with its attendant socioeconomic

adverse impacts on industries and commercial businesses, particularly SMEs and essential public services (hospitals, schools, etc.). This situation has resulted in high demand for fossil fuel powered-gensets backup solutions to keep businesses running.

To help address these challenges, the viability of clean, reliable and cost effective power solutions in line with the GoG's energy policy needs to be demonstrated. In this regard, renewable energy-based distributed generation has been identified as one of the solutions to which the private sector can play a central role. Net-metered solar PV systems with backup storage could provide environmentally sound and sustainable solutions for businesses to self-generate and continue operating when there is a power outage. The excess power can be exported to the grid under a power exchange scheme, which will relieve the grid and reduce the electricity bill of the net-metered consumer.

3.2.1. Objective

The objective is to develop a comprehensive net metering program and the deployment of at least 15,000 units of roof-mounted solar PV systems to reduce the economic cost of power on SMEs and households and increase RE constribution in the electricity generation mix by 25-30 MW.

3.2.2. Project Components

The net metering project will have the following components:

Investment

- Deploy 15,000 grid connected solar PV systems equipped with back-up storage capacity to meet desirable loads in the event of a power outage. Of special interest will be the determination of a financially viable optimum back-up storage capacity.

Technical Assistance

- Develop a credit recovery facility that uses the electricity billing systems and local banking institutions to finance the high up-front cost of net-metered PV with storage systems.
- Develop a standard contract between the utility and the net-metered customers and decentralized application process regime.
- Study the impact of a large number of distributed generators on the voltage, frequency and harmonics of the distribution networks and establish appropriate strategies for the implementation of the ambitious target.
- Develop a service provider-certification regime and support the training of a significant number of Ghanaian renewable energy service providers/experts in line with the sector local content and participation requirements.

- Capacity building of relevant stakeholders to the net metering project targeting key stakeholders such as GRIDCo, ECG, NEDCo, MoP, EC, PURC, solar PV service providers, beneficiaries and banks.

Implementation Support

- Provide support for the operational and management cost of the implementation team.

3.2.3. Rationale for SREP Financing

Considering the high upfront cost and the perceived high risk of financing renewable energy projects, concessional financing from SREP will help reduce the upfront investment cost of net metering with batery storage option, and boost demand and customer confidence while encouraging women and youth participation.

Since the completion of the pilot grid-connected solar PV project, additional funding to scale-up the project could not be secured to date. SREP will leverage the required financing and provide a comprehensive framework to scale-up the pilot grid-connected project. The experience in Ghana could then be replicated in the ECOWAS sub-region and create new economic opportunities for the renewable energy industry.

3.3. Project 3: Utility-Scale Solar PV/Wind Generation

In October 2014, the GoG announced a revised FiT for utility-scale PV and wind that has made investment in these technologies an attractive proposition. However, the new FiT (indicated in Table 3) have some elements that are currently hindering the full development of the utility-scale solar and wind sub-sectors. The FiT are offered for a maximum 10 year PPA, which is perceived too short a period to attract the long-tenor private financing necessary to make utility-scale projects cost-effective and financially sustainable.

While the potential returns on investment in utility-scale PV has stimulated interest from a number of developers (a small number of firms invested limited amounts in the early development of RE projects) to date, no wind project has reached financial close or started construction, and only one corporate-financed solar PV project is under construction.

3.3.1. Objective

The objective of this project is to assist the GoG to overcome key barriers that prevent the growth and expansion of the utility-scale solar PV and wind market in Ghana by catalyzing the first private sector project-financed utility-scale RE plants, demonstrating the Ghanaian RE sector potential to financiers and helping attract further investment in the future.

3.3.2. Rationale for SREP Financing

SREP financing will help early projects mitigate some of the perceived risks associated with first-mover projects, such as FiT payment risk and the relatively short validity of FiT (10 years). These risks are having an adverse impact on private investors' confidence to finance utility-scale wind and solar PV in Ghana, which could potentially delay the development of the entire sub-sector. This is demonstrated by the fact that there is only one project developer that has reached the construction stage since the first FiT were introduced on 1 September 2013. Concessional financing from SREP will enable developers to negotiate longer PPAs at lower tariffs that would be more commensurate with utilities' ability to pay and thereby reduce one of the key project risks.

Moreover, successful financial closure and development of the first few utility-scale RE projects with support from SREP are expected to demonstrate the viability of RE technologies in the country as well as the soundness of the regulatory regime to support them. Whilst a change in the regulatory framework may be necessary in the medium to long-term in order to further enhance the RE FIT mechanism, this is a lengthy and cumbersome process that requires careful study and some initial experience with the existing mechanism. The objective of this project is to support the development of the first RE projects under the existing regulatory framework in order to demonstrate both its strengths and weaknesses. Its weaknesses can then be understood in more detail and in the context of real experience, which will enable more informed and effective enhancement of the regulatory framework.

Concessional financing from SREP can also help mitigate the perceived investor risk of weak off-takers by helping to bring RE project tariffs down to more affordable levels, thereby reducing the future burden of RE on financially challenged Ghanaian utilities. By catalyzing the first utility-scale RE projects in Ghana, SREP will also help the Government carefully assess the grid impact of utility-scale RE and make more informed planning decisions for scaling-up RE in the future.

SREP support is also expected to pave the way for the leveraging of substantial financing from the private sector for utility-scale wind and solar PV development by helping the first projects obtain appropriate long-term financing. This is expected to stimulate the growth of a nascent local RE project developer community. Successful scale-up of large-scale wind and solar PV sectors in Ghana is expected to generate jobs during the construction, operation and maintenance stages, while helping to also build local RE capacity.

3.4. Project 4: Technical Assistance to Scale-Up Renewable Energy

The GoG has established key policy and regulatory measures to support renewable energy development. However, in spite of these measures, the pace of development of RE projects by private developers has been rather slow. In fact, many gaps in the existing renewables regulatory framework (specifically, the Renewable Energy Act) have been identified, namely the questions of what is technically feasible, economically

desirable and fiscally responsible for the integration of RE into the national grid under the current context and in the future.

National public stakeholders (MoP, EC, ECG, GridCo, NedCo, PURC), with the support of development partners, mainly GIZ, have taken measures to address some of the identified gaps that slow the implementation of the RE Act. Nevertheless, there are still significant barriers and constraints which must be addressed.

3.4.1. Objective

The objective of this project is to assist the GoG and its key partners in the private and financial sectors to overcome key technical, financial, regulatory and institutional barriers that inhibit the scaling-up of renewable energy investments in the country and may constrain the successful implementation of flagship renewable energy projects financed under this program.

3.4.2. Project Components

Technical Component

- Support for comprehensive resource assessments for a wide range of renewables (tidal wave, biomass, wind, etc.) that provide long-term seasonal data (for example, biomass supply or municipal waste for different seasonal periods) as well as end-use consumer and gender disaggregated data that can assist the design of different RE technologies such as net-metered PV systems.
- Support capacity development of main utilities (distribution companies and GRIDCo) to undertake dynamic grid studies to determine the proportion of renewables that can be safely integrated into the national power supply and accurately forecast future estimates of the contribution of renewables as the Ghana's power sector continues to grow in size and coverage.

Financial & Project Development Component

- Provide a transaction support facility or cost-shared grants for pre-investment work up to financial closure for developers and financial institutions.
- Pilot-test and recommend the most appropriate Partial Risk Guarantees and other risk mitigation instruments as well as model renewable energy payment agreements for project developers in Ghana.

Regulatory & Institutional Component

- Assist the GoG move to a bankable standard model PPA of suitable duration that is appropriate for small-scale renewable energy developers.
- Support the development of a tariff methodology for ancillary services required for smooth integration of renewable energy generation in the national grid and

improve the current RE FiT to address bankability issues (for example, limitation of the validity of the tariff to 10 years).

- Support the Ministry of Power to create the Renewable Energy Authority which would effectively implement renewable energy projects on behalf of the GoG.
- Support the MoP to create a "one-stop shop" solution to fast track government services related to RE projects that can address all of these issues. SREP to provide support for a prototype one-stop centre for renewables within the relevant sector agency to address the issues of inconsistency views among the sector actors.
- Support the RE sector to encourage consultation with women, female associations/NGOs and encourage them to apply in decision making positions.

3.4.3. Rationale for SREP Financing

This component is essential to lay the technical, financial, regulatory and institutional foundations for successful implementation of the SREP progam and associated flagship renewable energy projects.

3.5. Potential Project 5: Utility-scale Biomass Power Generation

Biomass resources include supply from agricultural residues (maize, sorghum, rice, etc.) and from agro-based industries (shea butter companies, cocoa, rubber & sugar processing plants, bio-ethanol plants, sawmills and palm oil factories). There is also a large potential for dedicated energy plantations on degraded land. Biomass residues/ waste resources are concentrated and could provide a reliable feedstock for large biomass power plants. Currently, these wastes are disposed of by burning, and constitute a fire, environmental and health hazard.

With regard to the use of agricultural residues in small-scale establishments, gender differentiation in terms of respective gender levels of involvement is more apparent in the agro-based industries. This is because women form the majority of the rural population. As a result, they operate most of the agro-based industries.

3.5.1. Objective

The objective of this project is to demonstrate the economic viability of biomass as a resource for clean and sustainable power generation, which will contribute to the GoG's target of reaching at least 10% renewable energy mix by 2020 and to the development of rural communities in Ghana. In this sector, the project will result in empowering rural women and youth in economic development and job creation.

3.5.2. Project Components

The project will have the following components:

- Identification of priority agro-industries and locations as well as the appropriate biomass technologies including the number of women and youth working in the sector.
- Resource assessments and confirmation of feedstock security.
- Feasibility studies.
- Support in negotiating Power Purchase Agreements.
- Definition of appropriate management and institutional arrangements.
- Financing the construction and commission of pilot biomass plants.
- Capacity building and policy support.

3.5.2. Rationale for SREP financing

In spite of the large untapped potential for the development of biomass plants in Ghana and the current appealing FiT regime, there is no significant assistance from the GoG, development partners, or the private sector. SREP financing would therefore help mitigate some of the perceived risks associated with first-mover and/or other high-risk projects, such as feedstock collection. As a result, it would demonstrate the economic viability of biomass as a source of power and pave the way for local and international private sector investors and financiers.

SREP support would also likely jumpstart the leveraging of substantial financing from the private sector for utility-scale biomass project by helping the first projects obtain appropriate long-term financing. This would, in turn, stimulate the growth of a nascent local biomass project developer community. Successful scale-up of biomass projects in Ghana has the potential to further generate jobs during the construction, operation and maintenance stages, while helping to build the local RE capacity. It will also have a positive impact on gender, benefiting mostly woman and children.

The benefits of this project would accrue directly through: time savings from women's biomass collection; reduced household expenditure on woodfuel and charcoal; and potential promotion of women's enterprises in the biomass and waste-to-energy value chains. The last mentioned benefit would subsequently indirectly impact allied sectors, such as agro-industry—whose workforce is largely comprised of female employees—by providing inputs.

4. PROGRAM IMPLEMENTATION ARRANGEMENTS

The Renewable & Alternative Energies Directorate (RAED) will be responsible for the overall program coordination and implementation of aspects of the SREP-Ghana, in

collaboration with the relevant/beneficiary institutions such as ECG, PURC, EC, NEDCo and the GEDAP PIU.

At the project level, RAED will implement Project 1 (RE mini-grids and stand-alone solar PV systems), while the Energy Commission will be implementing Project 2 (Solar PV based net metering with battery storage). Technical assistance to scale-up RE (Project 4) will be implemented by both RAED and the Energy Commission, and Project 3 (Utility-scale solar PV/wind power generation), will be driven by private sector companies.

The RAED has been implementing multi-donor funded projects, such as WB/IDA/GEF, Spanish, Japanese and Chinese government-funded RE projects, in addition to the ongoing four pilot mini-grids. The RAED has therefore demonstrated its capability to structure and implement RE projects and would leverage the experience gained to facilitate the speedy and efficient implementation of the projects under its responsibility. The RAED is currently implementing the renewable energy component of the USD 210 million multi-donor funded Ghana Energy Development Access Project I&II which includes the ongoing mini-grids and off-grid access in public institutions.

The Energy Commission has over the years, implemented key flagship programs on behalf of the GoG including the continent's most successful lighting retrofitting program, which saves Ghana over 120 MW of power generation investments and C02 emissions of about 112,320 tons per year. The Commission successfully piloted the RE net metering initiative and has developed key policy instruments and technical guidelines for the renewable energy industry. Recently, the EC piloted the UNDP funded "Promoting of Appliance of Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana" project with the objective to improve the energy efficiency of appliances marketed and used in Ghana through the introduction of a combination of regulatory tools such as Minimum Energy Performance Standards and Information Labels (S&L). The Energy Commission is finally implementing the Wind Resource Assessment component of the GEDAP project and the SE4All Initiative.

The RAED will be the interface between the GoG and financing partners and will prepare quarterly progress reports on key aspects such as design, procurement, implementation, financial management and implementation of environmental and social management measures, as well as the achievement of the program's development objectives and related monitoring indicators. With respect to the gender aspect, a gender expert will be engaged to structure, supervise, monitor and evaluate the effective implementation of gender mainstreaming. A multi-sectorial SREP Program Steering Committee (PSC) similar to the GEDAP PSC will be set up to provide oversight responsibility to all SREP activities in Ghana. This is to ensure inclusive decision-making and facilitate the smooth delivery of the program. The SREP PSC will meet within an agreed timeline to discuss the program and provide salient inputs in enhancing overall delivery.

The RAED will submit reports to the CIF Admin Unit through the SREP lead MDB. The Policy Planning Monitoring and Evaluation Directorate (PPMED) of the MoP will consolidate information on the program's results indicators from reports received from

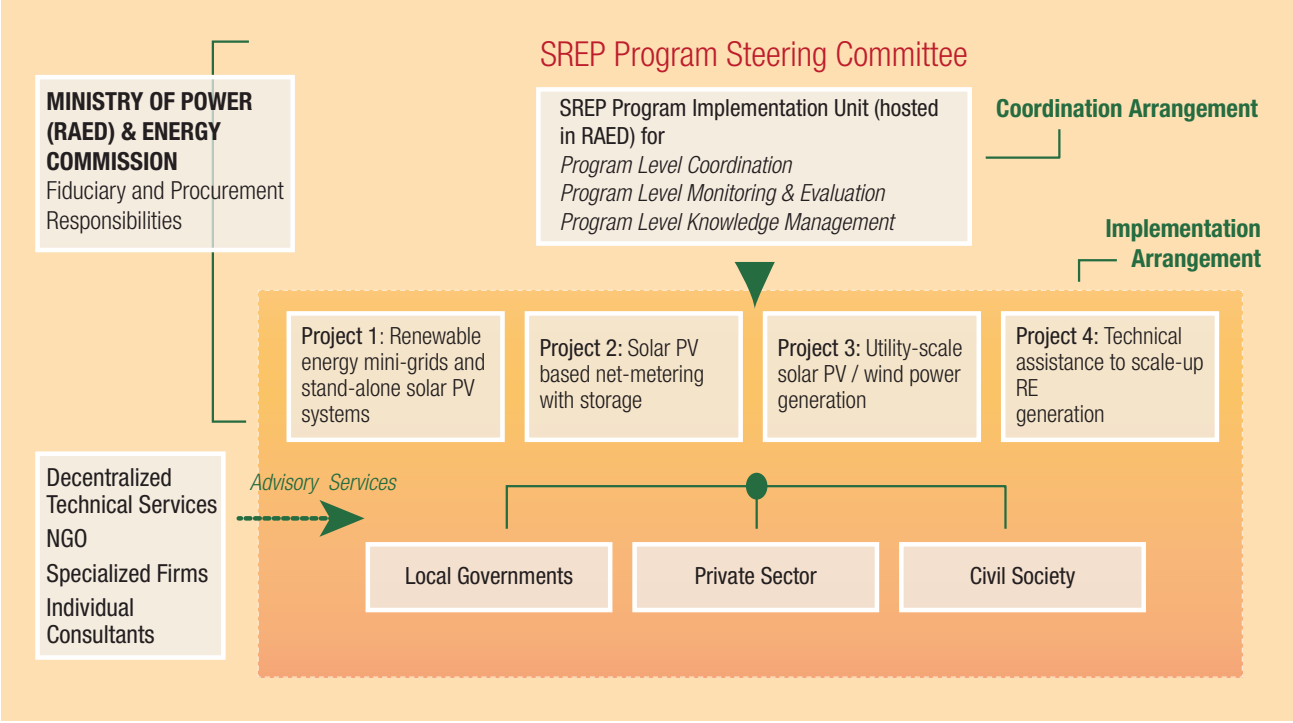
implementing agencies in order to prepare consolidated quarterly monitoring and evaluation (M&E) reports for submission to the stakeholders.

The MoP shall create a special SREP implementation unit within the RAED and where necessary recruit key staff for the day-to-day management of the program. Similarly, the Energy Commission will create a special SREP implementation unit for the implementation of its part of the program.

On the MDBs side, the AfDB will be responsible for the implementation of Project 1 (Renewable mini-grids and stand-alone solar PV systems); Project 2 (Solar PV-based net metering with battery storage); and Project 4 (Technical Assistance to scale-up RE). IFC will be responsible for the implementation of the investment component of Project 3 (Utility-scale solar PV/wind power generation).

The Ghana SREP program implementation structure is presented in Figure 9 below.

Figure 9. SREP Ghana Program Implementation Structure



5. PROGRAM CO-BENEFITS

The direct impact of the SREP-Ghana Investment Plan will be to engage the country in the large-scale development of renewable energy. The SREP will have a direct, positive impact on the living conditions of the Ghanaian people and the productivity of their economic activities, also ensuring a reduction in GHG emissions, which will contribute to improving climate resilience.

In a development paradigm in which social and environmental benefits are inextricably linked, the Ghana-SREP will help to:

- Reduce the exploitation of non-renewable energy sources by increasing the share of renewable energy in the national energy mix;
- Reduce GHG emissions due to the use of fossil fuels;
- Maximize economic development opportunities, including the creation of new economic activities and jobs related to new technologies with private-sector participation;
- Improve the rural population's quality of life, especially female-headed households, through household and institutional access to electricity; and
- Improve gender equality.

Implementing these investments will yield significant benefits, among which include:

- Reduced dependence on fossil fuels and thus lower energy bills.
- Better availability of political, administrative, and regulatory information capable of attracting foreign investment for RE development.
- Reduced levels of poverty. In the quest to improve Ghanaians' living conditions and decrease the level of poverty, the Government recognises improved access to and greater use of electricity as a key enabling condition. The SREP will support this effort in an environmentally sustainable way.
- Greater private-sector participation. The SREP will strengthen the participation of private-sector operators in renewable energy production through initiatives to: (i) build technical and organisational capacities, especially those for women, in the energy sector, (ii) improve legal and regulatory arrangements that engage the private sector in a meaningful way; and (iii) provide necessary and adequate finance to help develop the first utility-scale wind and solar projects that will demonstrate the Ghanaian RE sector potential to financiers and help attract further private investment in the future.
- Improved socioeconomic status of women. The SREP initiatives will contribute to enhancing women's quality of life by: reducing the time they allocate to household chores; improving their access to modern energy for income-generating activities; and increasing their access to modern forms of communication. In rural communities, the availability of electric lighting and other energy services can lead to better education, health, and public security, especially for women and children. Once a community has electricity, a wide range of income-generating activities opens up for women (e.g., ice-making and food-processing businesses, small retail shops, and restaurants). SREP will therefore create unique opportunities for women in particular to maximize the gains under the program. This in turn leads to greater financial independence and improved child welfare (as extra income from women is likely to be invested in children). According to the Ghana Living Standards Survey 5, women make up 70% of food crop farmers and most small enterprises are dominated by women (72%). In rural areas, 80% of businesses are operated by women.

These include small-scale, artisanal businesses of agricultural products, such as coconut, palm oil, fish and meat products and gari (processed cassava). The SREP investment will thus improve the productivity, efficiency and competitiveness of these women-headed SMEs.

6. ADDITIONAL DEVELOPMENT ACTIVITIES

Key activities supported by the development partners that complement SREP investments in renewable energy include the GoG-led GEDAP program that has financed a wide range of renewable energy activities in the country. Supported by the AfDB, WB and SECO, GEDAP has promoted both on-grid and off-grid renewables. Its flagship off-grid solar initiative has been instrumental in scaling-up solar applications in Ghana by working with local banks to finance small-scale solar home systems. SREP will build on the network of rural credit agencies supported by GEDAP to ensure the continued flow of local financing to off-grid RE solutions. GEDAP is also supporting several pilot mini-grid renewable energy projects that are expected to provide models for further replication by SREP. GEDAP is also assisting in developing and expanding Ghana's existing renewable energy resource base through the financing of small and medium hydropower, wind and biomass resource assessments. Some of the completed resource assessments are already being used by private developers to mobilize financing in utility-scale wind power – a sector that SREP plans to support with IFC assistance.

The EnDev initiative, managed by GIZ and supported by key donor partners, is also promoting a wide range of renewables. This is primarily focused on small-scale applications of renewable energy for productive use, while the GIZ RE project is involved in associated regulatory and capacity building activities. Its regulatory work on grid-connected renewables, both small-scale (net metering) and larger scale (FIT scheme, IPPs) will complement Ghana-SREP upstream regulatory activities that are aimed at creating an enabling environment for utility-scale solar PV and wind investments.

Other key development partners of Ghana that are active in the renewable energy sector include KfW (utility-scale solar) and AFD (hydro assessments). The governments of China, Japan and Korea also support the GoG's efforts to promote renewable energy development in the country. Their programs of assistance in renewable energy development dovetail well with SREP priority renewable energy initiatives.

6

FINANCING PLAN

The total estimated budget for implementing the SREP-Ghana Investment Plan is USD 230 million. In addition to the USD 40 million being requested from SREP, the program is seeking contributions from MDBs, development partners, private sector investors, and commercial banks. The GoG will also contribute to the program.

The SREP funding is being requested by AfDB and IFC. USD 30 million is being requested by the AfDB to implement Project 1 (Renewable energy mini-grids and stand-alone solar PV systems) and Project 2 (Solar PV based net metering with battery storage), while USD 10 million is being requested by IFC to implement Project 3 (Utility-scale solar PV/wind power generation). Project 4 (Technical assistance to scale-up RE) will be implemented by the AfDB through its Sustainable Energy Fund for Africa (SEFA) Trust Fund.

Table 7 below illustrates the program's financing plan. Co-financing amounts are tentative and will be confirmed during the project preparation phase, once the project cost is estimated more accurately. It is the understanding of the GoG that these requests are subject to confirmation by the management of the MDBs and development partners.

Table 7. SREP-Ghana IP Financing Plan (in USD million)

PROJECT	SREP	GoG	AfDB*	IFC	DPs	PI&B**	Total
RE mini-grids and stand-alone solar PV systems	17.5	8.0	27.0	0.0	12.0	18.5	**83.0**
Solar PV based net metering with battery storage	12.5	8.0	15.0	0.0	12.0	45.5	**93.0**
Utility-scale solar PV/wind power generation	10.0	0.0	10.0	10.0	0.0	20.0	**50.0**
Technical assistance to scale-up RE	0.0	0.0	1.5	0.0	2.5	0.0	**4.0**
TOTAL	40.0	16.0	53.5	10.0	26.5	84.0	230.0

** Including the AfDB private sector window and the SEFA Trust Fund*
*** Private investors & beneficiaries*

The financing modalities of the projects to be supported will include a combination of grant, concessional loans, and guarantees. The exact modalities will be determined during the implementation stage (Phase II) in accordance with relevant SREP guidelines. This decision will take into consideration, *inter alia*: barriers to specific renewable energy to be supported, the country debt situation, and revenue generating prospects as well as the financial rate of return of the investment.

NB: The Utility-scale biomass power generation project is kept in the SREP IP for future consideration by an interested partner/party, such as the Green Climate Fund as and when it becomes operational. It is however not indicated in the SREP IP financing plan since the funding for this project is yet to be secured.

7

ENVIRONMENTAL AND SOCIAL ASPECTS

Under the SREP-Ghana IP, preparation of environmental and social (E&S) studies must adhere to Ghanaian laws and regulations, as well as the E&S policies, guidelines, and standards of the MDBs. The lead implementing entity for the SREP public sector projects, the Ministry of Power, has undertaken numerous projects with the AfDB. As such, it has policies and procedures in place to ensure compliance with the GoG and the AfDB social and environmental safeguards.

1. APPLYING ENVIRONMENTAL AND SOCIAL SAFEGUARDS ON THE RENEWABLE ENERGY MINI-GRIDS AND STAND-ALONE SOLAR PV SYSTEMS PROJECT

Environmental and Social Management Framework. In the case of the RE mini-grids and stand-alone solar PV systems project, since specific locations of investments will be determined during project design, an Environmental and Social Management Framework (ESMF) will be prepared that defines the E&S planning, review, and clearing processes that follow national and MDB guidelines. The ESMF will ensure that energy is produced and utilized in an environmentally sound manner. It will also provide a corporate environmental and social safeguard policy framework, institutional arrangements and capacity to identify and mitigate potential safeguard issues and impacts of RE projects. The ESMF will be prepared in compliance with national guidelines and MDB safeguard policies. Through its Energy Sector Strategy, the GoG is fully committed to support and actively participate in international efforts and

cooperate with international organizations that seek to ensure sustainable delivery of energy to mitigate negative environmental impacts and climate change. By adopting mechanisms and procedures defined by the EPA and the AfDB/IFC, the ESMF will include the following components:

- *Environmental and Social Impact Assessment (ESIA)* to identify key environmental and social impacts and corrective measures for each subproject once exact intervention locations are known.
- *Environmental and Social Management Plan (ESMP)* to translate the ESIA into coordinated activities at local level, with detailed checklists and mitigation measures in order to address expected environmental and social impacts (especially for women).
- *Resettlement Policy Framework (RPF) followed by Resettlement Action Plans (RAP),* to present legal and institutional framework, eligibility criteria, methodology for asset valuations and mechanisms for stakeholder consultations and grievance redress.
- *Gender assessment* ensuring use of gender disaggregated participatory beneficiary feedback and women-targeted communications campaigns to alert project beneficiaries and affected persons to the existence of the planned grievance redress mechanism.

For mini-grid subprojects, separate, comprehensive E&S assessments must be conducted including an ESIA, an ESMP, and a RAP. Additional specialised E&S management plans and/or initiatives may be required to better address the impacts associated with a given subproject.

2. APPLYING ENVIRONMENTAL AND SOCIAL SAFEGUARDS TO THE SOLAR PV BASED NET METERING WITH BATTERY STORAGE AND UTILITY-SCALE SOLAR PV/WIND POWER GENERATION PROJECTS

Environmental and Social Assessments. For both SREP projects, separate, comprehensive E&S assessments must be conducted. These must include detailed studies aimed at uncovering the particular E&S impacts of each project. The studies include an ESIA, an ESMP, and a full or abbreviated RAP.[32] Adequate stakeholder gender disaggregated participatory consultations must be undertaken and guide the development of the E&S studies.

[32] The type of RAP will depend on the number of persons affected by resettlement experienced as a result of the project.

Stakeholder consultations. The ESMF contains detailed checklists and generic mitigation measures to ensure that potential impacts are addressed in E&S assessments and subproject management plans. In preparing the required detailed E&S studies (e.g., ESIA, ESMP, and RAP), the subproject operators must adhere to the requirements for ensuring that participatory stakeholder consultations are captured in the E&S policies, guidelines, and standards of the MDBs. Participatory consultations will be held with all stakeholders (including ministerial officials, representatives of local governments, the private sector and associations of civil society, including women associations) in order to:

- provide adequate information about the nature, timing, and scope of the relevant subproject impacts and mitigation measures;
- highlight gender issues (in order to improve women's access to lower-cost and cleaner energy while reducing the time that women and girls spend on fire wood collection and improving income-generating opportunities); and
- guide study development.

Responsibilities. In the case of the public sector projects, the MoP will have overall responsibility for procuring, supervising, reviewing and approving social and environmental studies and assessments, implementing the E&S frameworks and any specialized management plans and/or initiatives. Moreover, the MoP will organize capacity building initiatives for technical staff, including those of selected operators on issues related to social and environmental management and

The *Environmental Protection Agency (EPA)* - formally established on 30 December 1994 (Act 490) - is the leading public body for protecting and improving the environment in Ghana. It has the responsibility of regulating the environment and ensuring the implementation of Government policies on the environment. The Agency has, inter alia, the following regulatory and enforcement role(s):

- To issue environmental permits and pollution abatement notices for controlling the volume, types, constituents and effects of waste, emissions, deposits or other sources of pollutants and of substances which are hazardous or potentially dangerous to the quality of the environment or any segment of the environment;
- To issue notices in the form of directives, procedures or warnings to such bodies as it may determine necessary for the purpose of controlling the volume, intensity and quality of noise in the environment;
- To prescribe standards and guidelines relating to the pollution of air, water, land and other forms of environmental pollution including the discharge of wastes and the control of toxic substances;
- To ensure compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in the respect of existing projects; and
- To promote studies, research, surveys and analyses for the improvement and protection of the environment and the maintenance of sound ecological systems in Ghana.

control. It is expected that these improved capacities will facilitate the implementation of safeguard instruments under the SREP. In the case of the private sector project, national policies as well as IFC's and AfDB's social and environmental safeguards will be followed.

Project or sub-project operators will be responsible—i.e., in compliance with national laws and regulations and MDB safeguard policies, guidelines and standards—for conducting the required detailed E&S studies (e.g., ESIA, ESMP, and RAP); obtaining clearances and licenses from relevant authorities; organizing stakeholder and gender disaggregated consultations; implementing all required mitigation measures; and conducting monitoring activities. The costs of all these activities will be integrated into the budget of each project (or sub-project in the case of the off-grid program).

The detailed E&S studies must be submitted to both the EPA and the AfDB/IFC for review and approval. EPA approval is based on Ghanaian laws and regulations, while that of the AfDB/IFC is based on their E&S policies, guidelines, and standards. The EPA will be responsible for the review and clearance of ESIAs and ESMPs for subprojects. It provides a one-stop clearance process by involving all other key governmental agencies in the approval process.

3. ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS

The following environmental and social impacts are typical of the type of projects that are being envisaged in this program:

Project type	Major E&S concerns
General	Influx of foreign workers or workers from other localities. Resettlement of people. Construction of infrastructure, resulting in the reshaping of topography and modification of landscapes. Potential deforestation. Land acquisition.
Mini-grids construction	Soil compaction and damage to vegetation due to equipment. Air pollution resulting from gas emissions and smoke exhaust from generators, compressors, and vehicles. Deleterious effect of dust carried by winds across exposed surfaces.
Waste generation	Waste disposal, pollution control, and safety.
Biomass plantations	Loss of natural habitats and indigenous species, displacement of food or other crops.
Wind power	Aesthetics, noise pollution, and bird fatalities.
Solar	Recycling of batteries and parts.

HIV/AIDS and Collaboration with Public Health Sector and Department of Public Works. An influx of workers from other localities raises concerns of social conflict and the risk of spreading HIV/AIDS and other STDs. The projects will establish procedures

for gender-disaggregated participatory reporting grievances and lay out mechanisms for conflict management and resolution. In the area of HIV/AIDS, public-awareness and education campaigns will be undertaken with relevant local health authorities. During construction and operation, the projects will ensure adequate training in public safety hazards and adherence to warning signs and strict workplace rules which will target women and women's associations. Prior to commencing work, a compliance monitoring plan will be established as well as a communication and outreach plan targeted at women and womens' associations, especially).

Environment, Health, and Safety Management System. Subproject operators will design, construct, and operate the projects and implement an environment, health, and safety (EHS) management system.

Public Disclosure. Project and subproject implementation will require communication and consultation with both the Ghanaian stakeholders impacted directly and indirectly by the projects and other stakeholders within and beyond the projects' zones of influence. Disclosure of the detailed E&S studies (i.e., ESIA, ESMP, and RAP) must be done in compliance with the public-disclosure requirements of the AfDB/IFC. Relevant documentation will be made available on the websites of the GoG and the AfDB/IFC and through additional means.

8

MONITORING AND EVALUATION AND KNOWLEDGE MANAGEMENT

This section describes the areas in which the key aspects and tools of monitoring and evaluation (M&E) and knowledge management will be strengthened as part of implementing the SREP Investment Plan.

STRENGTHENING MONITORING AND EVALUATION

With its results measurement framework, the M&E system will be considered as a central part of the SREP IP design and implementation. As a key tool to plan and monitor program activities, the system is essentially aimed at:

- Defining how transformational impacts will be measured before, during and after the life of the program;
- Ensuring that data collected, processed and analyzed at the level of the three investment projects harmoniously feed into the programmatic M&E system; and
- Supporting the knowledge management and sharing initiatives of the program, by highlighting successful outcomes and lessons learned and recommending ways to improve program implementation and its transformational impact.

Based on a set of SREP core indicators, the SREP M&E system will, to the extent possible, be integrated into the existing national M&E system of the energy sector, while solving some of its main constraints and bottlenecks, through capacity building initiatives. Therefore, its design will avoid the development of parallel structures or processes for monitoring and evaluation.

RESULTS FRAMEWORK

The main purpose of the SREP-Ghana IP results framework is to establish a basis for future monitoring and evaluation of the impact, outcomes and outputs of SREP-funded activities. In addition, the results framework is designed to guide Ghana and MDBs in further developing SREP-funded projects' results frameworks. Accordingly, Table 8 below summarizes the proposed SREP M&E Results Framework, in line with expected outcomes and results.

More broadly, the program's development outcomes are expected to encompass many dimensions beyond those required for monitoring under the SREP guidelines. Among others, these include improved reliability of electricity; economic savings to the nation and financial savings to consumers from lower-cost electricity; high-value jobs created in new energy subsectors; less volatile electricity supply; and an improved enabling environment resulting from the positive experiences of the SREP interventions, which will create the conditions for transformative change in how energy is supplied to the nation.

Table 8. SREP Program and Projects Results Framework

Result	Indicator	Baseline	Targets by 2020	Means of Verification
SREP Transformative Impacts				
Support low-carbon development pathways by reducing energy poverty and/ or increasing energy security	National measure of energy poverty	MEPI[a] = 0.62 (2008, access rate of 56.1%) Electricity used in 2014: 24.3 GWh	MEPI[a] = 0.1 (access rate of 90%) Electricity used: 4.1 kWh per capita	Country-based reporting using household survey data
	Electricity output from renewables in GWh per year	GWh per year.[b]	115.6 GWh per year	Utilities and MoP
	Increased annual public and private investments ($) in targeted subsector(s) per country	n/a	USD 230 million	National M&E
SREP Program Outcomes				
Increased supply of renewable energy	Increased annual electricity output (GWh) as a result of SREP interventions	Wind/Solar electricity output: 3.9 GWh	Wind/Solar electricity output: 39.36 GWh per year	SREP Projects' M&E systems
		Off-grid: 18.0 GWh per year Solar PV Net-Metering: 2.4 GWh per year	Off-grid: 36.76 GWh per year Solar PV Net-Metering: 39.42 GWh per year	
Increased access to modern energy services	Increased number of women, men, businesses and community services benefitting from improved access to electricity as a result of SREP interventions	0.05 (in million)	Wind/Solar electricity Project: ~ 0.0626 million Off-grid Program: ~ 0.5 million Solar PV Net-Metering Project: ~ 0.0949 million	SREP Projects' M&E systems
New and additional resources for renewable energy projects	Leverage factor: USD financing from other sources compared to SREP funding	USD 40 million	Additional financing leveraged from the SREP initial resources: USD 190 million	SREP Projects' M&E systems
Avoided GHG emissions	Avoided GHG emissions (tons CO_2e per GWh) as a result of SREP interventions[1]	n/a	76,664 tons CO_2e per year once SREP projects are operational	SREP Projects' M&E systems

a. MEPI = Multidimensional Energy Poverty Index
b. From grid, captive, mini-grid and stand-alone renewable energy plants, emission factor for Ghana is 0.6tons/MWh/yr

[1] Emission reduction profile for Ghana 2013, (Ghana CO_2 grid emission factor is 0.6CO2e/MWh)UNEP/ RISOE).

Project	Baseline GWh	2020 GWh	Incremental GWh/yr	Capacity factor	MW equivalent	Investment USD million	Average USD million per MW
RE Mini-grids and stand-alone solar PV systems	18.0	36.8	54.7	18%	23.3	83.0	3.6
Solar PV based net metering with battery storage	2.4	39.4	41.8	18%	25.0	93.0	3.7
Utility-scale solar PV/ wind power generation[2]	3.9	39.4	43.4	18%	25.0	50.0	2.0
Total	24.3	115.6[3]	139.9	18%	73.3	226.0	Average of 3.1

[2] VRA's 2.5 MW solar plant in Navrongo as baseline.
[3] Depending on when SREP IP implementation commences, this figure is bound to change. The analysis is based on the assumption that a total of 73.3 MW of power would have been added by 2020. However, if this is achieved earlier then the avoided CO_2 will increase.

Parameters	Emission factors	Units
CO_2 avoided (Results Table)	76,664	ton/year
Ghana CO_2 emissions factor (grid)	0.6	ton/MWh
CO_2 emissions factor (diesel off-grid)	0.8	ton/MWh
Incremental Grid electricity (Results Table)	115.6	GWh/Yr
Grid CO_2 emissions avoided	47,256	tons CO_2
Inc. Off-grid electricity (Results Table)	76,664	GWh/Yr
Off-grid CO_2 avoided	29,408	tons CO_2
Total CO_2 avoided (calculated based on GWH from SREP Projects Results Table)	76,664	tons CO_2
Variance of CO_2 emissions avoided between Results Table CO_2 Estimate and calculated from GWh estimate	0	tons CO_2

3. RESPONSIBILITIES AND M&E-RELATED TASKS

During the SREP IP preparation, a quick assessment concluded that the existing sector-wide M&E system lacked the human and technical capacity for handling M&E activities within the Ministry of Power.

The MoP is responsible, through its Policy Planning, Budgeting, Monitoring and Evaluation (PPBME) Directorate, for monitoring the activities carried out in the sector. However, it was mentioned that few staff are working in this area and the turn-over of staff does not allow for the building of stronger capacity over time. Also, the reliability of data collected in other institutions is sometimes an issue, as well as the timeliness of

data circulation. While SREP cannot address some of these issues, the MoP is willing to explore how some technical support could be provided to PPBME in the context of SREP for strengthening the existing M&E system.

In terms of future institutional arrangements for the SREP M&E system, an existing M&E officer, seated in the PPBME Directorate will have the responsibility to collect and consolidate data from the SREP-funded projects to ensure consistency at the programmatic level, in line with CIF standards. The M&E officer will support and assist the M&E teams of the three investment projects in: (i) operating their respective M&E systems; (ii) updating the logical framework indicators; (iii) demonstrating how output indicators will help achieve overall SREP outcomes in Ghana; (iv) documenting the social, economic, gender and environmental impacts of SREP program activities; and (v) preparing and submitting regular monitoring reports to the CIF administrative unit, in coordination with the MDBs.

4. STRENGTHENING KNOWLEDGE MANAGEMENT AND LESSONS SHARING

The SREP National Task Force identified areas for strengthening knowledge management and information and lessons sharing (ILS). The sections below describe the complementary program- and project-level activities targeted for SREP implementation.

4.1. Program Level

Raising awareness among national and local stakeholders about Ghana's energy-sector challenges and opportunities for developing the potential of renewable energy is a key element of the SREP-Ghana IP. The efficient management of knowledge is needed to measure the outputs obtained and share what has been learned with all stakeholders, including those at the national and local levels, in other pilot countries, and/or in other countries in the sub-region.

To strengthen the Ghanaian government's knowledge management and ILS capacity, the SREP will fund some dedicated activities which will be managed by the MoP. The communication team of the MoP will be mobilized to carry out the following activities in coordination with the Renewable Energy Directorate:

- Support the development and maintenance of an efficient internal energy-information system;
- Support the development of a dedicated on-line RE portal to improve the availability of RE information for interested stakeholders;
- Promote efficient knowledge management and exchange of best practices (including gender mainstreaming efforts) between projects and with other

African countries;

- Raise the SREP profile in order to raise additional funds and foster large-scale replication of activities countrywide and in the sub-region; and
- Support the management of renewable energy knowledge (i.e. approaches, methods, and lessons) acquired by the SREP.

Because knowledge management is closely linked to monitoring and reporting on program results and outcomes, the ILS and M&E teams should work closely together.

4.2. Project Level

Knowledge management and capacity building activities will also be developed at the project level. Based on specific capacity building activities identified during IP preparation, MDBs and the NTF have worked together to prepare a technical assistance project to be submitted to the Sustainable Energy Fund for Africa Trust Fund managed by the AfDB. This TA will complement the SREP-funded activities. Additional capacity building activities may be included in the investment projects as need be.

The ILS component will help draw lessons from the new business models and innovative activities to be adopted in the SREP-supported pilot projects so that similar models and activities can be replicated in other regions of Ghana and/or other countries. Lessons from project implementation and gender mainstreaming will help: determine key factors that contributed to success or failure; quantify some of the co-benefits of renewable energy development; and identify areas of the project implementation phase that could be improved.

9

RISK ASSESSMENT

The overall implementation risk of the SREP-Ghana IP is assessed as moderate to high.

Table 9 below presents the main identified risks and mitigation measures used to ensure successful implementation of the program. Appropriate corrective and supportive measures will be put in place during the implementation of the IP following the lessons learned from the activities. Guidance from members of the SREP Steering Committee will also be actively and regularly sought to ensure that good practices are adopted.

Table 9. Main Risks and Proposed Mitigation Measures

Risk Type	Description	Mitigation measures	Additional measures to which SREP may contribute	Residual risk
Technical	Insufficient RE resource data	- Comprehensive wind and biomass resources assessments are ongoing. - Wind and solar data obtainable from Energy Commission at very low cost.	- Undertake additional and more site specific RET resource assessments and develop comprehensive resource database which are accessible to investors/ developers. - Make reliable RET data/ reports available to developers at virtually no cost.	Moderate
	Limited capacity in appropriate selection of RE technology options and inefficient operation and maintenance of complex RE technology, machinery and equipment	Ministry of Power is supporting Ghana Standards Authority and the KNUST TEC Centre to develop capacities for the authentication of RETs, as well as with the Chinese Government providing technical assistance to selected Polytechnics and technical/vocational institutions to build critical middle level manpower for the industry.	Design and implement relevant renewable specific short and long-term courses.	Low
Financial	Limited risk mitigation instruments	The AfDB and WB are examining the option of providing Partial Risk Guarantees (PRGs) to private investors in the power sector. GoG has commenced issuance of Government Consent and Support Agreement and discussions are underway with AfDB to provide partial risk insurance to RE projects.	Pilot-test and recommend the most appropriate PRGs and other risk mitigation instruments as well as bankable standard model PPA for renewable energy project developers in Ghana.	Moderate
	Financing RE	Attracting private sector participation and financing by bundling procurement to be cost-effective and time-saving.	- Support near term development and deployment of light regulation aimed at small- and medium- scale renewable energy developers. - Support the first utility-scale RE projects in Ghana with concessional financing to lower the cost and therefore the perceived risk of non-payment by the utilities that currently face financial difficulties.	High

Risk Type	Description	Mitigation measures	Additional measures to which SREP may contribute	Residual risk
Institutional	Difficulties in enforcing approved regulatory and legal frameworks compounded by absence of a one-stop centre	MoP and associated regulatory institutions reviewing the option of developing light regulation, establishing a fast-track approval mechanism for renewable energy investments, and establishing a one-stop Renewable Energy Authority.	- Support near term development and deployment of light regulation aimed at small- and medium- scale renewable energy developers - Provide support for a proto-type one-stop centre for renewables within the Directorate for Renewables that could provide the embryonic model for the proposed Renewable Energy Authority.	Moderate
	Poor financial status of the electricity sector in general	Ongoing efforts from the GoG to enforce technical and revenue leakage reduction mechanisms/ strategies.	Consider asking GoG to set up a reserve fund (or support the provision of PRGs) to cover default or delayed payments to electricity suppliers.	High
	Main utility off-takers may not be able to support the FiT payments and re-imbursements to all the proposed utility-scale PV/wind plants and PV net-meters, respectively	- The current FiT regime has stipulated caps that limit the amount of renewables that can be added to the national grid. - The WB-financed Energy Development and Access Project in Ghana is working to improve the operational efficiency of the electricity distribution system, which is expected to enhance off-takers ability to support FiT payments.	SREP financing may be used to blend concessional resources with commercial financing to reduce the tariff of utility-scale PV/wind projects to more affordable levels, thereby reducing the future burden of RE on financially challenged Ghanaian utilities.	High
	Limited capacity of the utilities, regulators and financial institutions and project developers to structure and negotiate bankable PPAs	- MoP supporting Ghana Standards Authority and the KNUST TEC Centre to develop capacities for the authentication of RETs. - MoP and the Chinese Government providing technical assistance to selected Polytechnics and technical/vocational institutions to build critical middle level manpower for the industry.	- Develop tailored capacity building initiatives for utilities, financial institutions and renewable energy project developers. - Develop a bankable standard model PPA for renewable energy project developers in Ghana.	High

Risk Type	Description	Mitigation measures	Additional measures to which SREP may contribute	Residual risk
Social	Projects have unacceptable social impacts	Intensive stakeholder consultations were carried out during SREP preparation and will continue when projects are implemented. A specific project-level, social-safeguards assessment will be undertaken according to the ESMF, and compensation or other mitigation actions will be taken in accordance with the framework and GoG and MDB guidelines. By providing affordable electricity to more people, the program will promote greater economic growth and equity, including targeted investment activities in rural areas. A focus on productive energy uses and employment creation and gender mainstreaming is incorporated into the program design and will target vulnerable groups (women and youth).	Design of financial mechanisms under the SREP will take affordability and willingness to pay into account, supported by information, education, and communication campaigns. Further elaboration on energy uses, employment creation, and targeting of women impacts will be assessed during appraisal of the four proposed investments projects.	Low

ANNEX 1: DETAILED INVESTMENT BRIEFS

PROJECT 1: RENEWABLE ENERGY MINI-GRIDS AND STAND-ALONE SOLAR PV SYSTEMS

Background

About 20% of Ghana's total population (representing 5 million people, based on the 2010 Ghana Statistical Service population census report) do not have access to electricity, out of which about 2.9 million reside in lakeside and island communities created by the Akosombo Dam. These islands and lakeside communities are the most difficult and uneconomical areas to electrify through the national grid electrification scheme. The challenges posed by the electrification of these communities are now seen as a significant hurdle in the country's quest to achieve universal electrification access (at least 90% of total population) by 2020. (NB: The Government of Ghana's target has been now moved to 2016.)

Preliminary results and projections of a MoP Geographical Information System (GIS) study with funding support from the World Bank (WB) determined the demands and categorization of communities for off-grid electrification. The demand for the mini-grid sector is about 350,000 people in 400 communities, therefore investment requirements must meet this need.[33] The estimated population for stand-alone PV systems to reach those in sparsely populated communities is 2.5 million people.

Current Efforts

There are a number of ongoing pilot mini-grid and stand-alone renewable energy (RE) electrification initiatives spearheaded by the GoG with support from development partners, including the African Development Bank, State Secretariat for Economic Affairs (SECO) of Switzerland and the WB. Among these initiatives are the following:

Mini-grid

- Four pilot hybrid RE mini-grids with WB funding. When completed as planned in September 2015, the pilot mini-grids will serve an estimated 10,000 people. They will also provide empirical data to fine-tune the ownership, management

[33] The full GIS survey will provide further data and these figures will be validated to fine tune the projections for generation and distribution investments. It is estimated that the total communities needing the mini-grids will be about twice the communities covered by the GIS survey. Source: GEDAP/WB/GIS Assessment Database, 2015.

and operation models envisaged.

- Ghana's Ministry of Power (MoP) is in advanced-stage negotiations for the design and construction of two hybrid mini-grids to serve about 2,000 people in the Aflive and Azizakpe island communities in the Lower Volta estuaries through GoG funding.
- SECO has provided funding for the construction of an additional (one) mini-grid on the Lower Volta estuaries to complete the Four-Island Ring.
- The GoG is being assisted through a WB facility to establish the appropriate ownership, operations and management of mini-grid models and to recommend the most viable options. This work is expected to be completed by the third quarter of 2015.

Stand-alone systems

- More than 38,000 solar home systems (SHS) and lanterns have been deployed to date. The Lighting Africa[34] initiative provided technical support to enhance the quality of lanterns that were promoted.
- Ecobank and National Investment Bank (NIB) are developing RE portfolios to locally finance RE investments. The ARB Apex Bank implemented a USD 10 million facility, which provided credit and a 50% capital subsidy to PV end-user consumers and stimulated the sale of 16,000 SHS and lanterns within a 3-year period.
- The GoG is redirecting the kerosene subsidy to finance solar lanterns, based on the rationale that the socio-economic and environmental benefits associated with solar lanterns far outweigh the benefits from kerosene lanterns and that the kerosene subsidies were not reaching most of the intended rural target groups. A total of 75,000 portable lanterns have since been procured and nearly 50,000 distributed/sold through a 70% subsidy scheme. The target is 2 million lanterns by 2020 and establishment of at least one private-sector led solar lantern assembly plant in Ghana.
- The GoG has developed a Community Lighting & Battery Charging Facility Project (CL&BCP) to facilitate the sustainability of stand-alone systems deployed in rural communities through revenue generation from community-owned battery charging stations. Under a Japan International Cooperation Agency-sponsored project in 2010-11, twenty rural communities benefited from the installation of 20 solar PV battery charging stations. Since then, only an additional 35 charging systems have recently (2014-2015) been installed in 35 new rural communities under GEDAP. The slow scaling-up of this self-sustaining model is due to difficulty in raising donor or GoG funding for RE projects in general. Viewed as the flagship program for the renewable energy

[34] Additional information on Lighting Africa, an innovation of the World Bank Group, may be found at: www.lightingafrica.org. 17 April 2015.

sector, SREP will therefore provide sustainable leveraging by attracting additional funds for this initiative.

Key Challenges

Scarce financing for renewable energy. Compared to conventional grid-based rural electrification programs that receive regular and consistent funding from the GoG, private sector and multilateral development partners, which resulted in Ghana registering one of the highest levels of electricity access in sub-Saharan Africa, the renewable stand-alone and currently, mini-grid sub-sector rely on intermittent project funding primarily sourced from development partners and NGOs.

High operation and maintenance costs. Although there are unlimited opportunities, Ghana has not registered desired progress in developing and expanding its renewable energy stand-alone market. Operation and maintenance—especially the cost of replacement of major components such as batteries—still remain a major barrier to stand-alone PV systems for households and SMEs.

Identifying private sector firms which prioritize RE. Although the recent WB-funded stand-alone solar PV project exceeded its sales targets, its principal banking partner, ARB-APEX Bank, has not shown interest to continue working in the sector once the project is completed due to internal restructuring. Instead, ARB-APEX Bank will concentrate on its core role of providing funds to rural banks and supervising their activities. However, given the immense impact of the project, some of the ARB-APEX Bank partner rural credit institutions have expressed interest in maintaining and expanding their solar PV business portfolio. Therefore, the challenge for the stand-alone solar PV market is to identify and catalyze private sector financing from firms wishing to continue work in the sector.

Limited capacity in RE. Furthermore, experience in mini-grids remains limited as the country is yet to complete any of the ongoing pilot projects. The national uniform (post stamp) tariff policy hinders private sector investment in mini-grid electrification. In other words, mini-grid investment under the current policy environment is a publicly funded social infrastructure initiative. Generation and distribution must be funded by the Government whereas the private sector or designated body such as the upcoming Renewable Energy Authority (RE Act 832) must participate in the operation and maintenance of the infrastructure.

Objective

The objectives of this project are to:

1. Encourage sustainable public and private financing for scaling-up renewable energy mini-grids and stand-alone PV systems to achieve the GoG universal access goal by electrifying lakeside and island communities in Ghana, especially female headed households.

2. Fine-tune and replicate the proven and innovative conventional rural electrification model for the mini-grid and WB/GEDAP/ARB Apex Bank credit and partial grant subsidy model to providing electricity to deprived and marginalized off-grid communities.
3. Scale-up the pay-as-you-go model for the community energy service centre lighting component.

Project Components

The project is structured around two main components:

Public sector-led renewable energy-based mini-grid component:

- Procurement and installation of 55 mini-grids to service a total population of 137,500 (26,442 households including SMEs, public facilities such as schools, clinics, community water schemes, etc., with an estimated load of 16,500 kW[35] and at cost of USD 37 million).
- Development of a framework for the integration of mini-grids into the existing grid-connected rural electrification model.
- Fine-tuning of proposed ownership, operation and management models under the ongoing seven pilot initiatives (4 pilots with GEDAP/WB funding, 1 pilot with SECO funding and 2 pilots with Korean funding) and adopt the most sustainable and scalable model.

Private-public sector led stand-alone solar PV component:

- Installation of 20,500 stand-alone systems to meet desirable loads for households to serve an estimated 106,600 people using a partial subsidy and credit facility under the private sector-led initiative.
- Installation of 1,350 stand-alone systems for schools to serve some 243,000 students.[36]
- Installation of 500 stand-alone systems for health centres and 400 stand-alone systems for communities to service an estimated 215,000 people.[37]
- Review of the proposed models to restructure the financing scheme of the stand-alone component.
- Zoning and prioritizing of communities for effective and efficient delivery.

[35] An estimated 120 W per person based on data from ongoing mini-grid initiatives and rural electrification statistics from the utilities (ECG/NEDCo).
[36] Assumption of 180 students per school (least option from Ghana Education Service, number of students benefiting could increase significantly to about 45% more).
[37] On average (using GEDAP data, each health facility services about 350 people and the community lighting and energy service centre benefits about 100 people per system (a system is comprised of a desirable energy service centre and 4-10 solar streetlights for public lighting).

Rationale for SREP Financing

Increased access to electricity and improved reliability of power supply that result from sustainable new mini-grids and the solar-PV stand-alone systems is essential to bridge the socioeconomic disparities between Ghana's urban and rural population. To sustain reliable power supply to deprived rural communities, investments must remain financially viable after project completion. To enable the development of mini-grids, the SREP will adopt an innovative mechanism to provide capital subsidies and long-term concessional facilities modeled along the conventional rural electrification scheme. Tariffs will allow the operators (community, private sector and the Ghana Renewable Energy Authority) to fully recover operation and maintenance costs of the investment to ensure long-term sustainability.

Furthermore, the SREP-Ghana IP will work to remove key barriers to providing solar-based stand-alone electricity to rural areas, including those related to: technical problems; consumer perception and awareness of the advantages of the systems; and available financing to make these systems affordable for low-income consumers. SREP will fine-tune the Bank/GEDAP ARB Apex Bank model for stand-alone solar systems, to bring on board a wider range of financing institutions (i.e. committed individual rural banks, or those working in microfinance), private sector partners, MDBs and community-based institutions (NGOs and civil society organizations) to ensure sustainable scale-up under SREP.

To provide long-term consumer loan financing for the stand-alone component, a line of credit will be created and operated as a revolving fund for on-lend to credible private sector and community-based microfinance firms. The structure will be detailed out to ensure that the participating financing partners are able to refinance loans with reasonable terms of repayment over initial investment and major components replacement. Also, SREP will provide partial grants to customers or consumers to make stand-alone SPV systems affordable and create critical mass demand as an incentive to service providers and suppliers operating in these remote and relatively marginalized areas.

Finally, SREP will mobilize additional concessional financing during implementation for both the renewable mini-grid and stand-alone components from other development partners and serve as the main flagship program for the sector with which all partners must work.

Result Indicators

Key results indicators for this project include:

- Study on integrations of mini-grids completed
- 55 mini-grids installed
- Study on financial institutions completed

- 20,500 stand-alone systems for households installed
- 1,350 stand-alone systems for schools installed
- 500 stand-alone systems for health centres installed
- 400 stand-alone systems for communities installed

The project will result in the following outcomes: (i) the allocation of dedicated budgetary support for renewable mini-grid electrification including subsidies and aspects of the Energy Fund to mini-grid and stand-alone SPV deployment; (ii) two or more committed local financial institutions with active portfolios in Ghana's stand-alone PV market; (iii) scaling-up of the successful private sector-led stand-alone PV deployment approaches as well as public-financed renewables-based mini-grids; (iv) the connection of 244,100 people and improved health, education, and energy service delivery to about 458,000 people in the next 3-5 years; and (iv) improved energy access to remote communities, the most vulnerable of which include female headed households.

Financing Plan

The financing will cover a line of credit facility for on-lending to consumers through participating financial institutions as well as grant elements to provide partial subsidies to consumers to make solar home systems (SHS) affordable and ensure adequate demand as an incentive to suppliers to move into remote, relatively poor areas. The MoP will manage the grants through selected local financing institutions, which will provide up to 40% of the full cost of the stand-alone SPV including supply, installation and commissioning.

The total estimated project cost is about USD 83 million, of which USD 17.5 million is sought from the SREP, USD 27 million from the AfDB, and USD 12 million from other development partners. The private sector, through commercial banks, will finance about USD 18.5 million, while the GoG will provide USD 8 million.

Indicative Budget	SREP	GoG	AFDB	IFC	DPs	Private Sector	Total
Investment	15.0	6.0	27.0	0.0	12.0	18.5	**78.5**
Technical Assistance	1.0	0.5	0.0	0.0	0.0	0.0	**1.5**
Implementation Support	1.5	1.5	0.0	0.0	0.0	0.0	**3.0**
Total	**17.5**	**8.0**	**27.0**	**0.0**	**12.0**	**18.5**	83.0

Lead Implementing Agencies

The AfDB will be the lead MDB for the implementation of this project. The Renewable & Alternative Energies Directorate (RAED) of the MoP will be the implementing agency on behalf of the GoG.

Tentative Project Preparation Timetable

It is expected that the project will be presented to the AfDB Board for approval in January 2017. Submission to the SREP Subcommittee for their no objection is expected around November 2016.

Project Preparation Grant

The GoG is requesting a preparatory grant of USD 899,800 to prepare the project (see PPG below).

SCALING-UP RENEWABLE ENERGY PROGRAM IN LOW INCOME COUNTRIES PROJECT PREPARATION GRANT REQUEST			
1. Country:	Ghana	2. CIF Project ID#:	[Trustee to assign ID]
3. Project Title:	RE-Based Mini-grid and Standalone Electrification Project		
4. Tentative SREP Funding Request (in USD million total) for Project at the time of Investment Plan submission:	**SREP Component:** USD 17.5 million		
5. Preparation Grant Request (in USD):	USD 899,800	**MDB:** AfDB	
6. National Project Focal Point:	Seth A. Mahu/Ministry of Power smagbeve@yahoo.com, smahu@energymin.gov.gh		
7. Executing Agency:	Ministry of Power		
8. MDB SREP Focal Point and Project / Program Task Team Leader (TTL):	**MDB HQ Focal Point:** Joao Cunha, SREP Coordinator, j.cunha@afdb.org	**TTL:** Thierno Bah t.h.bah@afdb.org	

9. Description of Activities Covered by the Preparation Grant

The objective of the proposed Project Preparation Grant is to ensure that Ghana develops sufficient in-house capacity to complete the project design and bidding documents, launch request for proposals, review, select and negotiate contracts for renewable energy-based mini-grids and standalone activities in the country.

The preparatory activities include, among others, the following: (i) set up project implementation unit and related structures for the program; (ii) analyze the GIS data and select candidate sites; (iii) undertake social economic surveys of selected island and lakeside communities; (iv) prepare environmental & social impact assessments; (v) develop templates for Request for Proposals and required tender documents; (vi) organize a technical workshop for national experts on competitive tendering for the selection of bidders.

10. Outputs

Deliverable	Timeline
PIU and related structures established	March 2017
GIS document reviewed and candidate sites selected	June 2017
Relevant templates and tender documents developed	September 2017
Social economic studies for the sites conducted (consultant)	March 2018
Environmental social impact assessment conducted (consultant)	March 2018
Experts technical workshop undertaken	April 2018
Procurement of all major project activities completed	July 2018

11. Budget	
Expenditures	Amounts (in USD)
Consultants (socioeconomic and ESIA studies)	450,000.00
Field activities and sensitization of communities	135,000.00
Workshop	28,000.00
Travel/Transportation	55,000.00
Others (PIU, Administrative Costs, etc.)	150,000.00
Contingencies (10%)	81,800.00
Total Cost	[899,800.00]
Other Contributions:	
Government of Ghana	USD 200,000 (salaries, workshops, etc.)

12. Timeframe

It is expected that the project will be presented to the AfDB Board for approval in January 2017. Submission to the SREP Subcommittee for their no objection is expected around November 2016.

13. Other Partners Involved in Project Design and Implementation

World Bank, State Secretariat for Economic Affairs (SECO), GEF

14. If applicable, explanation for why the grant is MDB executed

Not applicable.

15. Implementation Arrangements

The Procurement and Fiduciary function associated with the envisaged activities will be ensured by the Renewable and Alternative Energy Directorate (RAED) at the Ministry of Power. The RAED has been implementing multi-donor funded projects, such as WB/IDA/GEF, Spanish, Japanese and Chinese government-funded RE projects, in addition to the ongoing four pilot mini-grids. The RAED has therefore demonstrated its capability to structure and implement RE projects and would leverage the experience gained to facilitate the speedy and efficient implementation of the projects under its responsibility. The RAED is currently implementing the renewable energy component of the USD 210 million multi-donor funded Ghana Energy Development Access Project I&II which includes the ongoing mini-grids and off-grid access in public institutions.

AfDB has a field office based in Accra that shall provide the needed support with regards to the implementation of the PPG grant as need be.

PROJECT 2: SOLAR PV BASED NET METERING WITH BATTERY STORAGE

Background

The GoG's policy and strategy to meet the high average electricity demand growth rate of 11% is to exploit all the opportunities of power generation available to the country. This includes the use of conventional and non-conventional power generation systems such as renewable energy net metering technology.

Given the high electricity demand, the GoG is unable to cope with the magnitude of investment required without additional support. Key to the Government's strategy is the creation of an enabling environment to encourage private sector participation. To date however, this has yet to yield the anticipated results as the expected investments from IPPs have not been forthcoming.

Furthermore, the energy sector continues to experience electricity supply challenges due to poor rainfall patterns resulting in low water levels in Ghana's three hydroelectric power stations, coupled with an erratic supply of natural gas from the West African Gas Pipeline to power thermal plants. As a result, considerable strain has been felt on the country's power system, specifically on generation, which over the years has not been able to adequately match the demand.

This situation has resulted in frequent load shedding with its attendant socioeconomic impacts on industries and commercial businesses, particularly SMEs and essential public services (hospitals, schools, etc.). Meanwhile, backup power solutions have increased in demand in order to keep businesses running and the influx and use of small to medium-size petrol/diesel gensets has almost tripled over the last few years. Most of these gensets however, are inefficient and pose severe environmental and health challenges and further harbour associated social and economic consequences.

To help address these challenges, the viability of clean, reliable and cost effective power solutions in line with the Government's energy policy needs to be demonstrated. In this regard, renewable energy-based distributed generation has been identified as one of the solutions to which the private sector may play a central role. Net-metered solar PV systems with backup storage provide the possibility for businesses to self-generate and continue operating during power outages. The excess power can then be exported to the grid under a power exchange scheme, which will relieve the grid and reduce the electricity bills of net-metered consumers.

Current Efforts

In 2010, the GoG, through the Energy Commission, initiated a pilot grid-connected solar PV project. The aim of the pilot was to help determine the technical and economic viability of small-scale grid connected solar PV systems and provide lessons for a

larger scale deployment. The pilot also helped promote the deployment and use of small-scale grid-connected renewable energy solutions across key sectors to augment consumption from the national grid and help keep tariffs within manageable levels.

The Energy Fund provided up to a 40% matching grant on the hardware cost to support the installation of the solar PV systems upon a successful completion of installation works. Out of a total of 39 individual and institutional applications received as shown in the table below, only 16 with total installed capacity of 120kWp actually received financial support due to limited funding (inability of some applicants to raise counterpart funding) and technical constraints.

CATEGORIES	PHASE 1	PHASE 2	PHASE 3	TOTAL	SHARE OF APPS
Households	2	9	0	**11**	28.20%
Clinic/Hospital	0	2	0	**2**	5.13%
Agro Processing Companies	1	2	4	**7**	17.95%
Hotels	0	0	2	**2**	5.13%
Real Estate	0	2	0	**2**	5.13%
Educational Institutes	2	2	0	**4**	10.26%
Offices	0	4	3	**7**	17.94%
RET Installers	0	1	3	**4**	10.26%
Total	**5**	**22**	**12**	**39**	**100.00%**

Apart from households expressing interest, there was high level of interest from SMEs and businesses. On the whole, the sizes of the solar PV system installed ranged from 0.8kWp to 42.77kWp, with an average of 7kWp. Analysis showed that an average system size for the residential, educational/health institutions and small/medium scale businesses were about 4kWp, 10kWp and 20kWp, respectively.

Lessons learned during the pilot. The distribution utilities' policy of replacing postpaid meters with prepaid ones—both to reduce the commercial losses and improve revenue collection—had an adverse impact on the pilot net metering project since prepaid meters are incapable of measuring the net consumption of power (import/export). This made it difficult for the customer to appreciate the benefits of the investment and therefore affected the scaling-up of the project.

In response to that challenge, the utilities, in collaboration with the regulators, procured 350 bi-directional meters to be tested at the existing and future installations by the end of 2015. Going forward, there will be a need to ensure effective stakeholder consultation and collaboration with all parties involved (utilities, regulators, consumers, etc.) to ensure a sustainable scaling-up of net metering.

Another rational for customers opting for net metering is to provide back-up power in the event of grid failure. However, the pilot net metering system did not have storage capacity due to the additional cost to the customers. As a result, customers could not appreciate the benefits during power outages. Going forward, there is a need to integrate battery storage to solar PV net metering systems to meet desirable load in

the event of power outage.

The over-arching lesson which therefore emerged from the pilot was: the more apparent the benefits of the project (e.g., watching net consumption decrease and enjoying back-up power), the greater consumer buy-in.

The President of Ghana, in his State of the Nation address in February 2015, announced a 200,000 rooftop solar PV program as a measure to save the country about 200 MW of power and sustain small businesses and households in the wake of increasing electricity tariffs. This rooftop solar PV program is off-grid, unlike the net-metered solar PV system project which is grid connected with backup. The indicated sources of financing for the President's initiative include an adjustment of the Energy Fun Levy on Petroleum Products from GHp 0.05 to GHp 1.0 per liter, part of which would be used to establish the Renewable Energy Fund (REF) and an ancillary service charge of GHp 1.0 per kWh of electricity transmitted.

Other intitiatives include:

- The 715kWp solar PV net-metered installation at the Noguchi Memorial Institute for Medical Research of the University of Ghana with funding support from the Japanese Government.
- An additional 25 grid-tied PV having a total capacity of 7 MW were installed at the end of 2014 through private sector initiatives.
- The launch of the Ghana Renewable Energy Fair to promote the rapid utilization of renewable energy resources in the country, especially through net metering.
- The development of a net metering code with technical assistance from the German Government.
- Introduction of key incentives such as an import duty waiver for solar systems (e.g., modules, batteries, and other accessories delivered as systems).

Key Challenges

Although interest in solar PV net metering is high, the high upfront costs of USD2,500[38] per kWp and the perceived high risk of financing renewable energy projects pose a major setback for scaling-up. Additionaly, the storage option increases the investment cost by 25% to 30%.

Objective

The objectives of the project are to:

- Develop a comprehensive net metering program and the deployment of at least 15,000 units of roof-mounted solar PV systems to reduce the economic cost of power on SMEs and households, and

[38] This includes the cost of the bi-directional meter.

- Increase RE contributions in the electricity generation mix by 25-30 MW.

Project Components

The net metering project will have the following components:

Investment

- Deploy 15,000 grid connected solar PV systems equipped with back-up storage capacity to meet desirable loads in the event of power outage and determine the optimum financially viable back-up storage capacity.

Technical Assistance

- Develop a credit recovery facility that uses electricity billing systems and local banking institutions to finance the high up-front cost of net-metered PV with storage systems.
- Develop a standard contract between the utility and the net-metered customers and decentralized application process regime.
- Study the impact of a large number of distributed generators on the voltage, frequency and harmonics of the distribution networks and establish appropriate strategies for the implementation of the ambitious target.
- Develop a service provider certification regime and support the training of a significant number of Ghanaian renewable energy service providers/experts in line with sector local content and participation requirement.
- Capacity building of relevant stakeholders of the net metering project targeting key stakeholders such as GRIDCo, ECG, NEDCo, MoP, EC, PURC, solar PV service providers, beneficiaries and banks.

Implementation Support

- Provide support for the operational and management cost of the implementation team.

Rationale for SREP Financing

Considering the high upfront cost and the perceived high risk of financing renewable energy projects, concessional financing from SREP will help reduce the upfront investment cost of net metering with battery storage and boost demand and customer confidence.

Since the completion of the pilot grid-connected solar PV project, additional funding to scale-up the project could not be secured to date. SREP will leverage the required financing and provide the appropriate framework to scale-up the pilot grid connected project. The experience in Ghana could then be replicated in the ECOWAS sub-region and create new economic opportunities for the renewable energy industry.

Results Indicators

Key results indicators for this project include:

- 15,000 SMEs, public institutions (including educational and health institutions) and to a limited extent, households, would benefit from clean and reliable supply of electricity resulting in 25-30 MW new capacity to the total installed capacity.
- Improved technical and financial framework and institutional and human capacity for the sustainable scaling-up of net metering in Ghana.
- Improved power quality (voltage, frequency and harmonics) within the local network.

Financing Plan

The total estimated project cost is about USD 93 million, of which USD 12.5 million is sought from the SREP, USD 15 million from the AfDB, and USD 12 million from other development partners. The private sector will finance about USD 45.5 million through commercial banks, while the GoG will provide USD 8 million.

Indicative Budget	SREP	GoG	AFDB	IFC	DPs	Private Sector	Total
Investment	10.5	6.5	13.0	0.0	7.0	45.5	**82.5**
Technical Assistance	1.0	0.0	2.0	0.0	5.0	0.0	**8.0**
Implementation Support	1.0	1.5	0.0	0.0	0.0	0.0	**2.5**
Total	**12.5**	**8.0**	**15.0**	**0.0**	**12.0**	**45.5**	**93.0**

Lead Implementing Agencies

The AfDB will be the lead MDB for the implementation of this project. The Energy Commission will be the implementing agency on behalf of the GoG.

Local financing institutions including the National Investment Bank, Ecobank, Fidelity, UniBank, etc. have shown strong interest to participate in the project implementation given they have also been adversely impacted by the power crisis. The two main distribution utilities—Electricity Company of Ghana (ECG) and Northern Electricity Distribution Company—have shown strong interest to support the implementation because of its potential benefits. They are also represented on the SREP IP National Task Force and have actively participated in the deliberations and the development of this project concept. ECG has currently purchased 300 reversible meters to kick-start the nationwide implementation of the net metering scheme.

Tentative Project Preparation Timetable

It is expected that the project will be presented to the AfDB Board for approval in January 2017. Submission to the SREP Subcommittee for their no objection is expected around November 2016.

Project Preparation Grant

The Government of Ghana is requesting a preparatory grant of USD 610,500 to prepare this project (see PPG table below).

SCALING-UP RENEWABLE ENERGY PROGRAM IN LOW INCOME COUNTRIES PROJECT PREPARATION GRANT REQUEST			
1. Country:	Ghana	2. CIF Project ID#:	[Trustee to assign ID]
3. Project Title:	Net Metered Solar PV For SMES and Lighting Project		
4. Tentative SREP Funding Request (in USD million total) for Project at the time of Investment Plan submission:	**SREP Component:** USD 12.5 million		
5. Preparation Grant Request (in USD):	USD 610,500	**MDB:** AfDB	
6. National Project Focal Point:	Seth A. Mahu/Ministry of Power smagbeve@yahoo.com, smahu@energymin.gov.gh		
7. Executing Agency:	Ministry of Power		
8. MDB SREP Focal Point and Project / Program Task Team Leader (TTL):	**MDB HQ Focal Point:** Joao Cunha, SREP Coordinator, j.cunha@afdb.org	**TTL:** Thierno Bah t.h.bah@afdb.org	

9. Description of Activities Covered by the Preparation Grant

The objective of the proposed Project Preparation Grant is to undertake the project preparation activities that lead to the development of a comprehensive net metering programme, deployment of at least 15,000 units of roof-mounted solar PV systems to reduce the economic cost of power on SMEs and households and as a result add 25-30MW of capacity to the generation mix.

The following preparatory activities will be carried out: (i) review the net-metering regulatory framework including the code; (ii) develop and establish the project implementation arrangements; (iii) develop the financing framework including the credit recovery facility; (iv) identify credible financing institutions and establish necessary agreements that ensure active participation of these financing institutions; (v) conduct the impact of large the net-metering on the distribution systems; (vi) develop the necessary templates for service connection, capacity building awareness creation; (vii) develop the marketing systems; (viii) develop templates for request for applications and required tender documents; (ix) provide a technical workshop to key stakeholders; (x) conduct procurement activities.

10. Outputs

Deliverable	Timeline
Net-metering frameworks reviewed and recommendations made	April 2017
Financing institutions identified and contracts established	June 2017
Implementation arrangements developed and established	July 2017
Net-metering impact on distribution networks conducted (consultant)	March 2018

Service connection training conducted and templates developed (consultant)	January 2018
Experts technical workshop undertaken	April 2018
Procurement of all major project activities completed	July 2018

11. Budget

Expenditures	Amounts (in USD)
Consultants (net-metering impact and service connection studies and templates)	355,000.00
Workshop	30,000.00
Travel/Transportation	20,000.00
Others (PIU, Administrative Costs, etc.)	150,000.00
Contingencies (10%)	55,500.00
Total Cost	[610,500.00]
Other Contributions:	
Government of Ghana	USD 250,000 (salaries, workshops, etc.)

12. Timeframe

It is expected that the project will be presented to the AfDB Board for approval in January 2017. Submission to the SREP Subcommittee for their no objection is expected around November 2016.

13. Other Partners Involved in Project Design and Implementation

UNDP, GIZ

14. If applicable, explanation for why the grant is MDB executed

Not applicable.

15. Implementation Arrangements

The Procurement and Fiduciary function associated with the envisaged activities will be ensured by the Energy Comission. The Energy Commission has over the years, implemented key flagship programs on behalf of the GoG including the continent's most successful lighting retrofitting program, which saves Ghana over 120 MW of power generation investments and C02 emissions of about 112,320 tons per year. The Commission successfully piloted the RE net metering initiative and has developed key policy instruments and technical guidelines for the renewable energy industry. Recently, the EC piloted the UNDP funded "Promoting of Appliance of Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana" project with the objective to improve the energy efficiency of appliances marketed and used in Ghana through the introduction of a combination of regulatory tools such as Minimum Energy Performance Standards and Information Labels (S&L). The Energy Commission is finally implementing the Wind Resource Assessment component of the GEDAP project and the SE4ALL Initiative.

AfDB has a field office based in Accra that shall provide the needed support with regards to the implementation of the PPG grant.

PROJECT 3: UTILITY-SCALE SOLAR PV/WIND POWER GENERATION

Background

In October 2014, the GoG announced a revised FiT for utility-scale solar PV and wind that has made investment in these technologies a more attractive proposition. There is a pipeline of 31 utility-scale solar PV and wind investments that are at various stages of development (see the table below) with a total envisaged installed capacity of 1,835 MW.

Utility-scale Solar PV and Wind Projects

	Projects with valid prov. licenses	Projects with siting permits	Projects with construction permits	Total
No. of Projects	15	15	1	31
Capacity (MW)	377	1,438	20	1,835

However, the new Renewable Energy Tariffs (indicated in Table3) have some elements that are currently hindering the full development of the utility-scale solar and wind sub-sectors. The FiT are offered for a maximum 10 year PPA, which is considered too short a period to attract the long-tenor private financing necessary to make utility-scale projects cost-effective and financially sustainable. Moreover, the new FiT limits the utility solar PV capacity without grid stability or storage system to 150 MW as per the Energy Commission's guidelines on integration of utility-scale solar PV systems into the national electricity distribution and transmission systems (each individual plant should not exceed 10 MW and 20 MW if interconnected at distribution and transmission voltages, respectively)39. Wind capacity is also limited to a maximum of 300 MW.

While the potential returns on investment in utility-scale PV has stimulated interest from a number of developers (a small number of firms have invested limited amounts in the early development of RE projects) to date, no wind project has reached financial close or started construction, and only one corporate-financed solar PV project is underway. Private sector solar PV and wind investments still face a number of interrelated barriers, including: (i) lack of long-term financing; (ii) limited experience and track record of RE project development by local sponsors; and most critically (iii) perception of payment risk related to the newly gazetted tariffs or FiTs. These barriers are exacerbated by the fact that RE projects in Ghana suffer some diseconomies of scale and higher development costs. While FiTs significantly affect the profitability of RE projects and influence their ability to attract financing, the sector requires additional support to catalyze first project-financed solar PV and wind plants due to the high perceived risk of a largely untested new FiT regime.

[39] PURC. Publication of Feed-in Tariffs and Capacity Cap for Electricity Generated From Renewable Energy Sources (1 October 2014).

In addition, Ghana has not yet institutionalized a systematic and competitive set of benchmarks that would allow for the prioritization of the most deserving PV and wind developers under the set limited capacity. Furthermore, the roadmap for future expansion of the solar and wind utility-scale sub-sectors, beyond the current caps, is still unclear.

Ghana's transmission and distribution networks are not robust enough to accommodate all the proposed utility-scale plants. In addition, the balance sheets of main utility off-takers may not be able to support the FiT payments to all the proposed plants. Indeed, many investors have expressed concerns over FiT payment risk, since there is no operational experience thus far with this regulatory regime, while the principal off-takers are under financial stress.

Objective

The objective of this project is to assist the GoG overcome key barriers that prevent the growth and expansion of the utility-scale solar PV and wind market in Ghana by: catalyzing the first project financed utility-scale RE plants; demonstrating the Ghanaian RE sector potential to financiers; and helping attract further investment in the future. It would also bring into sharper focus the most important barriers that need to be overcome to ensure a more rapid growth of Ghana's utility-scale RE sector.

Project Components

This project involves the structuring, financing and construction of solar PV/wind power plants by private investors.

Rationale for SREP Financing

SREP financing could help the early projects mitigate some of the perceived risks associated with first-mover projects, such as FiT payment risk and the relatively short validity of FiTs (10 years). These risks are having an adverse impact on private investors' confidence to finance utility-scale wind and solar PV in Ghana, which could potentially delay the development of the entire sub-sector. Since the first FiTs were introduced on 1 September 2013, there has been only one project developer currently at construction stage. Concessional financing from SREP will enable developers to negotiate longer PPAs at lower tariffs that would be more commensurate with utilities' ability to pay and thereby reduce one of the key project risks.

Moreover, successful financial closure and development of the first few utility-scale RE projects with support from the SREP should demonstrate the viability of RE technologies in the country as well as the soundness of the regulatory regime to support them. While a change in the regulatory framework may be necessary in the medium- to long-term in order to further enhance the RE FIT mechanism, this is a lengthy and

cumbersome process that requires careful study and some initial experience with the existing mechanism. The objective of this project is to support the development of the first RE projects under the existing regulatory framework in order to demonstrate both its strengths and weaknesses. Its weaknesses can then be understood in more detail and in the context of real experience, which will enable more informed and effective enhancement of the regulatory framework.

Concessional financing from SREP can also help mitigate the perceived investor risk of weak off-takers by helping to bring RE project tariffs down to more affordable levels, thereby reducing the future burden of RE on financially challenged Ghanaian utilities. By catalyzing the first utility-scale RE projects in Ghana, SREP will also help the GoG carefully assess the grid impact of utility-scale RE and make more informed planning decisions for scaling-up RE in the future.

SREP support is also expected to pave the way for the leveraging of substantial financing from the private sector for utility-scale wind and solar PV development by helping the first projects obtain appropriate long-term financing. This is expected to stimulate the growth of a nascent local RE project developer community. Successful scale-up of a large-scale wind and solar PV sector in Ghana would generate jobs during the construction, operation and maintenance stages, helping to also build local RE capacity.

Result Indicators

By providing utility-scale power supply, the project will benefit the entire Ghanaian population that has access to the national grid, thus it will indirectly contribute to meeting the country's long-term goals. The primary result of the project will be measured in terms of additional utility-scale RE capacity added to the Ghanaian grid by private sector operators. Private sector investment will also be measured.

Financing Plan

The total estimated project cost is about USD 50 million, of which USD 10 million is sought from the SREP, USD 10 million from IFC and USD 10 million from the AfDB (private sector window). The private-sector lending will amount to about USD 20 million.

Indicative Budget	SREP	GoG	AFDB	IFC	DPs	Private Sector	Total
Investment	10.0	0.0	10.0	10.0	0.0	20.0	50.0
Technical Assistance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Implementation Support	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	10.0	0.0	10.0	10.0	0.0	20.0	50.0

Lead Implementing Agencies

The IFC will be the lead MDB for the implementation of this project investing in private sector companies.

Tentative Project Preparation Timetable

IFC will conduct an initial market assessment following approval of the SREP-Ghana IP. Depending on market conditions and appraisals, it is expected that the project will be submitted to the SREP Sub-Committee for approval in the first quarter of 2016 and presented to the IFC Board for approval in the third quarter of year 2017.

Project Preparation Grant

The Government of Ghana is not requesting a PPG for this project.

PROJECT 4: TECHNICAL ASSISTANCE TO SCALE-UP RENEWABLE ENERGY IN GHANA

Background

The GoG has established key policy and regulatory measures to support renewable energy development. However, in spite of these measures, the pace of the development of RE projects by private developers has been rather slow. In fact, many gaps in the existing renewables regulatory framework (specifically, the Renewable Energy Act) have been identified, namely the question of what is technically feasible, economically desirable and fiscally responsible for the integration of RE into the national grid under the current context and in the future.

National public stakeholders (e.g., MoP, EC, ECG, GridCo, NedCo, PURC), with the support of development partners, mainly GIZ, have taken some measures to address some of the identified gaps that slow the implementation of the RE Act. Nevertheless, there are significant barriers and constraints that must still be addressed. Among the key barriers identified for scaling-up RE in Ghana, stakeholders consulted during the preparation of the IP highlighted the following:

Technical Gaps

- Some resource assessments have been carried out, but not covering all technologies or all regions of the country. Also, the data is not easily made available to potential investors which slows investment decisions and project preparation.
- Weak grid that will have difficulty handling integration of a large portion of renewables.

Financial & Project Development Constraints

- Limited expertise in structuring loan products and credit mechanisms for RE investments.
- Absence of guarantee facilities that can stimulate renewable energy investments.
- Inadequate expertise in project development.

Regulatory & Institutional Barriers

- Absence of a standard non-negotiable PPA with suitable duration appropriate for small-scale renewable energy investors. For small projects, a simple non-negotiable PPA reduces time and cost for project development and financial closure, while it avoids any perception of favoritism and variations between terms and conditions among projects.
- Absence of a methodology for taking into account renewable energy ancillary services (e.g., frequency regulation, spinning reserve, reactive power, etc.) in

the tariff regime.

- Import duty relief is an important incentive for renewable energy projects. However, the relief policy is inconsistently applied on the ground by Ghana Revenue Authority at Ghana's ports of entry.
- During the project development cycle, potential investors are faced with the cumbersome process of navigating through the various approval steps at the government level. Various permits, approvals and consents are required from numerous government entities, which leads to a time consuming and arduous process for the applicant.

The GoG is working on operationalizing a Renewable Energy Authority (REA) as a "one-stop-shop" which will be empowered to ensure consistent and timely implementation of all aspects of Government-led renewable energy and related policies. It will work to shorten the project development cycle. The GoG will require considerable capacity support in order to successfully establish the REA.

Although each of the priority RE projects in this SREP-Ghana IP has a TA/capacity building component specific to each respective technology, it is proposed that this TA project address barriers that are not specific to any particular RE technology, but that constrain the entire renewable energy sub-sector.

Objective

The ojective of this project is to assist the GoG and its key partners in the private and financial sectors to overcome key technical, financial, regulatory and institutional barriers that inhibit the scaling-up of renewable energy investments in the country and more specifically could constrain the successful implementation of the flagship renewable energy projects financed under this program.

Project Description

Technical Component

- Support for comprehensive resource assessments for a wide range of renewables (tidal wave, biomass, wind, etc.) that provide long-term seasonal data (for example, biomass supply for different seasonal periods, municipal waste) as well as end-use consumer gender disaggregated data that can assist the design of different renewable energy technologies such as net-metered PV systems. This data should be gender-disaggregated, and include questions on (i) uses of energy in the household; (ii) identifying responsible household member for bill payment; (iii) gender disaggregated-data on willingness-to-pay for different technologies/mechanisms; (iv) gendered preferences for different levels/quality of energy access.

- Support capacity development of main utilities (distribution companies and GRIDCo) to undertake dynamic grid studies to determine the proportion of renewables that can be safely integrated into the national power supply and accurately forecast future estimates of the contribution of renewables as Ghana's power sector continues to grow in size and coverage.

Financial & Project Development Component

- Provide a transaction support facility or cost-shared grants for pre-investment work up to financial closure for developers and financial institutions.
- Pilot-test and recommend the most appropriate PRGs and other risk mitigation instruments as well as model renewable energy payment agreements for project developers in Ghana.

Regulatory & Institutional Component

- Assist the GoG move to a non-negotiable PPA of suitable duration that is appropriate for small-scale renewable energy developers.
- Support the development of a tariff methodology for ancillary services required for smooth integration of RE generation in the national grid and improve the current RE FiT to address bankability issues (e.g., limitation of the validity of the tariff to 10 years).
- Support the MoP to create the Renewable Energy Authority which would effectively implement renewable energy projects on behalf of the GoG.
- Support the MoP to create a "one-stop shop" solution to fast track government services related to RE projects that can address all of these issues. The SREP to provide support for a prototype one-stop centre for renewables within the relevant sector agency to address the issues of inconsistency among the sector players.

Rationale for SEFA Financing

This component is essential to lay the technical, financial, regulatory and institutional foundations for a successful implementation of the SREP program and associated flagship renewable energy projects.

Financing Plan

The total estimated project cost is about USD 4 million, of which USD 1.5 million is sought from SEFA, and USD 2.5 million from other development partners.

Indicative Budget	SREP	GoG	AFDB /SEFA	IFC	DPs	Private	Total
US $ Million	0	0	1.5	0	2.5	0	4

Lead Implementing Agencies

The AfDB will be the lead MDB for the implementation of this project. The Renewable & Alternative Energies Directorate (RAED) of the Ministry of Power and the Energy Commission will be the implementing agency on behalf of the GoG.

ANNEX 2: ASSESSMENT OF COUNTRY'S ABSORPTIVE CAPACITY

MACRO-ECONOMIC CONTEXT

The country's commendable annual growth rate averaging 8% over the past years has been broad-based across sectors, an indication of inclusive growth. This growth was driven largely by performance in service sectors, which accounted for 50% of GDP in 2013, followed by industry (including oil production) at 29% and agriculture at 21%. Agriculture though remains the mainstay of the economy in terms of food security and employment. The experienced growth led to per capita income increasing from USD 1,622 in 2012 to USD 1,838 in 2013, affirming Ghana's status as a middle income country. The growth has also enabled Ghana to make progress on reducing the incidence of poverty which stands at 28.5% of the population living below the national poverty line.[40]

Despite the Bank of Ghana's gradual rise of its policy rate by 300 basis points cumulatively from 16% in May 2013 to 19% in July 2014, inflation continues to hover above the target range of 9.5% +/-2%. Inflation reached 17% in 2014, well above the Central Bank's inflation target. The automatic adjustment of petroleum and utility prices towards cost-recovery implemented since February 2013, and pass-through-effect of the continuing depreciation of the domestic currency (by over 40% in 2014), are among major factors fueling the persistent high inflation rate. The rate of depreciation of the Cedi especially in 2014, is highly associated with the sharp rise in non-food inflation, since Ghanaians are highly dependent on imported consumer goods.

In 2014 economic growth reached its lowest level in many years. Non-oil GDP grew at only 4.1% and was expected to decline further in 2015 to 3.5% on the backdrop of a severe energy crisis and fiscal consolidation, high interest rates, a fast depreciating currency, and low aggregate demand.

DEBT SUSTAINABILITY

Although the government is committed to fiscal sustainability with the ultimate objective of reducing the budget deficit to around 6% of GDP by 2016, trend performance has

[40] Poverty in Ghana. The Borgen Project, July 2013. http://borgenproject.org/poverty-in-ghana/. 15 April 2015.

registered widened budget deficits of over 10% of GDP for the past two years (2013 and 2014). Key contributors to the widened deficit include increased spending on wages and salaries, interest payments on outstanding public debt, arrears payments on subsidies, and low levels of revenue collection. With tax revenue accounting for 17.6% of GDP in 2013, Ghana does not compare favorably with most countries in sub-Saharan Africa, such as Kenya with tax revenue of around 20% of GDP.

As the Government continues experiencing high levels of budget deficit, the size of public debt rose from 48% of GDP in 2012 to 55.8% of GDP in 2013. Interest payments on public debt is taking a substantial share of domestic revenue, rising from 17.3% in 2012 to 24.6% and 32% in 2013 and 2014, respectively; thus undermining spending on essential social and development activities. A joint IMF/WB Debt Sustainability Analysis conducted in May 2014, indicates Ghana debt risk of distress being moderate, but its vulnerability has increased as its debt service-to-revenue ratio was approaching high risk levels; projected to 45% in the long-run. In addition, the recently raised Eurobond of USD 1.0 billion in September 2014 is likely to push Ghana's debt risk level from moderate to high risk distress.

To address all this, the 2015 Budget adopted by Parliament included a strong set of measures. Swift implementation of these measures, in particular the elimination of distortive and inefficient energy subsidies, the new tax on petroleum products, and stronger containment of the wage bill should contribute to a significant reduction in the fiscal deficit over the medium term, with the fiscal deficit projected to decline from 9.5% of GDP in 2014 to 7.5% in 2015 and about 3.5% in 2017, including the repayments of all arrears outstanding at end 2014.

INSTITUTIONAL CAPACITY

The electricity system is structured into three main subsystems: generation, transmission and distribution. Power generation has been unbundled creating the enabling environment of independent power producers (IPPs) to enter in electricity generation. The transmission system operator (TSO) is state-owned and regulated. There are essentially three distribution system operators (DSO) namely the electricity company of Ghana (ECG) responsible for southern distribution, Enclave Power (EP) responsible for power distribution within the free economic zone, and the northern electricity distribution company (NEDCo). There are two electricity markets regulated and unregulated. There are currently 30 bulk customers in the unregulated market. All the structures are under the Ministry of Power.

Line ministries and agencies in the energy sector generally have a good track record of implementing projects such as the Ghana Energy Development and Access Project. The identified project under SREP Technical Assistance aims to assist the GoG and its key partners in the private and financial sectors to overcome key technical, financial, regulatory and institutional barriers that inhibit the scale-up of renewable energy investments in the country.

ENERGY INVESTMENT IN THE AGENDA FOR TRANSFORMATION

The Scaling-Up Renewable Energy Program will, via the AfDB and IFC, support the GoG in improving its energy sector, in particular its renewable energy sector. The SREP will also support the GoG in strengthening its capacity to conceive and implement sound technical, financial, regulatory and institutional foundations for a successful implementation of the SREP program and associated flagship renewable energy projects aimed at improving the environment in which Ghanaian firms operate.

The concessional funding allocated to Ghana will support secure long-term public financing with the mini-grid project as well as scaling-up the deployment of renewable energy mini-grids systems in Ghana. The SREP financing with the Solar PV based net metering (for SMEs and lighting project) is key to ensure the financial viability of this pilot phase. It will help reduce the financing cost and hence improve the returns, which will therefore set the stage for the sustainable rollout of a robust private sector-led roof mounted solar PV program in Ghana. The SREP is also expected to pave the way for the leveraging of substantial financing from the private sector for utility-scale wind and solar PV development by helping the first projects obtain appropriate long-term financing.

The SREP investment will benefit the country in leveraging funds and by ultimately resulting in inclusive growth and job creation by the resulting reliable supply of electricity for Ghanaians, SMEs and larger industries. This also aligns with the Ghana Shared Growth and Development Agenda II (2014-2017) which identifies power as the major binding constraint to the accelerated economic growth and development of the economy. Ghana has the capacity to absorb this debt.

The SREP will help solidify relevant expertise at the MoP to handle the implementation of the existing framework regarding renewable energy (e.g., acts, codes etc). These facilities will be available for the SREP-Ghana implementation.

In summary, the concessional funding granted to Ghana as part of the SREP, will meet the concessional criteria and will have little impact on Ghana’s capacity to service its debt.

ANNEX 3: STAKEHOLDER CONSULTATIONS

BACKGROUND

The SREP-Ghana Investment Plan is the product of a comprehensive participatory process involving many institutional, national, and international actors, led by the Government of Ghana and represented by the Minister of Power, with support from the multilateral development banks, particularly the AfDB and IFC. The main stages of the consultative process have been the following:

- Multiple technical meetings during the scoping mission with the development partners, civil society organizations, and private sector representatives (December 2014);
- Consultations with key national stakeholders during the joint mission, including national institutions, private sector representatives (sponsors, commercial banks, etc.), civil society organizations and development partners, to present the draft investment plan and proposed investment priorities (February 2015);
- Posting the draft Investment Plan on the MoP's website for two weeks to allow national stakeholders to review and comment on the proposed investments (March 2015).

The lists of stakeholders consulted during the missions are available in the Aide-Memoires, which have been posted on the Climate Investment Funds (CIF) website.[41]

STAKEHOLDER FEEDBACK AND SUGGESTIONS

The nature and scope of the SREP-Ghana IP has been welcomed and endorsed by all stakeholders. Their comments have been taken into consideration while finalizing the IP. During consultations, a number of issues were raised by the private sector, civil society and development partners.

Key issues raised by the private sector

Meetings were held with various representatives from the private sector RE community in Ghana – including developers and commercial banks - to get an overview of the current situation, as well as their views and thoughts on how to improve the enabling

[41] Climate Investment Funds. https://www.climateinvestmentfunds.org/cif/content-new-countries-under-the-srep.

environment for the development of the RE market in Ghana. Key issues raised were the following:

- ***Implementation of the regulatory framework for RE:*** While in theory, the regulatory framework is appropriate, in reality it lacks consistent and clear implementation mechanisms. The Renewable Energy Act (RE Act) is not clearly and efficiently enforced and implemented. Inconsistencies include confusion on the tariffs available to developers, the conditions of Power Purchase Agreements, the time and red tape necessary to obtain various licenses and permits, and the discretion exercised by officials on implementation of the import duty relief policy.
- ***Financing constraints:*** Erroneous perceptions about the cost of solar technologies, inadequate financing instruments and high cost of capital were identified as some of the key barriers facing players in the sector. Current financing cost on the local Ghanaian commercial banking market is obviously too high to make RE projects viable. With interest rates of around 30% per year, payback periods cannot exceed 8 years for solar home systems, for example. In addition, appropriate long-term financing is not available in Ghana. The provision of concessional facilities and matching funds were identified as possible areas for consideration under SREP.
- ***One-stop shop:*** Currently, potential private investors have to undergo a cumbersome application procedure, often involving various ministerial departments to finally get the clearances and agreements they need for their business. A more streamlined approach would be helpful, which could translate into the creation of a "one-stop shop" for investors.
- ***Independent Power Producers (IPPs):*** SREP funding is perceived as being instrumental to mobilize the key stakeholders and investors (public and private) interested in realizing investment opportunities in the RE space and addressing the various obstacles (e.g., risk perception, regulatory uncertainty, technology risk, financing challenges, etc.) to crowd-in more private sector investment.
- ***Lack of capacities:*** A main obstacle for RE IPPs is the limited capacity of the utilities and regulators to structure and negotiate bankable PPAs and the weak balance sheet of potential off-takers. Capacity building for the relevant stakeholders and support to potential off-takers to improve efficiency is therefore critical.
- ***Availability of data:*** RE resource gender disaggregated data seems to be available, but is not routinely disclosed by ministries in an appropriate manner. Improving information and data sharing will be critical to further mobilize private investors.
- ***Knowledge management and information sharing:*** The efficient management of knowledge is needed to thoroughly assess the results obtained from early IPPs and to share lessons learned from pilot projects to demonstrate to private sponsors the bankability of RE investments.

Issues raised by civil society

Civil society already plays a key role in promoting renewable energy in Ghana. NGOs - particularly the Netherlands Development Organisation (SNV), the Climate Action Network, and the Kumasi Institute of Technology, Energy and Environment (KITE) - confirmed their active participation in Ghana's RE sector as well as their interest in participating in the SREP-Ghana activities. This IP will build on past and ongoing NGO activities in renewable energy to maximize synergies and ensure innovative practices and networks of Ghana's civil society are mobilized to support the expansion of RE in the country. NGOs consulted in the preparation of this Ghana IP identified the following key issues that need to be addressed to facilitate rapid development of the Ghana RE sub-sector:

- ***Limited Awareness:*** NGOs highlighted the need to address limited awareness of the benefits of renewable energy among the general public. A key element of the SREP will be raising awareness among national and local stakeholders about Ghana's energy-sector challenges and opportunities for developing the potential of renewable energy, especially for off-grid solutions.
- ***Financing RE:*** The high up-front costs of RE technologies and unfavourable financing terms (interest rates that can be as high as 30%) were some of the main challenges mentioned by CSOs as key constraints to the scaling-up of renewable energy solutions in Ghana .
- ***Community perceptions of the adequacy of off-grid renewable energy options:*** Potential end-users are sometimes reluctant to accept decentralized renewable energy solutions and prefer grid-connected solutions, mainly because they are not adequately sensitized and informed about the benefits and reliability of RE off-grid solutions.
- ***Capacity building:*** There is a need for additional capacity building to expand existing Ghanaian RE expertise in civil society organizations.

Issues raised by development partners

Development partners consider the SREP-Ghana initiative an opportunity for Ghana to accelerate renewable energy development as it is closely aligned to their interventions in the country and provides an opportunity to crowd-in additional resources for the scale-up of RE investments. Development partners' support to RE development includes investments and activities in mini hydro, off-grid electrification, mini-grids, solar, biomass and related technical assistance. A number of key observations were raised by development partners. It was pointed out that this SREP-Ghana IP can draw valuable lessons from renewable energy development initiatives of development partners. Of special interest are initiatives driven by the AfDB, SECO and WB that are jointly supporting the Ghana Energy Development and Access Project, in addition to a wide range of renewable energy investments in Ghana.

The proposed SREP off-grid program which includes both mini-grids and solar home systems, dovetails well with the SE4All investment prospectus which focuses on energy access. This can provide a sound basis for collaboration and cooperation.

KfW (involved in the preparation of the 12 MW solar PV project with the Volta River Authority) pointed out the need to improve the information which is made available to sector stakeholders in order to scale-up RE investments in the country and encouraged SREP-Ghana to participate in the refinement and dissemination of available information.

GIZ operations in the RE sector focus on the productive use of energy and financing for small-scale projects through a results-based-evidence scheme. GIZ welcomed the pre-identified SREP investment, particularly the technical assistance project which is expected to complement the TA support already provided by GIZ to MoP.

Comments Received on the Draft Investment Plan Posted on MoP Website

In order to facilitate review by national stakeholders, the Investment Plan was made available on the MoP website.[42]

[42] Ghana Ministry of Energy. Draft Investment Plan. www.energymin.gov.gh/Power/?page_id=37. 2 April 2015.

ANNEX 4: RATIONALE FOR RANKING AND SELECTING PRIORITIES FOR SREP SUPPORT

Criteria	Tidal Wave	Solar	Wind	Small Hydro	Biomass/ Waste Power	Mini-Grid	Stand-Alone Systems
SREP Criteria							
Increased installed capacity from renewable energy	**Low**. Technology yet to be proven; resource potential may be high but yet to be assessed.	**High**. Irradiation level ranging from 4 to 6 kWh/m^2 but constrained by diffused radiation and absorbable capacity due to intermittency; policy target of 150 MW vs. 8 MW today.	**Moderate**. Concentrated along the coast (5 to 6 m/s at 50m mast height, 2,000 MW exploitable potential) and constrained by absorbable capacity due to intermittency; policy target of 300 MW vs. 0 MW today	**Low**. Potential estimated at 4 MW	**Moderate**. Exploitable potential estimated at above 100 MW	**Moderate**. Approximately 2,000 lake side and 200 islands to be electrified. About 70 MW load	**Low**. Large number of potential users, but small unit capacities (maximum 50 W)
Increased access to energy through renewable energy	**Low**. Same as above	**Moderate**. Helps access but supply intermittent	**Moderate**. Helps access but supply intermittent	**Low**. Helps access to lesser extent due to seasonality	**Moderate**. Helps access with dispatchable power	**High**. Directly increases access to millions in hard-to-reach areas	**High**. Directly increases access to millions in hard-to-reach areas and can be used as a back-up option in urban areas.
Low emissions development	**High**. No global warming emissions	**High**. No global warming emissions	**High**. No global warming emissions	**High**. No global warming emissions	**High**. No global warming emissions	**Moderate**. Hybrid systems would result in some level of emission	**High**. No global warming emissions

Criteria	Tidal Wave	Solar	Wind	Small Hydro	Biomass/ Waste Power	Mini-Grid	Stand-Alone Systems
SREP Criteria							
Affordability and competitiveness	**High**. If resource is confirmed, low-cost electricity	**Low**. Cost remains high in Ghana despite the fact that it is coming down in the global market	**Moderate**. Cost can compare favourably with conventional systems	**Moderate**. More affordable than latest IPPs	**Moderate**. More affordable than latest IPPs	**High**. Less costly than grid connection by displacing investments into transmission and distribution networks, and reduction in fuel cost for generation	**Moderate**. Less costly than diesel generation or use of kerosene and batteries. Subsidies needed for affordability.
Productive use of energy	**High**. Base-load, reliable power supply helps improves productive use	**Moderate**. Intermittent power must be backed up to supply reliable power needed for productive use	**Moderate**. Intermittent power must be backed-up to supply reliable power needed for productive use	**Moderate**. Seasonal intermittency must be backed up to supply reliable power needed for productive use	**High**. Base-load, reliable power supply helps improves productive uses	**High**. Quality and quantity of power suitable for productive use	**Moderate**. Affordability usually limits power levels per user; suitable for households use, commercial and agricultural activities
Economic, social, and environmental benefit	**Moderate**. Potential adverse social impacts if power plant area is restricted for fishing	**Moderate**. Land requirements may conflict with other uses; must be designed to meet environmental standards	**Moderate**. Land requirements may conflict with other uses; must be designed to meet environmental standards.	**High**. Run of the river systems with limited environmental and social impacts	**High**. Addressing sanitation issues; economic benefits high in local communities in supplying feedstock from sustainable sources	**High**. Reliable electricity brought to community sooner than possible by grid extension; income generation potential supported by electricity supply	**Moderate**. Reliable electricity brought to community sooner than possible by grid extension; environmental impact of improper battery disposal must be managed

Criteria	Tidal Wave	Solar	Wind	Small Hydro	Biomass/ Waste Power	Mini-Grid	Stand-Alone Systems
SREP Criteria							
Economic and financial viability	**Moderate**. Ongoing 14.5 MW phase 1 project of a larger 1,000 MW with a signed PPA with promising economic and financial viability	**Moderate**. Good financial returns with current feed-in tariff policy; Forex risks related to the feed-in tariff to be mitigated	**Moderate**. Good financial returns with current feed-in tariff policy; Forex risks related to the feed-in tariff to be mitigated	**Moderate**. Good financial returns with current feed-in tariff policy; Forex risks related to the feed-in tariff to be mitigated	**Moderate**. Good financial returns with current feed-in tariff policy; Forex risks related to the feed-in tariff to be mitigated	**High**. Less costly than grid connection by displacing investments into transmission and distribution networks, and reduction in fuel cost for generation	**High**. Less costly than diesel generation or use of kerosene and batteries; subsidies needed for affordability
Leveraging of additional resources	**Low**. New technology yet to be proven – high risk	**High**. Many partners support solar development	**High**. Many partners support wind development	**Moderate**. Many partners support mini-hydro; however limited room for leveraging resources considering the limited potential	**High**. Many partners support biomass development	**High**. High interest from partners who are willing to consider supporting subsidy schemes	**High**. High interest from partners who are willing to consider supporting subsidy schemes
Gender equity	**Low**. Bulk grid electricity supplies do not target women	**Low**. Bulk grid electricity supplies do not target women	**Low**. Bulk grid electricity supplies do not target women	**Low**. Bulk grid electricity supplies do not target women	**High**. Better participation of women and additional income stream through sale of feedstock.	**High**. Benefits women and children as households are predominant users and benefit from social amenities	**High**. Benefits women and children as households are target users

Criteria	Tidal Wave	Solar	Wind	Small Hydro	Biomass/ Waste Power	Mini-Grid	Stand-Alone Systems
SREP Criteria							
Co-benefits of RE scale-up	**Moderate**. Offsets fossil-fuel use and improves air quality; increased income opportunities	**Moderate**. Offsets fossil-fuel use and improves air quality; increased high-value employment and income opportunities	**Moderate**. Offsets fossil-fuel use and improves air quality; increased high-value employment and income opportunities	**Moderate**. Offsets fossil-fuel use and improves air quality; increased high-value employment and income opportunities	**High**. Offsets fossil-fuel use and improves air quality; creates opportunities for farmers through sale of agricultural waste; increases income opportunities for fuel wood suppliers	**High**. Increased energy security and improved air quality for vulnerable and small communities; enhanced socioeconomic conditions; avoids risk from kerosene and candle fires	**High**. Increased energy security and improved air quality for households; enhanced socioeconomic conditions; avoided risk from kerosene and candle fires
National Criteria							
Contribution to the 10% renewable energy mix of the GoG by 2020	**Moderate**. Expected capacity of 14.5 MW may contribute significantly to the target	**High**. Contributes about 30% of total target (150 MW)	**High**. Contributes about 60% of total target (300 MW)	**Low**. Marginal contribution to total target	**High**. Contributes significantly to total target; base load; no capacity cap	**Moderate**. Expected capacity of 15 MW may contribute significantly to the target	**Low**. Expected capacity of 2 MW could contribute significantly to the target
Contribution to the universal access (at least 90%) target of the GoG by 2016	**Low**. Technology yet to be proven; the resource potential could be high but is yet to be assessed	**Moderate**. Helps access but supply intermittent	**Moderate**. Helps access but supply intermittent	**Low**. Helps access to lesser extent due to seasonality	**Moderate**. Helps access with dispatchable power	**High**. Directly increases access to millions in hard-to-reach areas (54% of island communities to be connected through mini-grids)	**High**. Directly increases access to millions in hard-to-reach areas and can be used as a back-up option in urban areas

Criteria	Tidal Wave	Solar	Wind	Small Hydro	Biomass/ Waste Power	Mini-Grid	Stand-Alone Systems
SREP Criteria							
Contribution to peak load	**Moderate**. May contribute to peak load subject to confirmation by ongoing project	**Low**. May contribute to peak load if peak shifts	**Moderate**. Wind coincides with national peak load profile	**Moderate**. May contribute to peak load	**High**. Will contribute to peak load since dispatchable	**High**. Will contribute to peak load at community level	**High**. Will contribute to peak load at household level
Project implementation readiness	**Moderate.** One project ongoing with potential for scaling-up to 1,000 MW	**High**. Nine siting permits and two construction permits issued to solar project developers	**Moderate**. One siting permit (for 250 MW) have been issued to NEK; VRA and Infraco are undertaking Wind Resource Assessments	**Low**. Feasibility studies completed for one 60 kW site	**Moderate**. 3 Siting permits issued to solar project developers	**High**. Four pilot projects underway and regulatory framework being developed	**High**. About 40,000 systems installed; regulatory framework being developed
Total	26	30	30	24	36	39	35

ANNEX 5: EXTERNAL REVIEW

Peer Review Comment	Response
1.0 COMPLIANCE WITH SREP	
Catalyse increased investments in renewable energy	
The Ghana IP proposes to increase the installation of RE systems to meet the demand for electricity, especially in areas presently un-served by the electricity grid and expand energy access. The IP proposes programs that will install grid-connected RE systems and stand-alone RE systems and provide technical assistance which is consistent with the objectives of the SREP. While it is proposed to leverage funds from additional sources, it is not clear how the programs will catalyze additional investments beyond the proposed program. This aspect is addressed in greater detail in the comments on specific programs.	Well noted.
Co-Benefits from Programs	
The Ghana IP in Section 5.6 provides a description of the co-benefits from the program. However, the co-benefits are described very generically. RE programs, in general, would all result in co-benefits, and the IP does not correlate the benefits to the proposed programs. It would be useful to provide some indicators, such as households to be electrified, to link the potential co-benefits to the specific programs proposed in the IP.	This has been done in ANNEX 1: DETAILED INVESTMENT BRIEFS. Each investment project has a section on the expected results where the indicators, such as households to be electrified, are presented.
Promote Private Sector Investments in RE	
While the program descriptions in the IP indicate that they will be leveraging private sector investments, they also emphasize the need for concessional financing and increased public finances. It is suggested that the program descriptions indicate how SREP financing will lead to increased private investments. This aspect is addressed in greater detail in the comments on specific programs.	Related to Project 3. Utility-Scale Solar/Wind is expected to leverage the most private sector participation. SREP funds will be used to catalyze the first utility-scale RE projects in Ghana leveraging private sector investments (it is expected that USD 1 of SREP funds will leverage at least USD 1 of IFC, USD 1 from the private sector window of the AfDB and USD 2 from the private sector. Moreover, these investments will help create a track record of viable RE projects, which in turn will help mitigate perceived investor risks and reduce the cost of financing future projects, demonstrating Ghanaian RE sector potential to financiers and helping attract further private investment in the future. Related to the two other investment projects. It is expected that private sector financing will be mobilized mainly through the commercial banks and strategic suppliers.

Peer Review Comment	Response
Blend Financing from Multiple Sources	
The Ghana IP indicates that it will leverage additional financing from MDBs, government and the private sector for program scale-up. Program descriptions indicate the challenges of financing RE programs to benefit remote areas and emphasize the need for blending SREP financing with increased MDB and public finances to implement programs. This aspect is addressed in greater detail in the comments on specific programs.	Well noted.
Knowledge Sharing and Incorporating Lessons Learned	
One of the objectives of SREP is to facilitate knowledge sharing and the exchange of international experience and lessons, and to incorporate lessons into program planning. The Ghana IP includes a description (Section 8.4) of how knowledge management and sharing of lessons will be a key aspect of program implementation.	Well noted.
Preference for Poverty Alleviation Benefits	
SREP gives preference to projects with strong poverty alleviation benefits. Economic and/or social development and environmental benefits are therefore key criteria during project selection. The Ghana IP targets the expansion of energy access to remote rural areas, which presently have inadequate or no energy access. The provision of energy to such areas is likely to result in poverty alleviation, economic benefits, and social and environmental benefits.	Well noted.
Potential for Program Scale-up	
A key SREP criterion is the potential of the proposal for demonstration and replication, particularly the potential for removing barriers in the enabling environment beyond the immediate project boundary to facilitate scaling-up through private sector investments. This aspect is not very apparent from the program descriptions given the challenges cited for RE. It is suggested that the potential for scale-up, especially with private sector investment, be described in the IP. This aspect is addressed in greater detail in the comments on specific programs.	This has been revised and the potential for scale-up in each of the project concept notes well outlined.
Enabling Environment	
The Ghana IP is consistent with policies and plans to expand the electricity infrastructure and promote RE. The IP indicates that the country has an enabling legal and regulatory framework to promote RE. The IP also acknowledges some of the policy, regulatory, and financing challenges to grid connected RE systems and seeks to address them through technical assistance, which is one of the proposed programs to be financed by SREP.	Well noted.

Peer Review Comment	Response
Increased Energy Access	
The Ghana IP proposes to increase energy access to remote areas of the country which are presently under-served or un-served and helps expand energy access from the present rate of 70% of households.	Well noted.
Implementation Plan and Capacity	
The Ghana IP identifies the Ministry of Power, the Energy Commission, and the AfDB and IFC as some of the agencies which will take the lead in implementing the proposed programs. However, the IP does not describe the implementation capacity of the local institutions nor does it provide a framework for how programs are proposed to be implemented. This aspect is addressed in greater detail in the comments on specific programs.	A broad level framework for implementation and capacity of implementing agencies has been provided and demonstrated in the on-going/current efforts. The framework for how the programs would be implemented has been provided.
Long-Term Economic Viability of the RE Sector	
The support for off-grid and grid connected programs and for technical assistance is likely to have a positive impact on the long-term viability of the RE sector. It is not clear from the IP if the programs will have a transformative impact on RE installations in Ghana. This aspect is addressed in greater detail in the comments on specific programs.	Provided. Refer to results framework and concept notes as well the investment section.
2.0 GENERAL COMMENTS ON THE GHANA IP	
Ghana is doing relatively well economically and has a relatively high rate of energy access (70%) among countries in sub-Saharan Africa. The country plans to expand energy access to 100% by 2016 (a target which has been moved forward form 2020) and also plans to generate 10% of its electricity from RE by 2020. The IP could make a stronger case for the need for SREP financing to further expand energy access and promote increased installation of RE systems.	Well noted. SREP rational has been strengthened for each proposed investment project.
The IP provides a lot of data and information on the energy sector and while some of it is referenced, the source for some information is not cited. It is suggested that the IP provide footnotes or endnotes with references for all statistical data and other information.	Noted and addressed.
The IP references the generation expansion master plan for Ghana but does not provide any details of planned generation. It is suggested that the IP provide a brief summary of the generation plants proposed in the master plan, including any planned RE systems to meet the 2020 target and the forecast average (and/or marginal) cost of generation. This would provide useful context for understanding the challenge of financing RE in the country, despite the fact that retail tariffs have been periodically increased to allow utilities to recover costs without subsidies.	Provided in Section 3 Figures 5 to 7.

Peer Review Comment	Response
The IP describes the Feed-in-Tariff (FIT) mechanism in Ghana and cites some of the challenges including the fact that it offers only a 10-year validity, which is cited as being inadequate for RE. It is suggested that the IP provide a summary description of how the FIT was estimated (marginal cost based, rate of return based, etc.) and describe why it is considered inadequate by project investors. This would strengthen the rationale for SREP financing for promoting RE systems.	As described in the IP, the current FiT in Ghana are offered for a maximum 10 year PPA, which is considered too short a period to attract the long-tenor private financing necessary to make utility-scale projects cost-effective and financially sustainable. RE projects typically have payback periods considerably longer than 10 years, thus investors are unwilling to commit to revenue uncertainty beyond 10 years.
Feedback from stakeholder consultations identifies the key issues for increased RE to be the lack of a streamlined process for RE project development, lack of clarity in the FIT mechanism, the need to effectively implement the existing regulatory framework, need to improve access to data on RE resources and affordable financing. The proposed programs in the IP address these key challenges.	Well noted.
The description of the GEDAP appears to indicate that there is customer willingness to pay for stand-alone RE solar home systems (SHS) and one of the principal challenges is the capacity of solar PV suppliers to obtain adequate financing for working capital. It also appears that GEDAP was a success with financing support from ARB-APEX Bank. It is stated that the business model, while successful, is not replicable due to internal bank restructuring which has led it to focus on other core banking functions. The implication appears to be that the GEDAP model was successful in piloting mini-grid projects and would continue to succeed if the bank had not restructured and changed priorities. It is suggested that the programs in the Ghana IP clearly demonstrate how they are building on this successful business model which needs the participation of more committed financial institutions rather than concessional financing.	Yes and clearly demonstrated in the revised IP.
The IP indicates that Ghana has developed a framework for a RE Fund (REF) to provide long-term financing support for development of RE resources. The legal and regulatory framework also appears to create an enabling environment to promote RE and attract private sector investment. It indicates that studies are being conducted with MDB support to address challenges to mini-grid and stand-alone RE systems. The IP also states that the Ministry of Power has plans to install RE systems with a total investment of USD 1.4 to 2.6 billion. The Government, with the support of MDBs and donor agencies also appears to be comprehensively addressing the various barriers to implementation of RE. The IP would be strengthened if it clearly described how the proposed programs build on these efforts and the technical assistance components complement rather than duplicate these efforts.	IP is building on these efforts by addressing the bottlenecks and piloting prioritised projects for potential scale-up.

Peer Review Comment	Response
3.0 PROGRAM SPECIFIC COMMENTS	
General	
The IP provides no information on proposed processes to implement each investment program other than stating the names of agencies that will lead the effort. It is suggested that the IP provide an indicative implementation process for each program component, which is best suited to achieve the objectives of the program and its components.	A high-level implementation schedule has been proposed for each project. Implementation modalities for the whole program are also discussed. As the projects are currently at the concept stage, the detailed implementation modalities will be defined during Phase 2 of the program, with the assistance of the PPGs.
The IP does not address how operations and management (O&M) will be provided and funded for the proposed pilot projects. It is suggested that an indicative O&M plan be included. This is especially important since past learning has indicated that program failures and loan defaults occur when O&M fails.	Same comment as above for the O&M, which has been discussed at high-level in the IP. A detailed O&M plan will be developed during the preparation phase of the projects.
The IP does not provide or propose a viable mechanism for channeling MDB funds to the various programs and their components. It is suggested that a schematic be included to indicate the channeling of SREP and MDB funds consistent with their requirements. The channeling of GoG and private sector funds should also be indicated.	Same comment as above for the financial management details. A detailed financial management assessment will be undertaken during the preparation phase of the projects.
The IP does not provide adequate information on how it proposes to leverage SREP support to raise additional funds of at least four times the financing sought from SREP.	The financing plan for the program is presented in the IP. USD 40 million will leverage an additional USD 190 million from the GoG, DPs and the private sector. There has been a tremendous amount of interest from DPs during the preparation of the investment plan. Once the projects are prepared, the lead MDB will seek co-financing from the DPs.
Renewable Mini-Grids and Stand-Alone Solar PV Systems	
It is suggested that the IP clearly state how the proposed mini-grid systems will demonstrate learning, which is distinct from the learning for other pilot projects and ongoing efforts. This is especially important since the proposed program is premised on public financing for mini-grids, which would suggest that it will be replicated when public financing supplemented by concessional financing becomes available.	Under the technical assistance component, there will be a fine-tuning of proposed ownership, operation and management models. That fine-tuning will be informed by the lessons learnt from the existing models and initiatives.
The IP states that 55 mini-grids will be installed. It is suggested that the IP provide some details such as the typical size of the planned mini-grids, the source of generation, the number of households to be connected within each mini-grid, the average generation cost (based on proposed RE generation), cost of the mini-grid system, etc. The systems costs are important to provide context to the SREP support and total financing (including leverage) being sought for the program.	Provided in Section 5.3.1.

Peer Review Comment	Response
The IP also provides the total number of stand-alone solar PV systems to be installed at households and public facilities. It is suggested that the IP provide some details of the programs such as the typical size the PV systems for each type of installation (household, schools, health centres, etc.), the average cost of installation, the provision of battery backup, etc. The systems costs are important to provide context to the SREP support and total financing (including leverage) being sought for the program.	Provided in Section 5.3.2.
The financing plan for this program should be clearly demarcated between the two program components: publicly financed mini-grids and private sector led solar PV stand-alone systems. The IP presently provides a total budget for the combined components.	Provided in Section 5.3.3.
Solar PV Based Net Metering	
The program description appears to emphasize the demonstration of the viability of solar PV systems with optimal storage to address issues related to grid reliability. Presumably, a pilot project is not needed to examine just the financial viability of solar PV systems with storage backup. The emphasis rather should be on demonstrating the merits and challenges of feeding power back to the grid and the issues related to grid stability and net metering. The IP, in fact, states that the program may face the same challenges as a much larger program to install 200,000 rooftop net-metered solar PV systems. The IP should therefore make a clear case for why this program is needed when the larger program will also presumably demonstrate and examine issues related to net metering.	Well noted. The description has been re-written to reflect the challenges. It should be noted that the 200,000 program is somehow different from this net-metered project as it will be deploying stand alone systems and not grid-tied ones as is the case with net metering.

Peer Review Comment	Response
The IP states that affordability of SPV has not been a challenge and it is primarily the equipment suppliers who have lacked the capacity to mobilize working capital. Given the past experience with commercial bank support for a stand-alone SPV installation, the IP should clarify why concessional financing is necessary for the proposed small systems with storage, especially given the relatively high tariffs in Ghana.	Well noted. The text has been updated to reflect the following: "Considering the high upfront cost and the perceived high risk of financing renewable energy projects, concessional financing from SREP would help reduce the upfront investment cost of net metering with storage option and boost demand and customer confidence. Since the completion of the pilot grid-connected solar PV project, additional funding to scale-up the project could not be secured to date. SREP could leverage the required financing and provide the appropriate framework to scale-up the pilot grid connected project. The experience in Ghana could then be replicated in the ECOWAS sub-region and create new economic opportunities for the renewable energy industry. In addition, by catalysing the first net-metered renewable energy project in Ghana through SREP, technical losses in the network would be reduced. Improvement in local network voltage will also become evident as there will not be the need for power to be transmitted from afar. Customers would also be able to reduce their dependency on the grid and electricity bills in the wake of increasing tariffs."
The program indicates that 15,000 systems are to be installed. It is suggested that the IP provide some details of the programs such as typical size(s) of the system(s) to be installed at each facility and the indicative costs. The systems costs are important to provide context to the SREP support and total financing (including leverage) being sought for the program. The project component could also include examining the impact of net metering on utility revenues and cost recovery.	The sizes of the systems depend on the consumption profiles of customers. These could typically range from 500W to 15kWp. The estimated cost would be from USD 1,200 to USD 37,500 per system.

Peer Review Comment	Response
Utility-scale Solar PV/Wind Power Generation	
The IP notes that 25 grid-connected solar PV installations with a combined capacity of 7 MW are operational and an additional 20 MW project is under construction. A further 15 IPPs have been provided clearances by the Energy Commission. The IP should clearly identify the rationale for this proposed program, which essentially is designed to develop a streamlined, transparent, and competitive mechanism for grid-connected solar and wind projects.The IP should also distinguish the merits of the program since the country already has developed a FIT mechanism, which too is designed to procure grid-connected RE through a transparent and streamlined mechanism (though not necessarily a competitive mechanism since the tariffs are fixed). While the present FIT mechanisms appear to have some drawbacks which need to be fixed to attract investments, the IP appears to focus on competitive mechanisms where each PPA has to be negotiated. If that is the objective, it should be made clear and should be shown to build on Ghana's experience in attracting IPPs.	In response to the first part of the comment related to the technical assistance component of the Utility-scale Solar and Wind Project, the comments have been acknowledged. After further discussions and consultations, the Government has decided to exclude the TA component for this project from the SREP Investment Plan. The activities proposed under this component will be further revised and considered under different initiatives carried out by the Government. In response to the second part of the comment, whilst a change in the regulatory framework may be necessary in the medium to long-term in order to further enhance the RE FIT mechanism, this is a lengthy and cumbersome process that requires careful study and some initial experience with the existing mechanism. The objective of the investment component of the project is to support the development of the first RE projects under the existing regulatory framework in order to demonstrate both its strengths and weaknesses. Its weaknesses can then be understood in more detail and in the context of real (as opposed to theoretical) experience, which will enable more informed and effective enhancement of the regulatory framework. The technical assistance component for this project has been dropped.
Among the challenges to utility-scale grid connected RE cited in the IP are the weak transmission and distribution network in Ghana and the weak financial capacity of off-takers to purchase RE power. It is suggested that the IP state how these challenges will be addressed.	Concessional financing from SREP can help mitigate the perceived investor risk of weak off-takers by helping to bring RE project tariffs down to more affordable levels, thereby reducing the future burden of RE on financially challenged Ghanaian utilities. By catalysing the first utility-scale RE projects in Ghana, SREP will also help Government carefully assess the grid impact of utility-scale RE and make more informed planning decisions for scaling-up RE in the future. The above explanation will be added to the IP as suggested.

Peer Review Comment	Response
The IP indicates that there is a lot of interest in developing wind energy projects in Ghana. WB is supporting wind resources assessments. VRA has plans for a 150 MW wind farm and is conducting assessments. A Swiss firm has a license for a 250 MW wind farm and is conducting feasibility studies. Another firm has a license for a 30-50 MW wind farm and is conducting studies. Granted these have not yet been installed, but it does not point to lack of private investor interest. The IP should clearly indicate how the proposed programs are distinct from these other efforts, or what specific challenges it will help overcome that the other planned wind energy projects do not address.	Whilst a small number of firms have invested limited amounts in the early development of RE projects to date, no wind project has reached financial close or started construction, and only one corporate-financed solar PV project is underway. There are no utility-scale RE plants in Ghana today due to challenges described in the IP, including: lack of long-term financing; limited experience and track record of RE project development by sponsors; and perception of payment risk related to the newly gazetted tariffs or FiTs. SREP will help the first utility-scale RE projects obtain appropriate long-term financing, demonstrate the Ghanaian RE sector potential to financiers and help attract further investment in the future.
Size and cost for the planned investment project should be provided to show the context to the SREP support and total financing (including leverage) being sought for the program.	The information is included in the project description annexes as well as in the results framework table. With respect to the private sector investments under Project 3 (Utility-Scale Solar PV and Wind Project), it is anticipated that a project will average 20 MW in size, and each USD 1 of SREP funds will leverage at least USD 1 from IFC, USD 1 from the private sector window of the AfDB and USD 2 from the private sector.
Technical Assistance	
The IP proposes three components to this programs that will address technical, financial and regulatory/institutional challenges to increased uptake and private sector investment in RE projects. It is suggested that the IP indicate how it will build on and be distinct from other efforts which also seek to address challenges to scale-up of RE.	Clearly demarcated in Section 5.3.4.
The financing plan for this component provided in Annex 1 needs to be revised to indicate proposed program budget and SREP support.	Well noted and revised appropriately. There is no SREP support requested for this component as it will be funded with the AfDB-managed SEFA trust fund and other DPs.