CTF PRIVATE SECTOR PROPOSAL

Name of Project or Program	**Utility-Scale Solar PV Sub-Program: Stage 2**
CTF amount requested	Investment – up to USD 34.25 million Implementation and supervision budget – USD 0.75 million Total amount – up to USD 35.0 million
Country targeted	CIF countries across Africa and LAC regions, with initial pipeline in some of following countries: Burkina Faso, Egypt, Mozambique, Rwanda, and Uganda
Indicate if proposal is a Project or Program	Sub-Program under the DPSP Phase II, Utility-Scale Renewable Energy: Solar Photovoltaic program

1 DETAILED DESCRIPTION OF THE PROGRAM

1.1 Proposal Context

IFC's *Utility Scale Solar PV Sub-Program* (the "*Sub-Program*") is part of the *CTF Utility-Scale Renewable Energy: Solar Photovoltaic program* (with an allocation of USD 95 million), under the *CTF Dedicated Private Sector Programs* (DPSP) – *Phase II*, endorsed by the CTF Trust Fund Committee (TFC) in June 2014. *Stage 1* of the *Sub-Program*, approved by the TFC in September 2014, made USD 20 million available for investments in solar PV power plants in Honduras. In just a few months, in December 2014, IFC announced the financial closure of a USD 146 million investment with SunEdison, a leading solar developer, to build a series of three utility-scale solar PV power plants with aggregate capacity of about 82 MW.[1] This investment became the first project committed under the CTF DPSP and the largest solar power development in Central America to date. The plants are now under construction and on track to meet the expected generation target of approximately 168 GWh/year of energy, helping reduce 70,000 tons of CO_2 equivalent (tCO_2e) per year. This CTF investment has begun establishing an initial track record of utility-scale solar PV projects under the new regulatory framework, while demonstrating the viability of the sector in Honduras.

This Proposal forms *Stage 2* of IFC's *Sub-Program* and aims to capitalize on the successful implementation of *Stage 1* in Honduras by expanding and broadening solar PV development to a larger pool of countries across Africa, and Latin America and Caribbean (LAC) in line with the stated objectives of the *DPSP Solar PV program*. As indicated in DPSP Phase II[2], in many countries across these two regions, "[] *conditions for solar photovoltaic projects are optimal and solar PV not only represents significant potential in these markets in terms of improving and diversifying the energy mix with a low carbon technology but also the potential to provide positive benefits to end-users by ensuring greater energy access and improvements in affordability."*

By supporting several **first-mover** private sector investments in utility-scale solar PV plants in up to three additional countries, the *Sub-Program* will establish the bankability of solar PV under emerging regulatory frameworks and contribute to lowering the cost of electricity. Through providing a critical

[1] Climate Investment Funds, *IFC, CTF and SunEdison partner on largest solar power effort in Central America,* 2015. Accessed in June 2015 at http://www.climateinvestmentfunds.org/cif/node/17425

[2] Climate Investment Funds, *Dedicated Private Sector Programs Proposal for Phase II*, 2014

demonstration effect the *Sub-Program* will also stimulate additional private sector participation in financing renewable energy (RE) projects, while diversifying the energy mix. As such, the *Sub-Program* will contribute to the reduction of a burdensome reliance on expensive fossil fuel imports and possibly decrease the negative effect of fossil fuel subsidies on public finances.

This *Stage 2* of the *Sub-Program* will respond to the regional nature of the DPSP, expanding beyond the successful work in one country (Honduras) to generate a broader impact. Eligible countries for participation in the *Sub-Program* will include all CIF countries in Africa (except South Africa) and those countries from the LAC region where the utility-scale solar PV sector has not yet reached commercial viability (countries like Chile and Mexico are, therefore, excluded). Sub-projects under this *Sub-Program* will seek synergies with the work being undertaken under CIF Country Investment Plans (CIP).

The *Sub-Program* will leverage a strong pipeline of solar PV projects that IFC has already built across the LAC and Africa regions. Not all the project from the current pipeline will be able to reach financial closure, but those that will are expected to be undertaken in a difficult environment and will likely require significant efforts and, therefore, relatively high level of concessionality. To continue developing this pipeline, IFC seeks an approval for USD 35 million of CTF funds for *Stage 2* of *IFC's Utility-Scale Solar PV Sub-Program.*

1.2 Regional Context

Many CIF countries in both Africa and LAC face common challenges to boost development and grow their infrastructure base. Specifically, one of the key barriers to economic development is the lack of reliable, affordable supply of power to meet commercial, industrial, and residential needs. Existing power generation capacity in many countries is not sufficient to meet demand, access to energy is often low, and the costs of existing generation in some countries are the highest in the world. At the same time, both regions are expected to face serious consequences of climate change that will affect agriculture productivity, food security, and biodiversity. Further, temperature and precipitation changes will adversely impact both Africa and LAC's hydrological regimes, reducing regions' ability to rely on hydropower generation and potentially increasing the role of fossil fuel generation.[3,4]

Africa

After decades of development challenges, many African economies appear to have started to shift towards sustainable growth: real income per person in the continent has increased more than 30% in the past ten years, whereas in the previous 20 years it had contracted by almost 10%. Driven by increasing infrastructure investment, higher agriculture production, and expanding service sector, Africa's GDP grew by 5% in 2014, surpassing the global average by 1.5%. While low commodity prices and lingering effects from the Ebola crisis may soften region's 2015 economic growth, a rebound to 5% is expected in 2016.[5] Investors have taken note of the region's economic potential, ramping up foreign direct investments (FDI) from USD 15 billion in 2002 to an estimated USD 87 billion in 2014.[6]

[3] The World Bank Group, *Climate Change: Is Latin America Prepared for Temperature to Rise 4 Degrees?*, 2012. Accessed in June 2015 at http://www.worldbank.org/en/news/feature/2012/11/19/climate-change-4-degrees-latin-america-preparation

[4] Notre Dame Global Adaptation Index, *Country Rankings*, 2015. Accessed June 2015, http://index.gain.org/ranking/vulnerability

[5] C. Fingar, *Foreign Direct Investment in Africa Surges*, Financial Times, May 19, 2015. Accessed in June 2015 at http://www.ft.com/cms/s/0/79ee41b6-fd84-11e4-b824-00144feabdc0.html#axzz3fPcnUnyd

[6] The University of Cambridge and PwC for the National Bank of Abu Dhabi, *Financing the Future of Energy*, 2015. Accessed in June 2015 at www.nbad.com/content/dam/NBAD/documents/Business/FOE_Full_Report.pdf

However, further significant development efforts are needed. Almost half of Africa's population (that has exploded from 507 million in 1990 to 936 million in 2013), lives on USD 1.25 a day or less.[7] Currently, Africa generates only 1% of global GDP and just 2% of world trade.[8] One of the biggest obstacles to sustainable, long-term economic growth is the shortage of investment in critical infrastructure, which is estimated at over USD 90 billion annually.[9] Currently, only USD 25 billion/year is being invested, leaving a major financing gap that cash-strapped governments are unable to fill.

Latin America

Since 2001, the LAC region has witnessed strong economic growth rates that have surpassed many developed economies, resulting in higher standards of living across the region. Over the past ten years, Latin America has lifted 70 million of its citizens out of poverty, while expanding its middle class by over 50%.[10] LAC's current gross national income per capita is USD 9,542, and the percentage of people living on up to USD 1.25 a day in the region has plummeted from 12.2% in 1990 to 4.6% in 2011.[11]

Nevertheless, Latin America faces significant hurdles to continued economic growth, prompting many countries to refocus public spending to help stimulate the economy while keeping inflation in check. In addition, strained government budgets and shrinking development finance flows (LAC attracted just 29% development finance during 2001 – 2011 period, compared with over 50% in the previous 10 year period) are making it more difficult to overcome Latin America's USD 200 billion annual infrastructure investment gap.[12] At the same time, energy use continues to grow across the region.

1.3 Energy Sector Context

Both Africa and LAC are in need of significant amounts of new energy infrastructure to continue driving economic growth. However, the two regions face very different energy access scenarios. For example, over the past four decades, a number of electrification programs in the LAC region have generated rapid increases in power access across residential, commercial, and industrial sectors.[13] On the other hand, Africa's access rates remain severely limited. Approximately 600 million Africans still live without access to electricity. Many businesses that do have access to grid-connected electricity experience an average of 8 power outages per month.

The energy mixes in these two regions are also quite different. Currently, Latin America has the cleanest electric grid in the world (measured by carbon intensity) as hydropower comprises over 60% of the region's power generation.[14] However, overreliance on hydropower is emerging as a significant

[7] The World Bank Group, *Regional Dashboard: Sub-Saharan Africa*, 2015. Accessed in June 2015 at http://povertydata.worldbank.org/poverty/region/SSA

[8] Deloitte, *Addressing Africa's Infrastructure Challenges*, 2013. Accessed in June 2015 at https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/dttl-er-africasinfrastructure-08082013.pdf

[9] African Development Bank Group, *Infrastructure Finance*, 2015. Accessed in June 2015 at http://www.afdb.org/en/topics-and-sectors/sectors/private-sector/areas-of-focus/infrastructure-finance/

[10] The World Bank Group, *Latin America and Caribbean Overview*, 2015. Accessed in June 2015 at http://www.worldbank.org/en/region/lac/overview#1

[11] The World Bank Group, *Regional Dashboard: Latin America & Caribbean*, 2015. Accessed in June 2015 at http://povertydata.worldbank.org/poverty/region/LAC

[12] K. Hughes, L. Kriel, *Latin America Taps Private Sector for Infrastructure Needs*, Reuters, March 17, 2013. Accessed in June 2015 at http://uk.reuters.com/article/2013/03/17/uk-iadb-infrastructure-idUKBRE92G0EW20130317

[13] R.A Yepez-Garcia, T.M Johnson, L. Alberto Andres, *Meeting the Electricity Supply/Demand Balance in Latin America & the Caribbean*, The World Bank Group, 2010. Accessed in June 2015 at http://siteresources.worldbank.org/EXTLACOFFICEOFCE/Resources/LACElectricityChallenge.pdf

[14] R. Tissot, *Latin America's Energy Future, Inter-American Development Bank*, Discussion Paper No. IDB-DP-252, 2012. Accessed in June 2015 at http://www.iadb.org/wmsfiles/products/publications/documents/37670565.pdf

challenge in the face of climate change-influenced impacts, such as droughts. LAC electricity demand is expected to double by 2030, which will further worsen the resilience of energy supply, as large amount of additional 239 GW of projected installed power capacity is likely to come from hydropower.[13]

Like LAC, Africa is expected to see a significant increase in power generation capacity. In 2012, Africa's total electricity capacity was 165 GW, with natural gas (36%), coal (25%), oil (20%), and hydro (15%) making up the bulk.[15] It is expected to increase by nearly 400 GW by 2040. However, despite abundant RE resources, most of the new capacity is likely to come from coal, natural gas, and hydro power.[16] While various initiatives, such as the USAID-supported Power Africa initiative[17] or World Bank Group's Scaling Solar program, already working toward mobilizing expertise and private sector investments, the sheer scale of power sector needs will necessitate additional effort and facilitation. Without such targeted efforts countries across Africa and LAC will increasingly rely on volatile (and often imported) energy supplies such as natural gas, coal, and oil/diesel, hampering trade balances and foreign currency reserves.

To increase the sector's attractiveness for investors, many African and LAC governments have made the restructuring of their respective power sectors a key priority. Additionally, in order to help diversify power generation and move towards a low carbon economy, some governments across Africa and LAC have also begun establishing policy conditions to stimulate growth of RE generation capacity. Thanks in part to these supportive measures as well as to targeted financial flows from the climate finance community, some middle income countries in the regions, such as Chile, Mexico, and South Africa, have already attracted substantial investments towards RE sector. Others, including many IDA countries, are setting aspirational RE goals and laying regulatory groundwork that could help attract private sector investment to RE sector. Some of these include:

- Colombia – The government has set a target of 6.5% of its electricity to come from renewables (excluding large hydro) by 2020[18];
- Egypt – In 2014, the government enhanced its regulatory framework to include a feed-in tariff scheme for both solar and wind projects[19];
- Nigeria – In 2012, Nigeria updated its RE master plan that seeks to increase the supply of RE from 13% of total electricity generation in 2015 to 23% in 2025 and 36% by 2030.[20]

1.4 Solar PV Sector Context

Over the recent years, solar PV technology began to emerge as an economically viable alternative to fossil fuel generation and an effective component of countries' power mixes.[21] As technology costs continue to fall, PricewaterhouseCoopers (PwC) and the University of Cambridge forecast that solar PV will approach grid parity in 80% of countries around the world by 2017.[6] Specifically, as many African and LAC countries feature strong solar irradiance resources, solar PV has the potential to transform grids.

[15] International Energy Agency, *Africa Energy Outlook*, 2014. Accessed in June 2015 at http://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf

[16] Bloomberg New Energy Finance, *H2 2014 Sub-Saharan Africa Market Outlook*, BNEF, 2014

[17] USAID, *Power Africa*, 2015. Accessed in June 2015 at http://www.usaid.gov/powerafrica

[18] International Renewable Energy Agency, *Renewable Energy in Latin America 2015: An Overview of Policies*, IRENA, 2015. Accessed in June 2015, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Latin_America_Policies_2015.pdf

[19] R. Harker, S. Stevens, C. Steyna, *Egypt's Renewable FiT Program Gains Traction*, *Renewable Energy World*, 2015. Accessed in June 2015 at http://www.renewableenergyworld.com/articles/2015/04/egypts-renewable-fit-program-gains-traction.html

[20] GIZ, *The Nigerian Energy Sector - an Overview with a Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification*, November 2014. Accessed in June 2015, http://www.giz.de/en/downloads/giz2014-en-nigerian-energy-sector.pdf

[21] European Photovoltaic Industry Association, *Global Market Outlook for Photovoltaics 2014-2018*, 2014. Accessed in June 2015 at http://www.epia.org/fileadmin/user_upload/Publications/EPIA_Global_Market_Outlook_for_Photovoltaics_2014-2018_-_Medium_Res.pdf

Indeed, a few African and LAC countries, like Chile and South Africa, have attracted a significant pipeline of utility-scale solar projects. However, apart from these and few other leading markets, utility-scale solar PV is virtually non-existent in CIF countries in Africa and LAC (see Annex A). In fact, 30 of the regions' CIF countries (11 in LAC and 19 in Africa) are home to only 315 MW of solar PV capacity, or the equivalent of 3-6 large-scale solar PV plants. These countries, which account for approximately 30% of the world's land area, account for only 0.2% of installed solar PV capacity.

For investors, the expected rapid growth of solar PV sectors in Africa and LAC present a significant opportunity. Given that utility-scale solar PV can be deployed in a rapid (large facilities can be constructed within 3-6 months), flexible, and scalable manner, developers continue exhibiting strong interest in leveraging investment opportunities. Yet, multiple challenges – especially first-mover disadvantages and non-existent local finance – still prevent private sector investments from flowing into RE sectors of these countries. Development finance, concessional support, and technical expertise are all needed to help demonstrate bankability of solar PV projects and unlock solar PV (and other RE) investments in these markets.

1.5 Barriers to Private Sector Investment

Despite considerable utility-scale solar PV potential in Africa and LAC, developers and investors have entered only a handful of CIF countries in these regions. While solar PV is an established technology in most of Africa and LAC, first-movers face significant market barriers, typical to the development of first-in-kind RE projects. Even projects awarded with power purchase agreement (PPAs) are likely to hit various challenges in reaching financial closure. The key barriers include:

- High transaction costs. Transaction costs of solar PV projects in African and LAC target countries are expected to be relatively high, averaging up to USD 2 per watt of installed capacity. These elevated costs reflect i) investment in time required by developers to individually negotiate non-standard or novel PPAs; ii) additional efforts for developers and financiers in assessing, managing, and mitigating off-take risks of power utilities that often have low credit ratings, high leverage, and poor management; (iii) difficulties associated with designing one-off financing; (iv) lack of infrastructure and options for transportation arrangements, with some of the projects facing the need to haul equipment for over 1,000 miles from sea ports to a destination point under poor road conditions; (v) many other challenging associated with first-mover projects;
- Limited ability to raise financing. International banks tend to shy away from these countries due to country and off-taker risk. Likewise, local/regional banks face restrictions on regulatory capital and maturity mismatches: banks typically do not offer loans for more than 8 years, whereas utility-scale solar PV projects require a tenor of 12 or more years to ensure bankability of projects and competitive cost of generation. Furthermore, as utility-scale solar PV is effectively non-existent in the vast majority of Africa and LAC countries, local banks often have limited or no experience in assessing and lending to solar PV projects;
- Lack of capacity and challenges linked to the learning curve. In most cases, project parties will have to enter a new market, new sector, or develop a new business model. Operating in an environment that often lacks an established supply chain, experienced local EPC contractors, knowledgeable off-taker, etc. increases the cost and time to build, manage, maintain, and repair solar PV systems. This lack of capacity increases risks for project sponsors and investors during the entire period of operations, as prolonged system downtimes and costly repairs can have major cash flow implications. In addition, project parties often have limited experience in addressing environmental and social impacts, and potential issues regarding land acquisition. IFC participation in projects will ensure application of high performance standards, but the needed learning curve and additional due diligence steps will add up time and costs;
- Permitting and regulatory compliance. The regulatory environment in most low income countries in both Africa and LAC has not been commercially tested. While most of African and LAC

countries have RE policies and/or targets,[22] many countries have not provided regulatory support necessary to drive investment in the sector. For example, Mozambique has a goal to develop 2 GW of solar PV, but is yet to provide the market with supportive regulatory policies such as a feed in tariff, electric utility quota/RPS, or investment/production tax credits. Furthermore, in order to minimize regulatory risk, the legal framework, under which the project operates, must be clear and not open to dispute. Project developers require a clear processes and procedures to obtain necessary project approvals and ultimately complete projects according to a pre-specified timeline and budget. Yet, many countries in the regions have overly complicated and/or unclear permitting processes for utility-scale RE projects that drive away private sector sponsors;

- Weak transmission network and/or unreliable grid. The grid's ability to absorb and transport generation to load centers is often limited or unknown, adding cash flow risk to potential RE projects. Often, sponsors are required to pay for new distribution infrastructure (such as a new substation or grid improvements), as local utilities do not have the capital available to do so themselves. In addition, the impact of integrating large amounts of variable/intermittent power generation into electricity grids throughout Africa and LAC countries, many of which rely on very small amounts of existing power capacity (e.g. Eritrea, Botswana, and Niger each have less than 200 MW of installed power capacity),[23] could create major technological challenges to balance of supply and demand, and maintain grid reliability;
- Off-taker and country risk. Many state utilities in Africa and LAC are in a weak fiscal position with a low credit rating due to high leverage, revenue uncertainty, and growing Capex requirements, which have led many utilities to operate below cost-recovery levels. In these conditions, sponsors may find that long term PPAs, which are critical to the commercial feasibility of utility-scale solar PV, are not bankable without additional insurance or enhancements, which are often either unavailable or come at a high cost. Furthermore, high poverty levels, periodic civil unrests, systemic corruption, and unstable political situations further increase project risk for investors and sponsors.

While governments are attempting to overcome the last three of the barriers listed above, concessional finance can create a significant momentum in surmounting the first three – which are linked with first-mover disadvantages. It is likely that the barriers faced by sub-projects in *Stage 2* of the *Sub-Program* will be higher than those faced in *Stage 1*. Remote locations, risky markets, and low levels of on-the-ground capacity associated with sub-projects, will likely result in a higher technology cost and a greater need for concessional support. While these barriers will add complexity to the projects, initial successes in these frontier African and LAC markets can help governments further enhance the policy and regulatory environment for developers and investors, contributing to continued sector growth and bringing down future project costs.

1.6 Program Description

The *Sub-Program* will continue the transformational effort started in *Stage 1* in Honduras and will expand and catalyze the development of the solar PV sector in other countries by addressing the barriers discussed above. It will support some of the first utility-scale private sector solar PV plants for a combined capacity of up to 90 MW in order to: (a) generate a demonstration effect and help create a track record of the successful financing of solar PV projects; (b) support emerging regulatory frameworks and demonstrate bankability of new PPAs; and (c) stimulate the entry of commercial lenders into new solar PV markets.

[22] REN21, *Renewables 2015 Global Status Report*, 2015. Accessed in June 2015 at http://www.ren21.net/wp-content/uploads/2015/06/REN12-GSR2015_Onlinebook_low1.pdf

[23] US EIA, *International Energy Statistics*, 2015. Accessed in June 2015 at http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=7

Stage 2 of the *Sub-Program* will draw upon experience of the work in Honduras and will largely maintain the same objectives, approaches, and investment structures, as was laid out in the original *Sub-Program* proposal (approved by the TFC in September 2014). The *Sub-Program* will continue to deliver new RE capacity that will increase energy supply, improve access to sustainable electricity, displace carbon-intensive generation, and reduce import of fossil fuels. As solar PV generation typically matches the demand curve, the new capacity may also allow utilities to shift hydropower resources from daytime to evening use, reducing the need for often costly peaking power resources, like diesel. Therefore, the *Sub-Program* can lower generation costs in many markets and improve financial positions of associated utilities by mobilizing significant private investment. Increased use of solar PV in the targeted regions will also improve security of energy supply and cost stability (as a result of less reliance on the volatile supply and price of oil and gas).

Stage 2 sub-projects will be undertaken in those countries in Africa and LAC, where utility-scale solar PV technology is truly first of its kind. It is expected that these sub-projects will face significant first-mover costs as well as high perceived risks (as described above) that are likely to be higher than those of the *Stage 1* sub-project in Honduras. It is, therefore, anticipated that the sub-projects in the *Stage 2* proposal will require a somewhat higher level of concessionality per watt of installed capacity. As with the Honduras sub-project, the concessionality offered will be used to bridge gaps between lenders' debt service coverage requirements and sponsors' minimum return expectations and, as a result, to lower the project tariff burden for energy users.

Given the nature of the targeted markets, which are characterized by high political volatility and relatively weak institutional capacity, not all the sub-projects in the current pipeline will reach financial closure and the proposed timeline is subject to adjustments. The final selection of sub-projects will be made on the basis of the sponsors' commitment and ability to timely deliver on the project (as this is crucial for establishing a track record and enticing future developers). All sub-projects financed under the *Sub-Program* will be required to meet IFC environmental, social, governance and other compliance standards, as well as all country regulatory requirements. IFC's participation in the sub-projects will ensure that IFC's Performance Standards, including Environmental and Social guidelines, are implemented early on in the project development cycle.

CTF financing will aim to leverage at least the same amount in IFC financing. Overall, IFC expects the *Sub-Program* leverage to achieve around 4x of the CTF amount (including IFC, other development finance institutions, private sector, etc.).

1.7 Program's strategy to achieve market transformation

The *Sub-Program* will continue playing a broad transformational role in the solar PV sector by supporting some of the first utility-scale solar PV projects in up to three more countries. Sub-projects funded under the *Sub-Program* will establish an initial track record and demonstrate the viability of financing utility-scale solar PV projects by the private sector in a complex and evolving regulatory environment. The *Sub-Program* will also help to establish project financing standards and reference documentation for future solar PV projects in these nascent markets.

In the long term, the need for concessionality in a particular country is expected to diminish because: (i) the perception of risk will fall, prompting greater interest of commercial investors, lowering the cost of capital, and enabling future projects to achieve reasonable returns; and (ii) the domestic market will mature and build capacity in understanding the technology (equipment supply, engineering, advisors etc.), while global markets will continue to grow and equipment costs will continue to fall. The *Sub-Program* will further benefit from synergies with the efforts of many governments in promoting solar PV technology.

2 FIT WITH INVESTMENT CRITERIA

2.1 Potential GHG Emissions Savings

Calculations of potential GHG emissions savings are based on the following assumptions:

- Expected total installed capacity: up to 90 MW;
- Average expected capacity factor: 19%;
- Average Combined Margin emission factor[24] across some target countries: 0.48 tCO_2e/MWh; and
- Anticipated lifetime of sub-projects: 20 years.[25]

The sub-projects under Stage 2 of the *Sub-Program* are expected to directly generate GHG emission reductions of about 70,000 tCO_2e over a representative year and around 1,400,000 tCO_2e over the life of sub-projects.

Given that the *Sub-Program* may result in opening up an abundant solar PV sector in several countries, triggering a series of follow-up projects, IFC anticipates a significant replication effect. Assuming a multiple of at least 4x, the *Sub-Program*, therefore, could indirectly lead to GHG emission savings of 5,600,000 tCO_2e.

Total expected GHG emission reduction for both stages under IFC's *Solar PV Sub-Program* are indicated below:

GHG emissions reduction, tCO_2e		***Stage 1 (Honduras)***	***Stage 2***	***Total***
Direct:	Annual	70,000	70,000	140,000
Direct:	Lifetime	1,400,000	1,400,000	2,800,000
Indirect:	Lifetime	5,600,000	5,600,000	12,600,000

2.2 Cost-Effectiveness

Based on the above calculations and the expected *Stage 2* cost of USD 35 million, the implied direct GHG emission reductions per CTF USD will be 25/tCO_2e (or 0.04 tCO_2e/USD) over the life of the sub-projects and indirect GHG emission reductions per CTF USD will be 6.3/tCO_2e (or 0.16 tCO_2e/USD).

With the total investment cost of all sub-projects estimated to be around USD 175 million, the total investment per direct lifetime GHG emission reductions is expected to be around USD 125/tCO_2e.

The expected cost-effectiveness estimate under Stage 2 of the *Sub-Program* (expressed in tCO_2e/USD) is slightly lower than that projected for Stage 1 (Honduras) at the time of TFC approval, with the difference largely explained by more difficult investment conditions that results in increased transaction costs, less aggressive financing structure, lower leverage, etc. of the expected sub-projects under *Stage 2* comparing to those under *Stage 1*.

2.3 Demonstration Potential at Scale

Solar PV generation is fully proven, both technically and commercially, and there are widespread examples of successful application at scale around the world. Many countries in Africa and LAC have an

[24] For grid-connected renewable energy IFC follows the International Finance Institution (IFI) Approach to GHG Assessment in Renewable Energy. GHG emissions are estimated based on the combined margin emission factor.

[25] 20 years lifetime is selected for consistency of estimates with those provided in the *Stage 1* of the *Sub-Program*. Values of lifetime for individual sub-projects may vary.

attractive solar resource that can support large scale development of solar PV generation. Yet, expansion of the sector has been limited and CTF support is expected to be critical to enable initial projects, which could provide impetus for a significant market scale-up. Success of first-mover projects will showcase the role solar PV can play in satisfying an already significant power demand that continues to grow. In Africa alone, it is expected that continued economic expansion will drive a 300% increase in the continent's electricity demand by 2040, requiring the addition of some 7,000MW of new power capacity each year until 2020.

2.4 Development Impact / Co-benefits

Sub-projects under this *Sub-Program* are expected to enable and accelerate solar PV investments in the areas of Africa and LAC, where markets are in their infancy. Overcoming barriers to financing solar PV projects will nudge countries onto a cleaner growth path with a more diversified energy mix. In addition, the *Sub-Program* is expected to generate the following benefits:

- Improved financial sustainability of state-owned utilities. By enabling cost-competitive solar PV projects, the *Sub-Program* will help strengthen the financial sustainability of relevant state utilities, which often play a critical role in the host country's fiscal deficit. Sub-projects will also reduce fossil fuel consumption and reduce balance of payment pressure for governments that either import these fuels or rely on heavily subsidized domestic supplies;
- Lowering electricity costs. The *Sub-Program* will help diversify the power mix, reduce electricity price volatility, and lower the cost of electricity and, therefore, help support a lower cost structure for industries and consumers;
- Local employment. The *Sub-Program* will stimulate growth in local employment by engaging local labor during project construction and operation and by delivering more energy to the grid, allowing for expansion of businesses and communities;
- Spill-over effects. By accelerating the development of this sector in several countries, it is expected that the development of the sector in other African and LAC countries will also receive a boost.

2.5 Implementation Potential

IFC has a strong track record of supporting first-mover private sector solar PV projects – from pioneering PPAs in Honduras to merchant solar in Chile, and landmark transactions in Jordan, among others. IFC will combine its experience in financing hundreds of megawatts of solar PV with regional knowledge.

IFC is currently assessing market conditions and possibilities of undertaking investments in various projects employing solar PV technologies. The range of potential investments covers a pipeline of significant total installed capacity. Based on the status and expected needs of the projects in the pipeline, it is estimated that the total USD 35 million of CTF funds could support approximately 90 MW of solar PV capacity, leveraging about USD 140 million of private sector financing.

2.6 Additional Costs & Risk Premium

There is often aging, inadequate or non-existent grid infrastructure, which can impact the design and structure of a project. While some countries, such as Sierra Leone, have grid development programs in place, it is recognized that more grid infrastructure funding are required to achieve effective integration of RE generation into the grid.

2.7 Financial Sustainability

The first few utility scale solar PV projects in each country are expected to require concessional funding

support due to high transaction costs, high risks, uncertainty, and lack of country experience. Over time, however, the need for concessional funds will likely diminish. The perception of risk will decrease, attracting greater interest from domestic and international financial communities. Equipment costs will also continue to fall, allowing for prevailing market tariffs to become sufficient to deliver desired rates of return to investors. Transaction costs will also fall, governments will start seeing early benefits of scaling-up solar PV projects, and ultimately, market perception of the regulatory environment will improve.

Thus, the development efforts, persistence, and high costs encountered by the early movers in the sector, will ease the development and implementation process and lower entry costs for future project developers. These demonstration efforts will also improve the capacity of solar PV technology service providers (equipment supply, engineering, advisors etc.), and prove the technical and economic realities of solar PV. Through these mechanisms, the *Sub-Program* expects to promote the sustainability of utility-scale solar PV projects, thereby accelerating the development of the sector.

2.8 Effective Utilization of Concessional Finance

Concessional funding will:

- Enable sub-projects to obtain financing with terms not currently available on the market, but necessary for sub-projects to move forward;
- Allow IFC and other commercial investors to provide financing to sub-projects, reaching financial closure;
- Set a precedent of a series of successful projects under new regulatory frameworks;
- Directly enable the construction of a series of solar PV plants and indirectly stimulate the solar PV sector in several countries and across regions;
- Encourage private sector participation in solar PV projects.

2.9 Mitigation of Market Distortions

Concessional finance is specifically targeted at addressing first-mover costs experienced by project developers who enter the new, evolving and un-proven solar PV markets in Africa and LAC. The *Sub-Program* targets markets/countries that have seen few (if any) investments, so initial market distortions cannot be foreseen or measured. After the first investments, and as the markets mature and become better understood by financiers and developers, it is expected that commercial financing will flow, reducing the need for concessional funding.

The sub-projects supported under the *Sub-Program* will seek to minimize the use of CTF funds and maximize the leverage achieved from IFC and other private sector financiers. Actual terms of CTF funds will be determined on a project-by-project basis and will be designed in a way to support a project, while adhering to a principle of minimal concessionality and avoiding market distortions.

2.10 Risks

Potential risks associated with the *Sub-Program* include:

- Country risk. Many of the countries have uncertain political, economic, and security outlooks, making the provision of long-tenor financing challenging.
  Mitigants: Sub-projects will be carefully selected and reviewed to ensure that PPAs include typical protections, such as political force majeure, and other appropriate risk-mitigating products, as necessary;
- Ongoing sector reforms. Many of the targeted markets are in varying stages of sector reform,

with significant uncertainty associated with their evolution over the next few years. These reforms will affect the proliferation of projects and IFC's ability to quickly assemble a pipeline of projects;
Mitigants: The *Sub-Program* seeks funding for a broad spectrum of countries across Africa and LAC, ensuring that the portfolio is diverse and increasing the likelihood of deploying the funds;

- Untested regulatory environment and off-taker credit risk. Sub-projects are likely to operate under untested regulatory environments. In the case of outright termination of a PPA by the off-taker, the project would be forced to find alternative electricity buyers, possibly through sale to the spot market.
- *Mitigant*: These risks will be critically evaluated by IFC when negotiating specific financing structures with selected sub-projects. Residual risks stemming from the uncertainty of the PPA may be addressed through financial structuring measures, such as sizing the project and debt exposure against different scenarios, including various spot price projections;

- First mover risks. Initial private sector utility-scale solar PV projects will face typical risks associated with lack of experience and capacity in the sector.
Mitigant: The *Sub-Program* will benefit from IFC's selection of sub-projects with the right combination of sponsors and suppliers to maximize the chances of success. The *Sub-Program* will also benefit from IFC's global experience in financing private sector solar PV projects.

3 PERFORMANCE INDICATORS

The performance indicators outlined below are derived from the CTF Results Measurement Framework. These indicators will be tracked at least annually and will include:

Indicator	Current Baseline	Anticipated Impact
DIRECT IMPACTS:		
Increased supply of RE, MW	0	90
GHG emissions avoided: per annum, tCO_2e over 20-year life of sub-projects, tCO_2e	 0 0	 70,000 1,400,000
Incremental financing leveraged (of all non-CTF parties), USD million	0	140
Jobs created	na	na

Annex A: Installed Solar PV capacity in a set of the CIF countries in Africa and Latin America regions[26]

Year	*2000*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
World	**805**	**6,060**	**8,611**	**14,541**	**22,372**	**38,795**	**68,956**	**97,290**	**135,503**	**175,305**
Countries[27]										
Africa, CIF countries (without South Africa)	***18***	***37***	***43***	***52***	***56***	***79***	***91***	***116***	***147***	***165***
% of the world PV capacity	***2.2%***	***0.6%***	***0.5%***	***0.4%***	***0.3%***	***0.2%***	***0.1%***	***0.1%***	***0.1%***	***0.1%***
Algeria	2	2	2	2	2	2	2	2	2	2
Benin	0	0	0	0	0	0	1	1	1	1
Burkina Faso	1	1	2	2	3	4	6	6	6	7
Congo							0	0	0	0
Egypt	0	1	1	1	1	15	15	15	15	15
Ghana									2	2
Kenya	7	11	12	12	13	15	18	34	50	60
Libya		2	2	3	3	4	4	5	5	5
Madagascar		0	0	1	1	2	3	3	3	3
Malawi			0	0	0	0	0	0	1	1
Mali		1	1	2	2	2	2	4	6	6
Morocco	7	11	12	13	13	14	14	15	16	17
Mozambique							0	0	1	1
Niger	1	1	1	1	1	2	3	4	5	6
Rwanda			0	0	0	0	0	0	0	9
South Africa	8	16	17	18	20	23	67	72	147	922
Tanzania		0	0	1	1	1	3	5	8	11
Tunisia	0	1	1	1	1	2	3	4	5	6
Uganda	0	5	8	12	14	15	16	17	19	20
Zambia		1	1	1	1	1	1	1	2	2
LAC, CIF countries (without Chile, Mexico)	***0***	***0***	***0***	***1***	***1***	***1***	***3***	***87***	***90***	***150***
% of the world PV capacity	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.1%***	***0.1%***	***0.1%***
Bolivia										2
Brazil							1	4	6	15
Chile							4	6	8	368
Dominica	0	0	0	0	0	0	0	0	0	0
Ecuador		0	0	0	0	0	0	1	1	26
Grenada			0	0	0	0	0	0	0	0
Guatemala										5
Jamaica		0	0	1	1	1	2	2	2	4
Mexico	14	16	19	19	25	29	36	53	67	131
Nicaragua									1	2
Peru								80	80	96
St. Lucia					0	0	0	0	0	0
St. Vincent & the Grenadines							0	0	0	0

[26] IRENA, 2015, *Renewable Energy Capacity Statistics*, 2015.

[27] Data for several CIF countries across the two regions (including Ethiopia, Haiti, Honduras, Lesotho, Liberia, Nigeria, Sierra Leone) are not available.