CTF PRIVATE SECTOR PROPOSAL

Name of Project or Program	**Renewable Energy Grid Integration Program**
CTF amount requested	Investment – up to USD 29.45 million Implementation and supervision budget – USD 0.55 million Total amount – up to USD 30.00 million
Country targeted	South Africa
Indicate if proposal is a Project or Program	Program

1 DETAILED DESCRIPTION OF THE PROGRAM

1.1 Proposal Context

IFC's South Africa *Renewable Energy Grid Integration Program* (the "*Program*") seeks to help kick-start and accelerate transformative investments and private finance in energy storage and renewable energy (RE) in the country, in line with the stated objectives of the CTF DPSP IV Global Energy Storage Program (GESP).

As decided in the June 2019 CTF Trust Fund Committee meeting, the GESP was established to make concessional climate finance available for all CIF countries to support them in accelerating the deployment of energy storage solutions to scale up RE development. A major objective of the GESP is to support international progress toward fully decarbonized power generation, and transmission and distribution systems on a timescale consistent with achieving the overall objectives of the Paris Agreement. Energy storage will play a critical role in moving the world toward a clean energy transformation by integrating variable RE into existing and developing power grids, increasing the penetration of RE into power systems, creating a more flexible and reliable grid system, improving energy access, and promoting the electrification of different economic sectors. The GESP will consider three main types of storage technologies, i.e., chemical/electrochemical, mechanical, and thermal, which can be deployed along the electricity value chain.

This funding proposal is being submitted for CTF Trust Fund Committee (TFC) approval in conjunction with the CIF Administrative Unit's request for the TFC to approve the GESP indicative pipeline and M&R approach, which would make the GESP operational. Therefore, this proposal will be the first submission under the program and is part of IFC's pipeline included in the GESP Paper.

The *Program* objective is to catalyze impact on the energy storage market and ecosystem in South Africa, as well as increase the use of RE and improve grid reliability, stability and power quality, while reducing carbon emissions. In all, the *Program* seeks to level the field between RE and thermal energy, not only in terms of cost, but also quality of power. By utilizing innovative de-risking structures that use blended concessional finance, the *Program* aims to support pilot and potentially game-changing investments in the South African energy storage market, which currently faces significant barriers and high first-mover costs.

IFC is closely engaged to establish and support adequate conditions and finance for the first-moving RE + energy storage projects under the government's plan for emergency power procurement, which will be carried out through a competitive public tender process that aims to reduce the country's electricity supply gap. IFC's involvement is starting at the bid qualification stage and prior to the bid submission

and bid award stages when winning projects will be selected by the Government of South Africa (GoSA). Contracts will be awarded to technologies with the lowest proposed tariffs, provided that other important technical criteria are also met. By offering a blended concessional financing package to all qualified participating bidders with RE + storage projects, IFC will attempt to make RE + storage technologies more cost-competitive with thermal alternatives. IFC's approach not only ensures transparency, but also provides broad market support for RE + storage, rather than selective support to specific clients.

RE + storage projects face a substantial cost disadvantage compared to those that might include other technologies. As a result, IFC expects that a significant amount of concessionality is needed to level the playing field between RE + storage and traditional thermal alternatives. It is possible that the concessionality provided by IFC's blended financing package might be insufficient to ensure that RE + storage projects achieve the needed cost competitiveness. IFC will continue monitoring the market developments to better understand the quantum of concessionality needed to achieve the desired tender outcome.

Sub-projects targeted by the *Program* will be aligned with collaborative efforts by IFC and the World Bank to improve the competitiveness of South Africa's energy sector by increasing private sector participation in relation to sector reform, supporting decarbonization of the energy sector, and promoting disruptive business models. Activities under the *Program* will also seek synergies with the work being undertaken under CIF Country Investment Plans, the Nationally Determined Contributions under the Paris Agreement, as well as by other development partners – all of which will help the GoSA meet its commitments under the Paris Agreement on Climate Change.

1.2 Country Context

South Africa is one of Africa's most industrialized countries and has the continent's second largest economy after Nigeria. The country's economy has more than tripled in size since its transition to democracy in 1994, but has not fully recovered from the aftermath of the 2008 global financial crisis.[1] While South Africa has made considerable strides toward improving the wellbeing of its citizens since the mid-1990s, the pace of progress is slowing. The country also remains a dual economy with one of the highest inequality rates in the world, as measured by the Gini index.

The GoSA regards climate change as a significant threat to the country and its socio-economic development. The impacts of climate change on biodiversity and water resources have already negatively affected economic growth, jobs, and livelihoods in South Africa. As one of the top 15 global greenhouse gas (GHG) emitters, with a high dependency on fossil fuels, the country aspires to undertake substantial emission cuts.[2]

The GoSA is an early adopter of strategic measures to combat climate change issues. In 1994, a National Climate Change Committee was formed as a multi-stakeholder platform to align government, business and industry, academia, non-governmental organizations and organized labor. The foundation of South Africa's climate policy is rooted in the 2004 National Climate Change Response Strategy, as well as the 2011 National Climate Change Response Policy (NCCRP). Furthermore, climate change is a key element of the National Development Plan (NDP)[3], the overarching plan for the country, which outlines a broad range of principles and policy measures for mitigation and adaptation to climate change. Together, the NCCRP and NDP address the immediate and observed threats of climate change to the country's society, economy and environment, and provide the basis for tracking South Africa's transition to a climate

[1] World Bank, World Development Indicators (2020). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=ZA. Accessed November 2020.
[2] IEA Atlas of Energy, (2020). *CO_2 Emissions from Fuel Combustion*. http://energyatlas.iea.org/#!/tellmap/1378539487. Accessed November 2020.
[3] Government of South Africa, (2012). *National Development Plan 2030*, Accessed in November 2020 at https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf

resilient society and lower carbon economy. Given the country's colonial past and history of apartheid, the GoSA maintains that any plans seeking to address the challenges and opportunities to accelerate the transition to a low-carbon, climate-resilient society, especially following the Covid-19 pandemic, need to be inclusive, just, and sustainable.[4]

The Covid-19 pandemic and its economic consequences add to the myriad of challenges that South Africa was already facing before the viral outbreak. These include widespread unemployment, a growing budget deficit stemming from lackluster growth, fiscal mismanagement, and state support to underperforming state-owned enterprises. The World Bank projects that the fiscal deficit will reach 16% of GDP and debt position will further deteriorate and climb to 82% of GDP by 2020. Notably, unreliable power supply from Eskom Holdings SOC (Eskom), the vertically integrated public power utility, has also caused a significant drag on the economy. Following a 2.6% contraction in Q1 2018, the economy entered a recession during Q2 2018 after it shrank by 0.7%. After a brief respite, the economy contracted yet again in Q4 2019 by 1.4%, which came after a 0.8% drop in economic output during the previous quarter, thus leading to the country's second recession in two years. As a result of these developments, all three major credit rating agencies downgraded South Africa's debt between November 2019 and April 2020. The country lost its last investment-grade rating in March 2020,[5] and was downgraded further into non-investment grade territory in April 2020.[6]

Although South Africa is vulnerable to fluctuations in international investment flows, its strong and independent central bank and free-float exchange rate provide sources of resilience for the country – further supported by nearly USD 53 billion in official reserve assets. As concerns regarding debt sustainability mount, however, and are compounded by the country's vulnerability as a commodity exporter, the South African Rand (ZAR) has been hard hit by deteriorating global risk sentiment. For example, during the first quarter of 2020, the ZAR depreciated by almost 20% vis-à-vis the US Dollar but has since recovered back to level achieved in February 2020.[7]

In response to the health and economic impact of Covid-19, South Africa's Economic Reconstruction and Recovery Plan, announced in October 2020, seeks to stimulate economic recovery on a transformative, inclusive, digital, green, and sustainable growth path. The Recovery Plan highlighted the need for swift structural reforms and clean governance to achieve an average GDP growth of around 3% over the next 10 years. To achieve this growth, the Recovery Plan targets creating jobs through aggressive infrastructure investment, reindustrializing the economy, focusing on growing small businesses, and accelerating economic reforms to unlock investment and growth, just to name a few. Stable energy supply is central to achieving these targets.

1.3 Energy Sector Context

South Africa produces over 40% of the electricity in Africa.[8] The electricity sector is dominated by Eskom, which operates the grid and generates approximately 96% of the electricity used in the country. (Private generators and municipalities contribute approximately 3% and 1% of national output,

[4] CIF (2020), *Supporting Just Transitions in South Africa Just Transition Case Study - September 2020*. Accessed in November 2020 at https://www.climateinvestmentfunds.org/sites/cif_enc/files/knowledge-documents/supporting_just_transitions_in_south_africa.pdf

[5] Moody's Investors Service, Inc., (2020). https://www.moodys.com/research/Moodys-downgrades-South-Africas-ratings-to-Ba1-maintains-negative-outlook--PR_420630. Accessed November 2020.

[6] Fitch Ratings, Inc., (2020). https://www.fitchratings.com/research/islamic-finance/fitch-downgrades-south-africa-to-bb-outlook-negative-03-04-2020. Accessed in November 2020.

[7] Wall Street Journal, (2020). https://www.wsj.com/market-data/quotes/fx/ZARUSD. Accessed November 2020.

[8] CIF (2020), *Supporting Just Transitions in South Africa Just Transition Case Study - September 2020*. Accessed in November 2020 at https://www.climateinvestmentfunds.org/sites/cif_enc/files/knowledge-documents/supporting_just_transitions_in_south_africa.pdf

respectively).[9] The utility has a capacity of approximately 42 GW and generates over 80% of its electricity from coal – an abundant resource in South Africa, with the remainder split across nuclear and renewables. As the primary source of energy, the reliability of Eskom to supply electricity is central to the country's economic performance.

South Africa has experienced considerable energy sector challenges in recent years. The sector is currently crippled by unprecedented load shedding that is primarily due to a lack of maintenance and neglect that has resulted in an unpredictable and unreliable system.[10] Curbing electricity supply in response to the acute 5 GW supply-demand gap seeks to protect the overstretched power system from total blackout. In turn, however, load shedding reduces Eskom's revenues – further compounding the major financial challenges already faced by the utility – and impacts the economy at large, lowering industrial output and business productivity. The current financial crisis plaguing Eskom has been decades in the making and is largely the result of the utility's parastatal nature, rising costs, falling revenues, crumbling infrastructure, as well as technical and financial mismanagement. Frequent and massive tariff increases have done little to improve Eskom's finances and are a major burden for end-users. The utility owes over USD 30 billion and is struggling to service the interest payments on its debt. The utility's debt represents approximately 11% of the national debt, and more than half of it is guaranteed by the GoSA.[11] As a result, the National Treasury describes Eskom as the single biggest threat to South Africa's economy.[12] It is imperative, therefore, that alternative sources of energy be developed to diversify the country's energy mix – not only from Eskom, but also from fossil fuels.

South Africa's Integrated Resource Plan (IRP) was developed to serve as a roadmap for the energy sector from 2010 to 2030. The IRP continues to be updated and was first promulgated (IRP 2010) in support of the overall National Development Plan 2030. In IRP 2010, the GoSA outlined ambitious RE and energy efficiency plans, with the objective to build 17.8 GW of new RE generation capacity by 2030. At the time, this represented over 40% of the country's planned power generation investments between 2010 and 2030.

To achieve the ambitious targets laid out in the IRP 2010, the GoSA embarked on a series of actions promoting private sector investments, including improvements to the regulatory framework. One such initiative is the Renewable Energy IPP Procurement Program (REIPPPP). Launched in 2011, the REIPPPP provides feed-in tariff incentives for the development of RE projects. Under the program, the GoSA has organized four procurement rounds to date, using a reverse auction process where private developers bid for allocated RE technology capacities and receive Power Purchase Agreements (PPAs) with Eskom. The REIPPPP has successfully channeled substantial private sector expertise and investments into grid-connected RE in SA, (i.e., 3.8 GW to date, more than 100 projects contracted totaling an investment of USD 12 billion).

IFC, together with the African Development Bank (AfDB), directed CTF resources to support the REIPPPP's efforts to promote Concentrated Solar Power (CSP) technology, which was allocated 600MW of capacity through four rounds of bidding. This support led to three groundbreaking CSP sub-projects totaling 250 MW of installed capacity. In the first REIPPPP round in 2011, IFC and CTF, along with South African and international investors, provided financing to two CSP projects awarded through a tender process: (i) Kaxu – a 100MW parabolic trough; and (ii) Khi – a 50MW tower. The Kaxu project completed construction in February 2015 and became the first operational private sector CSP plant in an

[9] Much of the private generation in South Africa has resulted from the REIPPPP.
[10] Retief, Hanlie (2019-12-16). "'Eskom is captured': Jan Oberholzer on wet coal, sabotage and stage 6 desperation". CityPress. Accessed November 2020.
[11] *Budget Review 2020*. National Treasury Republic of South Africa, 26 February 2020, http://www.treasury.gov.za/documents/national%20budget/2020/review/FullBR.pdf. Accessed November 2020.
[12] Carbon Brief (2018), *The Carbon Brief Profile: South Africa*, https://www.carbonbrief.org/the-carbon-brief-profile-south-africa. Accessed November 2020.

emerging market, as well as the first operational CSP plant financed, in part, by the Climate Investment Funds. In parallel, AfDB brought forward the 100 MW parabolic trough Xina CSP project, backed by AfDB's CTF funding, as well as by commercial financing from IFC and others. Overall, this helped mobilize over USD 2.2 billion in financing for CSP in South Africa. As a result, the value of CSP technology and its ability to provide reliable base-load power from a RE source became better understood, elevating GoSA's interest in further promoting the technology and encouraging CSP developers to improve project economics through technical design modifications. In addition, the growing CSP market has led to increased local capacity to provide related services, including manufacturing of project components, construction and maintenance of operational power plants.

The new IRP, released in October 2019, outlines a path from 2019 - 2030 for decommissioning inefficient coal plants (11 GW), and scaling up intermittent RE (by an additional 6.0 GW of solar and 14.4 GW of wind energy) supported by energy storage systems (2 GW). As a first step to implementing the IRP capacity expansion plan, a new tender is underway and largely modeled after the previous successes of REIPPPP. The Department of Mineral Resources and Energy seeks to add 2 GW of emergency power capacity under its Risk Mitigation Independent Power Producer Program (RMI4P). Bids are due in early December 2020, with the additional dispatchable power expected to be delivered into the grid by June 2022. The RMI4P supports the addition of energy to the South African grid from a range of energy source technologies, namely dispatchable gas-fired generation, renewables and storage solutions. The almost technology agnostic design of the tender mechanism levels the playing field between the alternative energy sources, as long as the quality and cost of power are favorable. This approach, therefore, presents an opportunity for the large-scale decarbonization of power production in South Africa through seamless integration of RE resources, provided they can be enhanced by battery storage to become flexible, dispatchable and competitive – the success of which would represent a first in the developing world.

The South Africa IPP Office recently indicated that it would release the Request for Proposals for the much awaited fifth round of the REIPPPP, further signaling unabated commitment to renewable energy. Should battery storage emerge as a possible contender competing directly with thermal technologies under the RMI4P, IFC expects that it would pave the way to become a mainstream component under the REIPPPP with further cost reduction.

Due to the lack of a reliable generating capacity and continued growth of power demand, South Africa's generation reserve margin is shrinking and there is an acute need for an expansion of the country's sustainable generation capacity. As rolling blackouts have become more pronounced and frequent, concerns regarding the reliability of grid power abound. Innovative battery storage solutions will help diversify the base load energy mix by integrating intermittent RE resources, thereby supporting the scale-up of RE and reliability of delivered energy to end-users, as well as the decommissioning of more than 10 GW of coal plants.

1.4 Energy Storage Sector Context

Energy storage is a crucial tool for enabling the effective integration of RE and unlocking the benefits of local generation and a clean, resilient, dispatchable energy supply, which can directly compete with fossil fuel-based generation. Energy storage solutions are needed most in developing countries, where power grids are weak and cannot take full advantage of their intermittent solar and wind resources. Storage solutions are also vital in emerging economies where a rapid increase in energy demand, especially during peak hours, needs to be urgently met by installing new generation capacity.

Despite falling costs, energy storage systems (ESS) remain expensive and the significant upfront investment required is difficult to overcome without government support (including appropriate regulatory frameworks) and/or low-cost financing. As a result, the energy storage market is small and primarily concentrated in developed countries. Roughly half of current storage systems costs are attributable to battery cells. The remaining costs derive from the process of packing the cells into battery

packs, adding cooling, software control systems, and any remaining balance of plant costs. In 2019, prices for fully installed four-hour utility-scale storage systems ranged from $300 to $446/kWh, which means that a 20 MW/80 MWh storage system would cost between USD 24 and 36 million.[13] Over time, system costs are expected to continue declining due to several factors, including technology improvements, manufacturing and supply chain economies of scale, competition between manufacturers, greater product integration ahead of installation, and more overall industry expertise.

Renewable sources of energy coupled with energy storage have the potential to decarbonize power systems while providing reliable, dispatchable electricity. Energy storage, amongst other components of power system flexibility, is essential to achieving a high penetration of variable RE such as solar PV and wind[14] and displacing fossil-fuel generation. RE systems with energy storage can also replace expensive diesel generators in island settings, small-to-medium sized grids, and industrial applications. Battery energy storage, for example, has unique advantages: being modular, fast responding, and readily deployable. The cost of some battery energy storage technologies has fallen 87% globally since 2010[15], with continued rapid declines expected as technology and economies of scale improve.

Demonstrating the performance of ESS technologies and systems in frontier markets without significant cost is a key barrier for grid-level ESS deployment at scale. Catalyzing activity involving novel technology and a new operating environment entails higher risk that must be shared between the public, power sector actors, and/or developers. Sustained market engagement can be sensitive to poor early performance, though learning from early experience can help to recalibrate market expectations. Inadequate demonstration of performance in frontier markets – including most developing countries – increases risks for safety, functionality, and profitability of ESS deployments and could hobble market development.

Despite there being over 5,000 MW of electrochemical battery ESSs in operation worldwide, there are no battery ESSs connected to the grid in all of Africa. Sub-projects under this *Program* will seek synergies with the work being undertaken by the World Bank and AfDB in financing the Eskom distributed battery storage program (BSP), using ~USD 250 million of CTF funding. The BSP seeks to install batteries at some existing Eskom-owned and fully fenced-out substations close to locations where wind and solar PV feed into the Eskom grid. Eskom's planned battery storage pilot project aims to serve as a test case for the assessment and development of the technical applications, benefits and regulatory matters associated with a utility-scale energy storage technology. Successful demonstration effect of storage projects in South Africa will enable variable RE to expand faster in Africa and other developing countries.

1.5 Barriers to Private Sector Investment

Excellent renewable resources in South Africa present significant opportunities for increasing the amount of energy supply in the country. More so, since the growth in electricity demand in the country outstrips the pace of RE capacity development. While South Africa has been successful in its initial scale up of RE generation, helping to drive down costs and develop the domestic RE market, multiple barriers – particularly the intermittency of the RE sources – still preclude the desired acceleration of RE growth. Augmenting RE systems with energy storage capabilities is the crucial next step in unlocking the growth of RE installed capacity.

Utility-scale applications of energy storage technologies are nascent. As a result, first-movers face significant market barriers similar to the ones faced by the developers of first-in-kind RE projects. Even

[13] BNEF (2019). Energy Storage System Costs Survey 2019.
[14] In practice, storage is more often combined with solar PV than with wind.
[15] BNEF (2019). https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/?sf113554299=1

projects awarded with PPAs are likely to encounter various challenges in reaching financial closure. Key barriers include:

- High upfront costs. The high upfront costs for ESSs remain the most significant barrier to growth. Despite the major reductions in system costs that have been achieved over the past several years, utility-scale energy storage remains an expensive technology. The significant upfront investment required is difficult to overcome without government support and/or low-cost financing. Approximately 95% of grid-scale storage deployments use lithium-ion batteries. Over the next decade, the scale of lithium-ion batteries production is expected to increase, driven mostly by electric vehicles, which will lead to a fall in system costs;
- Market transparency. The energy storage market is less mature than solar PV and wind, and the rapid improvement of economics has not been adequately disseminated. The successful demonstration of ESS projects at scale will increase market transparency and result in batteries being considered more often in the solution set;
- Lack of familiarity with storage technology among utilities. A lack of familiarity with newer technologies that are used in utility-scale ESSs and limited local technical experience to operate and maintain the installed systems have restricted the energy storage market in many non-OECD markets, with the exception of China. It is critical for energy ministries, national electric utilities, power system regulators, and other large commercial and industrial customers to be educated on the potential benefits of energy storage. Piloting commercial-scale storage projects could provide reference cases to demonstrate the value of the nascent technology;
- Underdeveloped grid infrastructure. The overall stability of the electrical grid in a particular country or region is an important consideration in determining the potential market for stationary ESSs. In most developing countries, power grids are weak and cannot take full advantage of the solar and wind potential. The stability of the grid will influence the type of ESSs that will be deployed, and how they are used;
- Regulators and financiers. Batteries and other ESSs can perform transmission/distribution functions and provide ancillary services, all while simultaneously serving as generators when they release stored energy. These multiple possibilities pose challenges for regulators, since current global electricity regulation regimes divide assets into generation and non-generation. The regulatory framework to adequately value and compensate for the service that batteries provide is often lacking. As a result, the increased cost brought on by the addition of ESSs is not offset by similar increases in revenue. Appropriate regulatory and policy environments and procurement practices need to be fostered to help drive down the cost of batteries at scale and to ensure financial arrangements that will create confidence in cost recovery for developers. Following successful pilot projects and accumulated experience, regulators will be able to better assess and value the benefits of storage systems, as well as create compensation schemes to attract more storage; and
- Lack of conducive regulatory environments. A main obstacle to faster adoption of ESSs is a lack of regulatory certainty, since some potential income streams depend on regulatory framework, e.g. the remuneration of ancillary services. Apart from China, no other emerging market had comprehensive storage regulations in place, as of February 2020.

While governments are primarily focusing on addressing the last two barriers listed above, the successful implementation of pilot projects can help create significant momentum in overcoming all the barriers listed. The first pilot projects will undoubtedly face adverse conditions, such as risky markets and low on-the-ground capacity, leading to higher technology costs and project risks, thus making concessional support critical. While these barriers add complexity to projects, initial successes in these markets can

help governments further enhance the policy and regulatory environment for developers and investors, contributing to continued sector growth and a reduction to future project costs.

1.6 Investment Services component

IFC seeks to support projects under the RMI4P to advance the adoption of energy storage in South Africa, and demonstrate the viability and/or large-scale application of battery storage solutions – in much the same way as IFC co-invested CTF funds in groundbreaking CSP projects, i.e. Kaxu and Khi in the first REIPPPP round. The GoSA has particularly emphasized the importance of a just transition to clean energy, since the coal industry employs many people across South Africa. Growth of the energy storage market in the country will lead to increased local capacity to provide related services, including manufacturing of project components, and maintenance of systems, among other benefits.

This proposed *Program* will aim to address the barriers mentioned earlier and catalyze further scale-up of RE by supporting the first ever private sector utility-scale RE + storage projects in South Africa (and the developing world). Given the strong RE resources in the country, IFC has been supporting innovative uses and business models utilizing solar and wind technology, in particular, to improve the cost of electricity supply from RE-power generation. Affordable battery-power energy storage is the missing link between the intermittent nature of the RE, and the demand for firm, predictable and dispatchable power. Much progress has been achieved towards reaching this objective; however, further concessional support is needed in the next phase of RE market development to promote system reliability through the direct inclusion of the *storage component* into RE plants. To that end, CTF GESP concessional funds for the *Program* will support private sector solar and wind generation projects with storage configurations, and will be structured in a way to clearly address and overcome the barriers that inhibit transformation.

The *Program* will support a pipeline of RE + storage projects that is being facilitated by the GoSA through the RMI4P tender. The original bid submission deadline was November 24 but was extended to December 22, 2020.[16] As such, the actual composition of the projects or a group of winning bidders is not yet known. However, IFC's experience in supporting similar reverse auctions across a number of countries and technologies indicates that the bid planning stage is the optimal time for interventions aimed at affecting project design and characteristics. For example, diligent and thorough planning of the solar PV tender by the Government of Zambia and the World Bank Group in 2015, coupled with a clear upfront indication of a potential financing package by IFC, enabled the tender to attract a large group of credible and experienced solar PV project sponsors. This intensified competition and led to record low tariffs at the time. Since then, this approach has been tried and tested in other markets.

The largely technology-agnostic nature of the South Africa emergency power procurement tender presents an opportunity to structure the conditions of the tender, including financial incentives, in a manner that will increase attractiveness of project structures that involve RE + storage. This will help to incentivize private sector developers, increase competition, and drive down the tariffs to levels competitive with those of thermal generation.

The USD 29.45 million of CTF investment funds allocated to this *Program* will be blended with IFC's own capital to support the RMI4P tender. The potential terms of IFC's blended concessional finance package will be announced and made available to all eligible bidders with RE + storage projects, since the structure of the tender will favor the lowest bid. With availability of the funds and certainty of the terms known before the bid submission, bidders will be able to structure their bids in a way that ensures all the subsidy provided by the CTF funds will be passed through to the tariff, bringing the cost of RE + battery storage systems down to the level where it is more competitive with fossil fuel-based generation.[17] There is the risk, however, that the RMI4P might not select any RE + storage projects if the costs are not brought down to levels competitive with other generation options.

At present, "winning" levels of concessionality are not fully known, since RE + storage markets in developing countries are non-existent. Therefore, the project costs – and resulting tariffs – cannot be

accurately assessed. It is widely acknowledged, however, that the project cost gap between RE + storage and thermal generation remains significant. As a result, a large amount of concessionality might be needed to level the playing field. IFC will efficiently structure the existing concessional resources and continue monitoring the market to determine whether alternative approaches such as Viability Gap Financing (VGF) are needed. The need for VGF in particular might become more pronounced, given that the CTF funds will have to be provided in USD (unlike IFC's own capital that can be provided in ZAR), thus weakening the concessionality effect of the CTF funds.

CTF financing will leverage at least the same amount in IFC financing. As the composition of the projects is not yet known, it is difficult to provide precise estimates of financial leverage and other broad parameters at this time. However, IFC expects the *Program* leverage to achieve around 18x of the CTF amount or more (including IFC, other development finance institutions, private sector, etc.). Concessional finance through the range of financial instruments available to the CTF will support the deployment of ESS at scale.

The *Program* presents a unique opportunity to support South Africa's decarbonization agenda, given its entrenched dependency on coal. The expected sub-projects have high demonstration potential, since RE + storage will help show how batteries can integrate power from intermittent RE such as solar PV and wind into the grid. This is especially important given the amount of RE already in operation and planned addition of more RE capacity in future. Replication in other countries can reasonably be expected.

Covid-19-induced market disruptions may affect the project dynamics and speed of delivery, leading to reprioritization of projects in the pipeline. Possible impact could be on construction activities and supply chains that could lead to delays. However, major suppliers are adapting to the situation, and most developers and contractors will factor potential disruptions in their schedules. Furthermore, fourth round REIPPPP projects were completed/commissioned during the pandemic without any major delays, which shows that contractors have adapted and are following prudent health and safety protocols. Overall, IFC does not expect Covid-19 to have a significant impact on the *Program*, given the urgency to procure emergency power. At the beginning of the pandemic, Covid-19 helped reduce load shedding in South Africa on account of the lockdown (one of the very few positive impacts). However, electricity demand shot up again once the lockdown was relaxed and, as a result, rolling load shedding is on the rise.

The final decision to provide CTF funding to a sub-project will be subject to a full due diligence process and approval by the IFC Board, as well as an internal IFC approval body governing blended concessional finance operations. Furthermore, each sub-project will be required to meet IFC environmental, social, governance and other compliance requirements, as well as all country-specific regulatory requirements. IFC's participation in the sub-projects will ensure that IFC's Performance Standards, including Environmental and Social guidelines, are implemented early in the project development cycle. Investments undertaken by IFC are not expected to require sovereign guarantees (except government guarantees to PPAs where necessary). Therefore, they will not necessarily be reflected in the country's debt service requirements, and thereby not affect the country's debt sustainability.

1.7 Program's strategy to achieve market transformation

The *Program* will continue playing a broad transformational role in the RE sector by supporting transformative utility-scale RE + storage projects. Sub-projects funded under the *Program* will seek to establish a track record and demonstrate the viability of financing dispatchable RE + storage projects by the private sector in a complex and evolving regulatory environment. The *Program* will also help to

[16] South Africa Independent Power Producer Office, (2020). https://www.ipp-rm.co.za/, Accessed November 2020.
[17] In the bid submission package, bidders are required to provide letters of support/intent from prospective lenders, providing financing terms and status of lender approvals, as well as a financial model (reflecting those financing terms) that informs the tariff offer.

establish project financing standards and reference documentation for future RE + storage projects in subsequent rounds of the REIPPPP.

In the long term, the need for concessionality 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 *Program* will further benefit from synergies with the efforts of the GoSA in promoting RE + storage technologies.

2 FIT WITH INVESTMENT CRITERIA

2.1 Potential GHG Emissions Savings

The RMI4P tender will award contracts to technologies with the lowest proposed tariffs, provided that other important technical criteria are also met. Concessional finance will enable the RE + storage combination to be competitive with other generation options, namely thermal. By bringing the costs down and leveling the playing field, CTF concessional funds can play an enabling role for the RE technology. Without concessional funds, it is more likely than not that the planned generation contracts will not be awarded to climate-friendly technologies. As such, this *Program* estimates the amount of GHG emission reductions generated by the expected RE plants that will be enabled by providing concessional finance to the battery storage component.

At this stage, not all the technical details are yet known to precisely calculate the GHG emissions reduction expected under the *Program*, since the specific design of the sub-projects is still being discussed and developed. As such, the GHG emissions reduction estimates presented in this proposal are based on the conservative options of potential design.

Calculations of potential GHG emissions savings are based on the following assumptions[18]:

- Expected total installed capacity: at least 300 MW for RE and 225MW/900 MWh for storage;
- Expected aggregate project cost: USD 300 million for RE and USD 270 million for storage;
- Weighted average Combined Margin Emission factor for solar/wind[19]: 1.008 tCO_2e/MWh (South Africa);
- Weighted average Capacity factor (based on indicative industry benchmark): 29%; and
- Anticipated lifetime of sub-projects: 20 years.[20]

The sub-projects under the *Program* are expected to directly generate GHG emission reductions of about 768,343 tCO_2e over a representative year and around 15,366,854 tCO_2e over the life of the sub-projects.

Given that the *Program* may result in an uptake of RE + battery storage projects, triggering a series of follow-up projects, IFC anticipates that these activities may result in increased stakeholders' capacity, enhanced sector knowledge, and noticeable replication effect. For example, assuming a multiple of at least 4x, the *Program* could potentially lead to an ***indirect*** GHG emissions savings of 61,467,416 tCO_2e.

[18] Expectations are based on performance of solar PV + electrochemical battery storage plants. The GHG emissions savings assumptions are associated with the solar PV component of the plant, which is enabled by the battery storage.
[19] 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.
[20] The IFC GHG accounting methodology provides guidance on calculation of the GHG emission reductions on the basis of one representative year. To assess the amount of the lifetime GHG savings, an indicative average life of physical assets is assumed to be around 20 years. Actual values of lifetime for individual assets and sub-projects may vary and are likely to be different from the lifetime of the financial instruments.

2.2 Cost-Effectiveness

Based on the above calculations and overall size of the investment component of this *Program* of approximately USD 30 million, the implied direct GHG emission reductions per CTF USD will be 0.512 tCO_2e/USD (or USD 1.95/tCO_2e) over the life of the sub-projects and indirect GHG emission reductions per CTF USD will be 2.049 tCO_2e/USD (or USD 0.49/tCO_2e).

With the total investment cost of all sub-projects estimated to be around USD 570.0 million, the total investment per direct lifetime GHG emission reductions is expected to be around USD 37/tCO2e.

2.3 Demonstration Potential at Scale

The 24.6 GW RE target outlined in the GoSA's IRP 2019 reflects its intent to diversify away from coal and transition towards cleaner energy. Solar PV and wind generation are fully proven, both technically and commercially, and there are widespread examples of successful application at scale around South Africa and the world. The energy storage market is less mature in comparison. CTF support is expected to be critical to enable the development of utility-scale battery storage projects in South Africa to enable the integration of power from intermittent RE into the grid, which could provide the impetus for a significant market scale-up. Success of the first-mover projects in the country will showcase the role utility-scale battery storage configurations can play in satisfying an already significant power demand that continues to grow.

2.4 Development Impact / Co-benefits

Sub-projects under this *Program* are expected to enable and accelerate utility-scale battery storage solutions in South Africa. Overcoming barriers to financing utility-scale RE + storage projects will set the country onto a cleaner growth path with a more diversified and sustainable energy mix. The *Program* is expected to generate the following additional benefits:

- Improved financial sustainability of state-owned utilities. By enabling cost-competitive utility-scale RE + storage projects, the *Program* may help strengthen the financial sustainability of the state utility, which plays a critical role in the country's fiscal deficit. Sub-projects will also reduce fossil fuel consumption and support the country's planned decarbonization of the energy sector;
- Economic recovery/growth and decarbonization. The *Program* will help diversify the power mix, reduce load shedding by adding desperately needed capacity, which will not only help spur economic recovery and growth, but also support the country's decarbonization agenda;
- Local employment. The *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; and
- Spill-over effects. Accelerating the development of the energy storage sector in South Africa will stabilize power supply in the region, since electricity is traded in the Southern African Power Pool and South Africa is the dominate trading partner. Additionally, it is expected that the potential development of the sector in other African countries and emerging markets will also receive a boost.

2.5 Implementation Potential

IFC has a strong track record of supporting transformative first-mover utility-scale RE projects. IFC will combine its experience in financing hundreds of megawatts of RE with its energy storage sector expertise. By offering tailored financial instruments and utilizing creative de-risking structures that use blended concessional finance to catalyze new private sector investment, the *Program* is expected to

establish a track-record by demonstrating the viability of commercial financing for utility-scale battery storage projects and contribute to the acceleration of the development of the market. The *Program* will coordinate closely with other domestic programs, where applicable, and relevant government entities during implementation.

2.6 Additional Costs & Risk Premium

The terms and amount of the CTF funding to be provided under the *Program* will reflect the reality of the market. CTF funding will seek to overcome barriers to market transformation for the *Program* with the minimum level of concessionality required.

2.7 Financial Sustainability

The objective of the *Program* is to catalyze impact on the energy storage market and ecosystem in South Africa, as well as increase the use of RE and improve grid reliability, stability and power quality, while reducing carbon emissions. The first-mover utility-scale battery storage projects are expected to require concessional funding support due to the high upfront costs, high perceived risks, uncertainty, and lack of in-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 private sector investors. Equipment costs will also continue to fall, allowing for prevailing market tariffs to become sufficient to deliver desired rates of return to investors.

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 battery storage technology service providers and prove the technical and economic realities of RE + energy storage configurations. Through these mechanisms, the *Program* expects to promote the sustainability of utility-scale battery storage projects, thereby accelerating the development of the sector in South Africa, across Sub-Saharan Africa and other emerging markets.

2.8 Effective Utilization of Concessional Finance

Concessional funding will:

- Enable selected sub-projects to obtain financing with terms not currently available on the market, but necessary for them to move forward;
- Allow IFC and other commercial investors to provide financing to sub-projects, reaching financial closure;
- Set a precedent of successful projects;
- Directly enable the construction of a series of transformative utility-scale battery storage plants and indirectly stimulate the RE sector in countries where little to no RE capacity has been financed by private sector to date and where it may not yet be competitive;
- Encourage private sector participation in dispatchable utility-scale battery storage projects in South Africa, which can be replicated in other emerging markets.

2.9 Mitigation of Market Distortions and Application of DFI Enhanced Principles of Blended Concessional Finance

The proposed *Program* will not distort the market, since it will not be displacing any private sector investment, but rather will support such investment. The *Program* represents an important opportunity to innovate, since it will leverage and enable financing to enter the nascent energy storage market in South Africa. Concessional finance will be directed towards addressing first-mover costs experienced by

project developers who seek to provide new and evolving energy storage solutions, given the high cost of battery storage technology. The sub-projects will represent first-of-its-kind energy storage investments in South Africa, so initial market distortions cannot be foreseen or measured. After the initial 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 *Program* will seek to minimize the use of CTF funds and maximize the leverage achieved from IFC and private sector financiers. Actual terms and structure of CTF funds will be tailored on a project-by-project basis and will be designed in a way to facilitate investment in a project, while adhering to the principle of minimal concessionality and avoiding market distortions. Each CTF project will be subject to IFC's own internal governance for blended concessional finance operations and will be reviewed by a corporate-level Blended Finance Committee.

The dedicated IFC team, working on the CTF tranche in each investment sub-project, as well as members of the Blended Finance Committee will carefully ensure that the sub-project structures respond to all DFI Enhanced Principles for Blended Concessional Finance for Private Sector Projects. Specifically:

- Economic Rationale for Blended Concessional Finance: While IFC will provide financing that is not readily available in the energy storage sector in South Africa, in light of the market barriers discussed in section 1.5, CTF funds will help rebalance the risk-return profile for the private sector sponsors and lenders (including IFC) and support a competitive tariff for a nascent RE + battery solution vis-à-vis thermal generation. Without concessional funds from CTF, IFC would not proceed with the projects;
- Crowding-in and Minimum Concessionality: The "minimum concessionality" principle requires that subsidies should not be greater than necessary to induce the intended investment. The CTF investment will provide a subsidy to the projects' investors, but only to the extent necessary for them to proceed. IFC will offer a blended concessional financing package to all participating bidders with RE + storage projects prior to the bid submission deadline. This will ensure that the subsidy provided by the CTF funds is available to all market participants and will be passed through to the tariff, which will help to bring down the cost of RE + storage;
- Commercial Sustainability: Use of blended concessional finance co-investments in the RE + energy storage sector in South Africa is expected to reduce over time as a track record is established, risks are better understood, and financiers are better able to assess and price relevant risks to enable further investment in RE + energy storage in South Africa and/or other emerging markets;
- Reinforcing Markets: Supportive regulatory environments for energy storage is being developed by the GoSA as reflected in its IRP 2019, with the support from other development partners. The successful implementation of battery storage solutions projects will help to clarify and reduce perceived regulatory risks, while also establishing a track record, which can mobilize investment from the private sector. This will also help highlight the benefits to the regulator and law makers at the national and municipal levels; and
- Promoting High Standards: The final terms of the CTF tranche of all investments will be approved by IFC's Blended Finance Committee in line with the CTF funds risk tolerance, eligibility criteria, and parameters of this *Program*. All the parties to the legal agreements are or will be made aware that IFC is acting on its own account, as well as implementing entity for CTF.

2.10 Risks

Potential risks associated with the *Program* include:

- Country risk. Uncertain political, economic, and security outlooks could make the provision of long-tenor financing challenging.
  Mitigants: Sub-projects will be carefully selected and reviewed to ensure that (i) PPAs include standard protections, such as political force majeure, and (ii) other appropriate risk-mitigating products are in place, as necessary.
- Off-taker credit risk. As outlined above, Eskom's financial situation has been in freefall over the past years. The utility has been accumulating losses and large of levels of debt and now relies on GoSA bailout to service its debt.
  Mitigant: GoSA is guaranteeing Eskom's payment obligations under the PPA through the Implementation Agreement. Analogous to REIPPPP, the PPAs will be banked based on government not Eskom risk.
- Supply chain risk. The global economic and financial ramifications of Covid-19 continue to impact global supply chains, from raw materials to finished products. These disruptions may affect the dynamics and speed of delivery of target sub-projects, which could result in delays.
  Mitigants: Major suppliers have since adapted to the pandemic, and most developers and contractors will factor potential disruptions in their schedules. The Round 4 REIPPPP projects were completed/commissioned during the pandemic without any major delays, which shows that contractors have adapted and are following good health and safety protocols.
- Technology risk. Many battery technologies are still under development. Battery technologies, however, are inherently hazardous as they utilize materials that could potentially react violently with each other. A primary focus has been on the fire hazards associated with Lithium-ion batteries and the potential for a condition known as thermal runaway, which results from internal shorts inside a battery cell and can ultimately lead to the battery catching fire or exploding.
  Mitigants. Technology risks will be critically evaluated. IFC will ensure proper planning, risk assessment, storage methods, and response protocols are in place to manage technology risks.
- Implementation Risk. IFC will use CTF funds to help offset battery costs and enhance the economic viability of RE + storage solutions to directly compete with thermal projects. This, however, may be insufficient to establish and support adequate conditions and finance to ensure RE + storage technologies are cost-competitive with other generation options. The RMI4P tender will award contracts to technologies with the lowest proposed tariffs, provided that other important technical criteria are also met. Therefore, the *Program* might not end up with any sub-projects if eligible RE + storage projects are not cost-competitive with thermal or hybrid RE projects with a minimal thermal component.
  Mitigants. With availability of the funds and certainty of the terms known before the bid submission, bidders will be able to structure their bids in a way that ensures all the subsidy provided by the CTF funds will be passed through to the tariff, bringing the cost of RE + battery storage systems down to the level where it is more competitive with fossil fuel-based generation.

3 PERFORMANCE INDICATORS[21]

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
CTF Core Indicators:		
GHG emissions avoided (tCO_2e): - per annum - over the indicative 20-year life of sub-projects	0	768,343 15,366,854
Incremental financing leveraged (of all non-CTF parties), USD million	0	540
Installed capacity of RE as a result of CTF interventions (MW)	0	300
GESP-Specific Indicators:		
Energy rating (MWh)	0	900
Power capacity (MW)	0	225
Regulations, codes or standards for energy storage solutions issued (#)	N/A	N/A
Project-specific Indicators:		
TBC		
TBC		
Development Co-benefit Indicators (as applicable):		
TBC		
TBC		

[21] At this stage, not all the technical details are yet known to precisely determine the anticipated impact of the relevant performance indicators under the *Program*. This information will be updated at the IFC Board approval stage for each sub-project.