JOINT SUBMISSION

BY

THE WORLD BANK AND THE AFRICAN DEVELOPMENT BANK

TO

CLEAN TECHNOLOGY FUND TRUST FUND COMMITTEE

ON A

PROPOSED PROJECT RESTRUCTURING

OF

SOUTH AFRICA – ESKOM RENEWABLES SUPPORT PROJECT

APPROVED ON NOVEMBER 12, 2010 BY THE CTF TRUST FUND COMMITTEE

Task Teams

African Development Bank: Farai Kanonda

World Bank: Reynold Duncan; Arsh Sharma; Frederic Verdol

1- EXECUTIVE SUMMARY

This note presents the technical, economic and strategic aspects of CTF-funded Project restructuring proposed by Eskom, the South Africa public power utility and sole Borrower and Implementing Agency for the Project. The Eskom Renewables Support Project (the Project) is a US$ 1,552 million multi-donor financing program initiated in 2011 to support Eskom with the following development objective: 'to facilitate the accelerated development of large scale renewable energy capacity in support of the long-term carbon mitigation strategy of South Africa'.

The Project restructuring seeks to (1) replace the 'Kiwano' (Upington) Concentrated Solar Power (CSP) Plant' pilot project with a large-scale distributed Battery Storage Program[1] linked to continuation of South Africa's Renewable Energy Independent Power Producers (REIPP) Program. The restructuring also seeks to (2) reallocate the remaining proceeds from the completed activities to the battery storage investment program and (3) extend the project implementation period until December 30, 2021, to allow sufficient time for successful implementation of this storage program.

The note presents a brief overview of the Project context and current status – and includes a cover note on Eskom's Governance and Internal Control issues, followed by detailed changes to the Project proposed by Eskom. The note also details the due diligence process undertaken by the ERSP financing partners in coordination with Eskom teams to arrive at the proposed Battery Storage Program technical design and financing plan. It also outlines the main reasons leading African Development Bank (AfDB) and World Bank (WB) to present this proposed restructuring to the Clean Technology Fund Trust Fund Committee (CTF TFC) for review and approval.

2- PROJECT STATUS

From its effectiveness in mid-2012, the Project was intended to implement its two large pilot projects in parallel, namely the 100 MW Sere wind farm (component 1) and the 100 MW Kiwano CSP plant (component 2). These projects encountered various implementation hurdles, partly due to their innovative nature for the utility and Borrower, Eskom. Moreover, it demanded intensive co-financiers' coordination – led by the WB and AfDB teams – as Clean Technology Fund (CTF), multilateral development banks (IBRD, AfDB). Other financiers (KfW, AFD, EIB) co-financed these clean energy infrastructure projects along with the Borrower.

The successful completion of component 1, i.e. commissioning of the 100 MW Sere wind farm in March 2015 within the planned budget, and its subsequent operation with a higher performance than anticipated (load factor of 33% versus 26% at appraisal) were positive Project outcomes that engendered very positive impacts on the way wind technology was perceived internally at Eskom, and nationally. However, since 2016, further Project implementation and disbursement have stalled due to lack of progress on component 2, the Kiwano CSP plant. As a result, the Project's Implementation Progress is rated 'Unsatisfactory', and the overall Project is off-track to meet its development objectives, despite the success achieved on the Sere wind pilot project.

Kiwano CSP had been at a standstill since the bid evaluation process resulted in Eskom receiving non-responsive bids in October 2015. In view of this Eskom requested termination of the procurement process, choosing not to make any exception to the procurement process to address the non-responsiveness. During the same time, CSP technology was dropped from RSA's Integrated Resource Plan (IRP – country's electricity masterplan) and removed as a priority from

[1] 'Component 2 would be renamed VRE Integration Using Battery Storage' component.

Eskom's Corporate Plan (corporate strategy document). WB gave no-objection to termination of the procurement process in August 2017 on the understanding that Eskom remains committed to finding an alternative for Kiwano CSP that would achieve the same development objectives as the original project (i.e. dispatchable clean energy supplied to the grid and transformational impact from innovative solution).

As of May 30, 2018, the Project's disbursement rate for CTF funds was 22%. The following table provides a breakdown of CTF funds (in US$ million) by project component:

- Table 1: Disbursement of CTF Funds by Component in the Project

Sub-project	World Bank		African Development Bank	
(US$ M)	***Initial Amount***	***Undisbursed***	***Initial Amount***	***Undisbursed***
Sere Wind	50	15	50	8 (*)
Kiwano CSP	200	200	50	50
Total CTF Funds	**250**	**215**	**100**	**58**

(*) Exact amount is US$ 7.67 million.

Disbursement ratios are of similar range for other financiers (though some funds were utilized for studies and management of the tender process). After Eskom canceled the CSP pilot, bilateral financiers reallocated their own financing towards other Eskom projects, while keeping engagement active on the CSP alternative and broader South Africa energy transition agenda. AfDB, in line with its policies, had cancelled its co-financing contribution but has since initiated the process to commit a new loan facility for the Battery Storage Program and AFD and EIB have expressed interest to re-engage and co-finance the program at a later stage (details in Section 3).

As a result, the remaining funds still committed to the Project include: (i) USD 195 million from IBRD, (ii) USD 215 million CTF funds to be implemented by IBRD, and (iii) USD 58 million CTF funds to be implemented by AfDB.

3- PROPOSED CHANGES TO THE PROJECT

The proposed changes do not require any amendment to the Project Development Objectives. The changes would involve (i) change in nature of investment eligible under project category 2 (component 2), (ii) reallocation of proceeds between categories, (iii) extension of project closing date and (iv) adjustment of Result Framework and indicator targets.

3.1- Description of changes

The proposed changes to the project components involve a change of activity in component 2 to include financing for grid-scale distributed electrochemical batteries, to complement the operation of new wind and solar power capacity to be built under REIPPP round 4, Sere wind farm financed under the Project, and with future distributed solar PV capacity to be built and operated by Eskom.

A technical assistance sub-component under component 2 will be added to (i) support the final design, procurement and supervision of energy storage infrastructure to be supplied through the project, (ii) to strengthen Eskom technical capacity in sustainable operation and maintenance of large scale batteries and (iii) to prepare the enabling environment (regulatory, technical, construction standards) for further private investment in VRE capacity using storage.

Change of the project closing date would allow implementation of the above-mentioned activities. Lessons learned from past implementation and analysis conducted by energy storage experts, estimate the Project extension that would be needed at forty-two (42) months, moving the project closing date to December 30, 2021. This extension factors in the necessary learning phase on an innovative technology; this aspect being supported by the ongoing Eskom experimentation program on battery storage and by knowledge activities initiated by the Donors and Eskom Storage Project team (joint visit of battery manufacturers, participation to conference and learning events on battery storage).

3.2- Changes in the Project Financing Plan

The Battery Storage Program aims to achieve the same development objectives as the original Kiwano CSP plant. However, the financing required for the Kiwano CSP was to construct a CSP plant, while the financing for the Battery Storage Program will be utilized towards supplying, installing and operating battery storage assets and will enable further private sector investment in dispatchable VRE. Thus, even though the available financing under the Project for component 2 would be reduced (from US$ 1,197.4 million for the CSP pilot to US$ 476 million for the Battery Storage Program), the Project could still achieve the same objective targets: additional financing being leveraged from the private sector (REIPPP) to finance the additional renewable energy capacity associated with the Project (amount of private financing enabled estimated at US$ 612 million).

Subsequent to Eskom's formal notification of Kiwano CSP cancellation, EIB, AFD and AfDB announced the cancellation of their loans to Eskom for this Project, as the sole purpose of their financing was the construction of a publicly-owned pilot CSP plant. However, KfW has decided to restructure their project to keep financing the energy transition agenda (e.g. to finance power transmission corridors linked to renewable energy development zones).

Remaining proceeds from the CTF funds under the Project (amounting to US$ 215 million (IBRD) plus USD 58 million (AfDB)) would be restructured to finance the Battery Storage Program. Confirmed co-financing sources for the Battery Storage Program would include:

US$ 195 million from IBRD (Eskom Investment Support Project, EISP): the IBRD loan to Eskom would co-finance the Battery Storage Program. EISP would be restructured to reflect the change in technology of Component B (ii) from CSP to battery storage. As EISP cannot be extended beyond December 30, 2019, the remaining proceeds would be utilized for the immediate financing needs. EISP targets regarding renewable energy would only be partially met when EISP closes in 2019[2].

US$ 8 million from Eskom: this budget has been approved along with the Battery Storage Program endorsement by Eskom Board in March 2018, to finance the owner's engineer contract and the supervision expenses for implementation of the program.

Further co-financing of this Battery Storage Program is under preparation, as (i) AfDB is considering financing additional battery storage infrastructure through a ZAR 3 billion[3] loan to Eskom (under preparation, Board submission expected in

[2] WB task team plans to restructure EISP (IBRD funded) and ERSP (IBRD and CTF funded) to include battery storage, post obtaining approval from CTF on the battery storage proposal

[3] 1 US$ = 12.6 ZAR (South Africa Rand)

2018for the first phase representing ZAR 1 billion earmarked for implementation by end 2019), and (ii) AFD expressed interest to re-engage and co-finance the program if initial results are promising and on schedule.

Changes to the Project would also reallocate the remaining proceeds from the Sere Wind Farm project to the Battery Storage Program, estimated around US$ 15 million (IBRD) and US$ 8 million (AfDB)[4]. The remaining CTF proceeds from Project component 1 would allow enhancement of the impact of the Battery Storage Program, once CTF and IBRD restructuring process is jointly approved. For the AfDB, this would involve, (i) the substitution of Upington (Kiwano) CSP under the original project with the Battery Storage Program; and (ii) the reallocation of USD 58 million (USD50 million from the CSP project and USD 7.67 million balance from the Sere Wind Project) to the Battery Storage Program. The tables below show the original financing plan as approved by the CTF Trust Fund Committee in November 2010, and the revised one following to the proposed restructuring.

[4] Activities under pilot 1 (100 MW Sere wind farm) have been completed in a satisfactory manner and below planned budget, thanks to an efficient competitive tender process and to contributions from co-financiers.

- Table 2: Original Project Financing Plan (as presented to CTF TFC)

Component	Estimated financing required	IBRD	AfDB	CTF via WB	CTF via AfDB	EIB	KfW	AFD	Borrower and other lenders
Component 1: **Sere Wind**	353.5	65	45	50	50	-	-	140	3
Component 2: **Kiwano CSP**	1197.4	195	220	199.375	49.75	50	100	-	382
Management fee	0.875	0	0	0.625	0.25				
Total	1551.775	260	265	250	100	50	100	140	385

- Table 3: Revised Project Financing Plan (as of May 30, 2018)

Component	Estimated financing required	IBRD	AfDB	CTF through WB	CTF through AfDB	Borrower and other financiers
Component 1: **Sere Wind**	353.5	65	45	34.375	41.75	143.50
Component 2: **VRE Integration Using Battery Storage**	468**	195	TBD***	215 (of which 20 for Technical Assistance)	58	*313 (investment leveraged through REIPPP – not counted towards project cost)* [5]
Management fee	0.875	0	0	0.625	0.250	
Total	822.375	260	45 + TBD***	250	100	143.50

* KFW, AFD have both been an active part of the Battery Storage Program, but have committed their original funding for CSP in other projects. AFD has expressed interest to fund the project at a later date
** Financing requirement significantly reduced due to private sector investment in REIPPP replacing public investment in new clean energy generation.
*** AfDB is preparing a new operation to co-finance Eskom Battery Storage Program (co-financing estimated ZAR 3 billion, AfDB Board approval scheduled for end 2018).

The financing instrument requested to CTF would remain a soft concessional loan[6]. Extension of the disbursement schedule would be done accordingly, to fit with the extension of Project closing date.

Aside of the battery program itself, other related co-financing is (i) the Eskom funded research program that financed installation and tests on batteries between 2015 and 2018 (US$ 5 million) and (ii) the USTDA funded (US$ 2 million grant)

[5] The battery storage program will leverage further private sector investment in the REIPP program (future bid windows) by ensuring dispatchability to the plants. This investment is not counted in the battery storage program financing cost.

technical assistance to GoRSA on the battery storage perspectives in South Africa, whose main output was a handbook[7] with recommendation on regulatory framework to enable the battery storage market opening.

3.3- Changes in CTF results framework

The change of activity in component 2 would imply the following adjustment in the overall Project's Result Framework:

(i) core indicator target measuring the installed capacity (in MW) under the project would be adjusted;
(ii) the intermediate indicator measuring percentage of achievement of Upington CSP plant would be removed;
(iii) end target of core indicators 'New RE Capacity' and 'CTF leverage' would be adjusted to reflect private investment in REIPPP program.

A comparison of the original Project result indicators ('Kiwano CSP' component) with the revised result indicators ('VRE integration using Battery Storage' component, or 'Battery Storage' component) are highlighted below in the table below.

- Table 4: Original and Revised Indicators for the Project

Indicator	**CTF/IBRD/AfDB/Others funded Project** (as approved by CTF TFC on November 12, 2010)	**CTF/IBRD/AfDB-funded Project** (after the proposed restructuring)	**Scaled-up Phase** Impact beyond the PDO, scale-up phase and enablement
Installed capacity for power generation [MW]			2,300 of clean energy generation [9]
Component 1 (Sere Wind):	100	100 (actual output)	
Component 2 (Kiwano CSP / Battery Storage)	100	60[8]	
Estimated annual power output [GWh/y]			
Component 1 (Sere Wind):	219	219[10]	3,760
Component 2 (Kiwano CSP / Battery Storage)	350-526	524	
Tons of GHG emissions reduced or avoided			
-Tons per year [tCO_{2eq}/y]			
Component 1 (Sere Wind):	238,000	238,000[11]	3,500,000 – 5,950,000[13]
Component 2 (Kiwano CSP / Battery Storage)	380,000 - 570,000	380,000 - 570,000	

[6] US Dollar Loan for a maturity of 40 years, 10 years Grace with a service charge of 0.25 percent per annum on disbursed amounts and a one-time management fee of 0.25 percent of the Loan amount.
[7] South Africa Energy Storage Technology and Market Assessment (March 2017, link)
[8] 135MW of new storage capacity would be commissioned by 2019, in various REIPP plant sites, plus 40 MW in Eskom Sere Wind site.
Additional 100MW of clean energy storage capacity will be commissioned by 2021 in various REIPP plant sites, plus 60MW of storage associated with Eskom distributed PV
[9] The implementation of the project will enable approximately 2,300 MW of wind and solar PV projects procured through the REIPPP program; of that capacity 460 MW is expected to be directly linked to the proposed battery storage component
[10] Sere Wind plant is overachieving its target over last few years with 298 GWh/y as the actual annual power output
[11] Sere Wind plant is overachieving its target over last few years with 271,000 tCO2/y reduced/avoided
[13] Own estimate; will vary upon technology selected for each RE power plant.

-**Tons over lifetime of the project [tCO_{2eq}]** Component 1 (Sere Wind): Component 2 (Kiwano CSP / Battery Storage)	 4,800,000 7,600,000 - 11,400,000	 4,800,000 [12] 9,560,000	
Financing leveraged through CTF funding [$ million] World Bank African Development Bank European Investment Bank KfW French Development Agency (AFD) Others (including private sector)	**1,200** 260 265 50 100 140 385	**999.5** 260 238.095[14] - - - 456.5[15]	
CTF leverage ratio [1:X][16]	1: 3.43	1:3.5[17]	
Cost effectiveness - CTF cost effectiveness [$\$_{CTF}/tCO_{2eq}$ avoided over lifetime of the project] - Total project cost effectiveness [$\$_{Total\ Project}/tCO_{2eq}$ avoided over lifetime of the project]	 22 - 28 96 - 125	 24 57	
Other co-benefits	**Access:** Several decentralized areas where Eskom plans to install solar PV with battery storage are remote ends of distribution lines where supply capacities are low, and potential customers cannot be connected. The addition of solar PV generation with battery storage will help address these issues, thereby significantly contributing to universal access which South Africa aims to achieve by 2025, and supply reliability. This will in turn help communities improve their quality of life through, for example, better education, health and commercial facilities. Rural entrepreneurship and other productive uses could also be developed. **Other benefits due to battery storage program enabling REIPP projects** **Jobs**: The 27 projects to be signed under REIPPP Bid Windows 3.5 and 4 (enabled by the battery storage program) will create 58, 419 full time equivalent jobs (using the Department of Public Works calculation) for SA citizens - mostly during the construction period and mostly for youths. **Socio-Economic and community benefits**: IPP spending on local community initiatives are – closely aligned with the broader needs of local municipalities as reflected in their Integrated Development Plans; and – responds to the specific		

[12] 1,050,000 tCo2eq over the lifetime of the Sere Wind plant has already been reduced/avoided

[14] $45m of firm financing + $238 million of potential financing from AfDB

[15] $143.5 million of financing for Sere Wind + $313 million of leveraged private sector funding in REIPPP

[16] Note: this ratio represents that amount of funding leveraged in addition to CTF resources. Express ratio in the format 1:X (e.g., 1:5, 1:6, etc.).

[17] Leverage ratio remains similar because of the private sector investment leveraged from part of the REIPPP (the 160 MW of wind and solar capacity directly linked to batteries).

	needs of communities. Economic and socio-economic benefits to communities through contractual obligations to spend between 1% & 1.5% of the project revenue on socio-economic development and 0.6% on enterprise development. **Local content (South African manufactured products)** minimum thresholds and targets were set higher for each subsequent bid window (round of bidding). REIPPPP has boosted local manufacturing to the extent that a small export industry has started to develop with imports of solar photovoltaic and wind turbine components progressively declining since 2012. **Water savings**: It is expected that Round 3.5 and 4 projects, once fully operational at maximum capacity, will save approximately 9.6 million cubic meters of water per annum.

Sere Wind project has been operational since March 2015 and performing satisfactorily technically and operationally. It has already overachieved its contribution to Project indicators with about 298 GWh of yearly power generation (against 260 GWh target) and 0.271 million tons of CO_2 equivalent offset (against 0.238 million tons target) in meeting these targets. The proposed alternative to CSP – battery storage with REIPP – is estimated to increase the values to 524 GWh/y[18] and 0.532[15] million tons of CO_2 equivalent offset by the end of 2021 when the Project would close.

3.4- Achievement of Original Projects' Objectives and CTF Requirements

The Project's original objectives are: '*to facilitate accelerated development of large scale renewable energy capacity in support of the long-term carbon mitigation strategy of South Africa*'. The Sere Wind component is complete, and duly contributing to achievement of initial Project objectives – 100 MW installed capacity, 260 GWh energy generation and 0.238 million tons of avoided CO_2. As Kiwano CSP has not been implemented, the Project has not fully achieved its objectives.

a) Potential for GHG emission savings

Based on the projected annual GHG emission reductions (see Table 4 above) and assuming a 20-year battery life, the direct cumulative emission savings from the proposed battery storage program would be in the range of ~9.5MT of CO_2 equivalent (within the original CO_2 offset target range for CSP component)

Based on calculations during the preliminary technical appraisal of the program, the cumulative CO_2 offset achieved by end 2019 due to new VRE utilization in place of fossil fuel based generation is equivalent to 0.265 MT. Cumulative CO2 offset achieved by end 2021 is equivalent to 0.478 MT (in the vicinity of the original CO_2 offset targets for CSP component). This brings the cumulative CO_2 offset for the program around 9.56MT over the lifetime of the batteries (20-year period).

Component 1 of the project (Sere Wind project) is already surpassing the Project indicators with about 298 GWh of yearly power generation (compared to the 260 GWh target) resulting in 0.271 MT of CO2 equivalent offset (compared to 0.238 MT of CO2 equivalent offset target).

The battery storage program will also contribute to the enablement of the Round 4 REIPP plants totaling 2,300MW translating into GHG emission savings potential at a higher-level. Most of this new output will displace fossil-fuel based generation. It is expected that Round 3.5 and 4 projects, with recently signed PPAs, will offset

[18] Estimates calculated using the targets for Sere Wind (and not the actual results) to account for variability and targets for battery storage output.

an additional 8.1 MT CO2 per annum. These projects, once fully operational at maximum capacity, will save approximately 9.6 million cubic meters of water per annum.

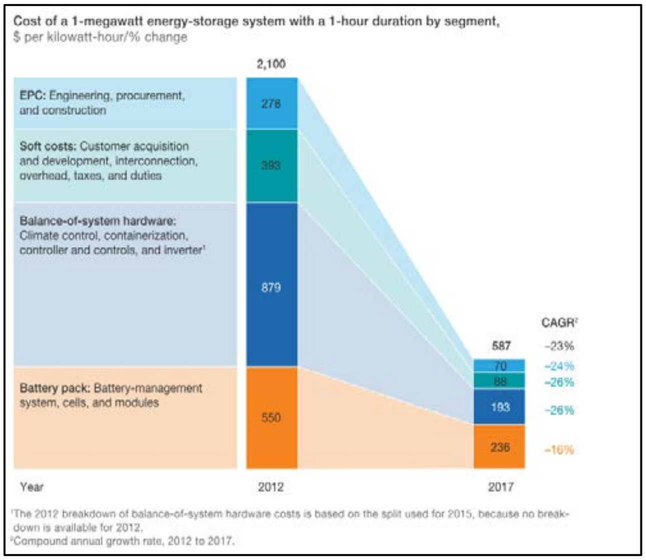
b) Cost-effectiveness

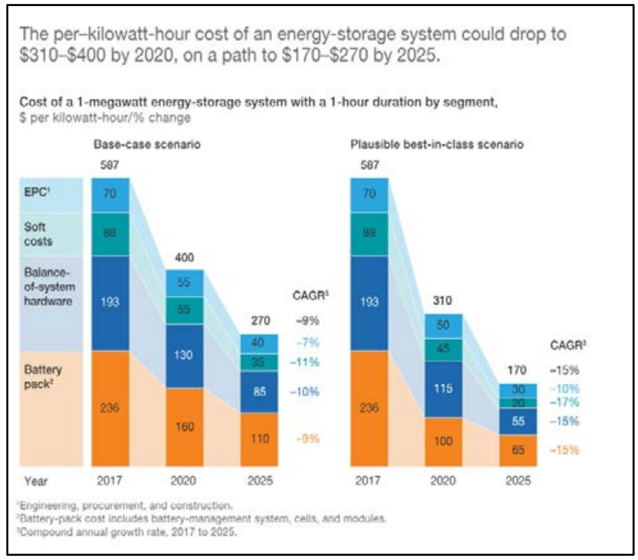
The transformative future of energy storage has been just around the corner for some time, and at the moment, storage constitutes a very modest contribution to the power systems globally (even though the global energy storage market is growing exponentially to an annual installation size of 6 gigawatts[19] (GW) in 2017 and over 40 GW by 2022 — from an initial base of only 0.34 GW installed in 2012 and 2013). But even now, battery storage can improve the economics of electricity production and distribution around the world. Today, electric companies are forced to build excess capacity so that they can meet peak demand, which only may occur a few days a year when temperatures soar and air-conditioning goes full blast for days on end. With battery storage, electricity generated at times of low demand and low cost can be tapped during periods of highest demand and prices. Eskom incurred R 8.7 billion (~USD 661 million) in 2016 to run fossil-fuel powered OCGT (Open cycle gas turbine) plants to meet their peak demand, severely impacting its finances.

Battery storage technology is probably at similar maturity level that CSP technology was in 2010 (during the original project preparation) in terms of technical feasibility and cost effectiveness. The technology is considered technically proven and there have been a few instances where the technology is commercially available at smaller scale. Grid scale battery-storage technology is approaching commercial viability but still needs concessional financing especially in the South African context to achieve financial viability. High upfront capital costs still remain one of the key barriers to the scale up of the technology. However, from 2012 to 2017, battery costs fell more than 15 percent per year, for a total five-year drop of more than 50 percent (according to McKinsey & Co. – see figure below). In aggregate, balance-of-system (BOS) costs—other hardware, soft costs, and EPC—declined even faster: more than 25 percent per year. Overall, the decline in Balance of System (BOS) costs contributed more than three times the savings that the decline in battery costs did. Based on research done by McKinsey - installed per-kilowatt-hour cost of an energy-storage system would decrease roughly 55 percent by 2025, thanks to continued advances in manufacturing scale and technology as well as improvements in storage-system engineering and design. There is also a plausible best-in-class scenario in which market-leading energy-storage manufacturers and developers deliver a step change in cost improvement: additional process-efficiency gains and hardware innovations could reduce the cost of an installed system by more than 70 percent (see figure below – right side). At that point, each kilowatt-hour of storage capacity would cost about $170 in 2025—less than one-

[19] Source: http://energystorage.org/energy-storage/facts-figures

tenth of what it did in 2012. In this scenario, battery packs could break through the $100 per-kilowatt-hour mark by 2020.





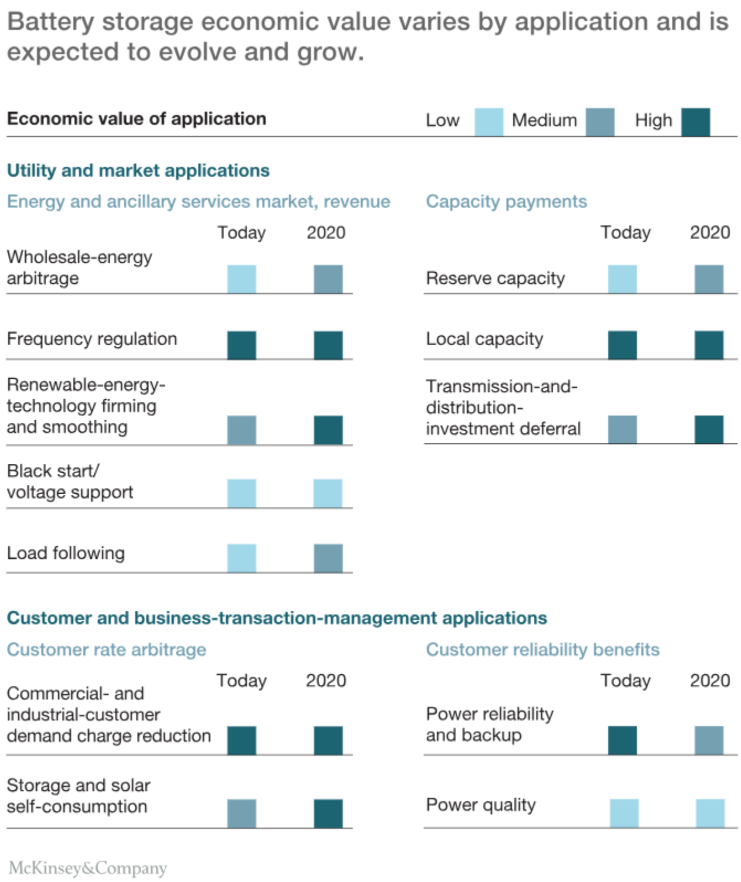
The battery storage program will be able to utilize the cost effectiveness of the battery storage technology during the project cycle through using procurement effectively at milestones incorporating the cost changes in the technology for the benefit achieved in terms of maximizing abatement potential.

c) Demonstration potential at scale

Wind and solar power have a considerable potential for scale up in South Africa. Economic potential assessed at the beginning of the Project - estimated 4 GW for wind and 30 to 38 GW for solar – has dramatically increased, mainly due to the cost reduction of these technologies in the last decade. As installed capacity will increase for VRE, its relative penetration rate should increase fasted if planned decommissioning of coal plant effectively happens by 2021. This drastic change in the power mix added to rapid change on the national demand shape should imply substantial changes also in the way the power system is operated.

Therefore, demonstration and replication potential of battery storage assets could potentially be the most important enabling tool for Eskom teams managing the system's reliability. If such programs are being developed by other power utilities around the world (e.g., Kepco in South Korea, EDF in France and other regional utilities in China and the United States), it would be the first program of this kind to be implemented in Sub Saharan Africa.

With the projected development of grid-scale battery storage as a solution to enable VRE, improve reliability, and defer grid investment. Value of a given battery storage system is also likely to grow during its lifetime, as its uses would evolve to fit with the power system's needs.



d) Development impact

Potential development impact of the Project is very high, due to the tremendous untapped clean energy in SA and the critical role of energy storage to make wind and solar more reliable and dispatchable. REIPPP program has largely contributed to RE penetration increase in South Africa electrical mix (currently 9%), creating thousands of jobs for infrastructure construction and hundreds of RE jobs for clean energy operation and maintenance. This battery storage program can not only contribute to develop a new indigenous clean technology market and set of skills, but could also change perspectives in the power sector strategy (wind and solar becoming local, dispatchable and cost-effective energy sources).

To this extent, energy storage would be also contributing to the country's energy transition, a key priority of World Bank's current Systematic Country Diagnostic (SCD) and incoming Country Partnership Framework (CPF).

e) Implementation potential

REIPPP was launched after approval of the initial Project (see Annex 1), and has exceeded the most optimistic expectations on RE development in SA made at that time (2010-2011). Now SA's power system is at crossroads, battery storage deployment can be transformational, by establishing benchmarks for costs and performance at utility scale, and by becoming the instrument to speed up and deepen RE penetration in the mix. With further wind and solar projects already announced in REIPPP future rounds and with the increased support for higher RE targets into the power mix, Eskom grids will have a pivotal role to enable integration and management of this clean energy, notably using energy storage.

f) CTF additionality

Eskom successfully ran a pilot experiment to test energy storage from its solar PV pilot plant: if batteries' technical value-added has been demonstrated through this research program, economic viability was not demonstrated, due to the innovative nature of the technology in SA, the lack of analysis on local benefits (service reliability, displaced clean energy, but also deferred grid investments) and the various arbitrages to be made in a long term national least cost plan for South Africa. A simplified economic analysis demonstrated however that a deployment of batteries at a significant scale would be close to viability; the error margin being significant for such a pilot project (size, innovation, variety of scenarios), it became obvious for Eskom Management that such a program could only be implemented if sufficient concessional financing is available. This initial analysis conducted Eskom to propose to use CTF remaining proceeds to implement its battery storage program.

g) Implementation readiness

From a broad perspective, the WB and AfDB see this Client-driven alternative as a unique opportunity to diffuse innovative practices on integration of energy storage in Africa power systems (no large storage currently installed in the entire region). Pioneering a power storage program within a large utility will result in faster ramp up of local technical capacity and regional experience exchange. AfDB and WB teams are looking for opportunities to rapidly increase Eskom staff's technical capacity, by joining energy storage community of practice and training programs (e.g., the one developed by WB for Western Africa utilities). Experience exchange with utilities more advanced in deployment of battery technology should also be part of the technical strengthening activities.

Eskom has a long experience in operating pumped-hydro storage, to displace power from baseload to peak demand. This capacity is nowadays almost exclusively utilized to displace VRE generation at the evening peak, but also to help cope with the sharper evening ramp rate (due to cumulated effect of solar generation phase out and demand for lighting and cooking ramping up).

The limited potential for expanding pumped hydro capacity in SA has reinforced Eskom's willingness to invest in large-scale battery storage. In 2014, the utility established a battery storage testing facility in its research center, and conducted experiments on solid and flow batteries charging from solar PV. This US$ 5 million research program is ongoing, and positive outcomes on battery operation and modelling of the battery program comforted Eskom management to keep financing applied research on energy storage.

- Eskom battery testing site in Rosherville, Pretoria

In addition to the team experimenting batteries (6 research engineers), Eskom plans to gradually scale up its implementation team to implement the Battery Storage Program, from 50 staff initially to 80 at the program peak. This staffing commitment is part of the overall high-level engagement taken by the utility, when approving the Battery Storage Program in its Corporate Plan in 2017. Technical assistance under the restructured ERSP will ensure capacity strengthening in operation and maintenance of the battery storage systems.

The Battery Storage Program would aim to achieve the same project development objectives as the CSP pilot project and enable the Project to fully achieve its objectives. The parameters of the Battery Storage Program (financing, output indicators) would remain below 15%[20] variation from the initial scope. WB and AfDB project teams and other partners involved consider the Battery Storage Program to be an innovative, transformational and scalable alternative to increase the share of dispatchable clean energy into RSA's power grids, hence contribute to GHG savings. Battery storage technology also matches with other CTF investment criteria, as (i) the technology is commercially available, with reliable large suppliers providing demonstrated products; (ii) a rapid global scale-up of this technology is dragging down its cost at cost-effective levels; (iii) its perfect role to enable VRE makes CTF financing a timely resource, complementary with large private sector investment in SA clean energy in the next few years; and (iv) demonstration effect of the CTF-funded batteries is intended to catalyze private investment in this technology in SA and Africa region.

A major change between the original CSP sub-project and this Battery Storage Program is that new renewable energy capacity will mainly be financed by the private sector[21]. This outcome will impact positively the Project's leverage on private sector investment. Eskom's technical concerns about the integration of this new VRE (that partly explained delays in signing PPAs) has led Eskom teams to proactively analyze and validate the energy storage alternative as a technical solution to better manage this variability. Eskom sees large scale battery storage as a transformational technology that could potentially facilitate transition to a cleaner energy mix, whereas CSP is now being commercially developed by the private sector in South Africa and does not therefore require the original learning experience that Kiwano CSP would have provided.

[20] With exception to the CTF leverage indicator end value, that would be increased to reflect the private sector investment on power generation (REIPPP).
[21] Only 40MW of distributed PV will be financed by Eskom.

4- DESCRIPTION OF ESKOM BATTERY STORAGE PROGRAM PROPOSAL

In April 2017, Eskom proposed to change the CSP technology to a Battery Storage Program under the same Project, and with the perspective to serve the same Project Development Objectives (PDO), by leveraging further private investment for clean energy generation and facilitating its integration to Eskom grids with the help of associated storage batteries.

4.1- Genesis

With a rapid acceleration of South Africa's REIPP Program (refer to Annex) and a demonstrated expertise in energy storage management from its 2,732MW pumped hydropower stations[22], Eskom has tested and piloted grid-scale battery storage technology, still in its early stages, as a way to integrate and dispatch Variable Renewable Energy (VRE) into their grids. Since 2015, Eskom has financed a US$ 5 million research program at the Eskom Research Center: grid-connected small battery modules – now totaling 1MW. Based on this experience, Eskom battery storage experts are convinced about the positive potential role of storage technology in South Africa's electricity mix in transition, and confirmed the value of testing this technology at scale in parallel with wind and solar PV development.

Availability of concessional funds for demonstrating impact of a significant Battery Storage Program is hence a timely opportunity to demonstrate the role of battery storage in facilitating the integration of wind and solar PV into Eskom grids – notably leveraging more efficient use of private investment under the Renewable Energy Independent Power Producers Program (REIPPP), and would represent a key enabler towards a cleaner energy mix in South Africa.

4.2- Description of the Battery Storage Program

The Battery Program would consist of supplying, installing and operating distributed battery storage infrastructure at Eskom sub-stations located at existing Variable Renewable Energy (VRE) plants operated by Eskom Renewables (including the Project-funded 100 MW Sere wind farm), upcoming distributed solar PV to be implemented by Eskom Distribution, and the new REIPPP sites (projects from Bid window 4).

The size of energy storage capacity needed has been determined so as to meet the same targets in terms of renewable energy capacity added as well as the Greenhouse Gas (GHG) offset estimated in the initial funding request approved by the CTF Trust Fund Committee (TFC). The project is not envisaged to have any financing gap and has sufficient firm financing available to implement the storage program of this size. Potential future support from additional co-financiers which may become available would further accelerate and scale-up deployment of battery storage technology, helping to ensure that this project meets the objective of facilitating SA's energy transition. The Project also maximizes the use of concessional financing sources available, as early stage investment in emerging technology (still considered high risk commercially) that needs such financing to reach financial viability at scale (cf. section 5.2 – Summary Economic Appraisal).

Specific investment to be implemented under the battery program would include (i) at least 175 MW electrochemical battery storage systems installed (solid-state or flow technology depending on the site and the need) by end-2019 and at least 335 MW of electrochemical battery storage installed for the entire program; (ii) the connection of the battery systems to the grid; (iii) the remote control-command system(s) to ensure optimal and automatic operation of the batteries in renewable energy production output, site by site; (iv) the operational assistance for implementation supervision (owner's engineer), training of relevant Eskom staff on operation and maintenance of the battery systems,

[22] Three pumped hydropower stations in operation: Ingula 1,332MW, Drakensberg 1,000MW and Palmiet 400MW.

and (v) the technical assistance to create and strengthen the enabling environment for scale up of the battery storage technology in South Africa.

Linkage between the Battery Storage Program and the REIPPP. The REIPP program is one of South Africa's measures to reduce its carbon footprint and meet its goals under the country's National Determined Contributions. It is a globally recognized program which has been running since 2011 and has installed a net capacity of over **3,500 MW** connected to the grid over three first bid windows.

However, rounds 3.5 and 4.0 had been stalled between July 2016 and March 2018, because of system over-capacity concerns, relatively high supply costs proposed offers and non-materialization of expected electricity tariff increases. The capacity from these 3.5 and 4 windows is expected to total about **2,300 MW**. The Energy Storage Program is based on the fact that most of the new capacity under these windows will be VRE technologies (wind and solar, representing around 1,200 MW capacity for Round 4, in Northern Cape Province only). Hence commissioning of some of the REIPPP PPAs is a pre-requisite to the successful implementation of the battery program, as the main purpose of the batteries will be to optimally dispatch this new clean energy.

Successful integration of VRE using storage will potentially impact the pace of decommissioning old coal fired power plants (5,000 MW expected to be decommissioned by end 2021) and the future of REIPPP (subsequent rounds potentially including an option for private investment in storage along new VRE).

By design, the Battery Storage Program would directly support integration of variable renewable energy (VRE) into the grid. Eskom is in the process of hiring a qualified Owner's Engineer (OE)[23], with demonstrated experience on large scale battery storage supply and installation. From the feedback on the first 175MW of batteries installed along with selected VRE sites by December 30, 2019, the program will be able to build on experience in terms of technology choice(s), adjust battery systems management requirement and optimize procurement strategy to allow installation of a potentially larger volume of batteries, by March 30, 2021. The Battery Storage Program would have a milestone at the end of 2019 to ensure proper analysis of the subset of the locations selected by Eskom to install the batteries. Lessons learned from the operational sites by assessing use site by site will factor in refining the size of battery for each site, choosing appropriate technology and improving installation and commissioning processes.

Of the total 2,300MW[24] of new renewable energy capacity – in 27 projects - for which the PPAs were signed on April 04, 2018, the storage program - for the purpose of modeling conservatively – has assumed 300MW of REIPPP capacity to come online by 2019 and another 2,000MW of REIPPP capacity to come online by 2021. By end 2019, a total aggregated capacity of 135 MW battery storage would be co-located with a selected subset of the IPPs sites, with the objective of facilitating the integration of these VRE power plants to the grid (offset intermittency and dispatch optimally the energy). A 40 MW battery storage capacity would also be installed at the Eskom-owned Sere Wind power plant, allowing to integrate the wind energy currently curtailed[25], and to dispatch the available wind energy when it is most needed (e.g. at peak demand).

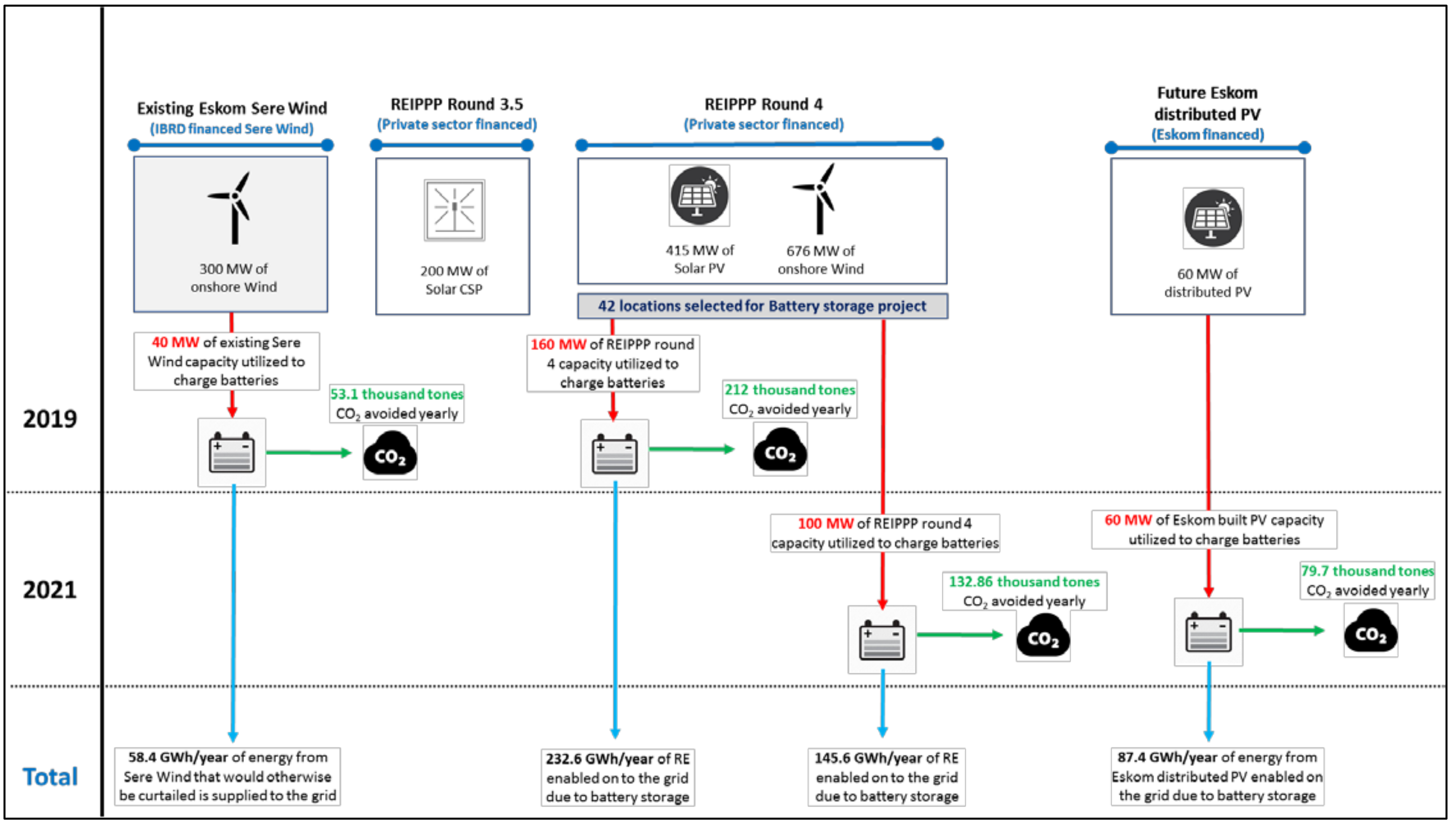
[23] The hiring of the OE is financed by Eskom using their own funds. OE is expected to come on board on June 29, 2018

[24] The 2 CSP projects of 100MW each awarded under REIPPP round 3.5 will not be backed up with batteries, as this technology has an embedded energy storage making the solar energy dispatchable; these projects have however been enabled by the Project, as part of the package of staled PPAs that were signed on April 04, 2018.

[25] Curtailment is a reduction in the output of a generator from what it could otherwise produce given available resources, typically on an involuntary basis. During 2015 and 2016, energy from Sere wind plant was curtailed a total of 12 times amounting to 9.16 GWh not integrated to the grid.

By end-2021, at least 160 MW of new (post the 135MW installed by 2019) battery storage capacity would be installed, located at Eskom substation level close to a further subset of the round 4 REIPPs, to scale up the volume of dispatchable clean energy. Also by 2021, 60 MW of Eskom-owned[26], distributed PV would be complemented with battery storage to improve its dispatchability. Figure 1 below illustrates the design and achievement of objectives of the Battery Storage Program.

FIGURE 1:PROPOSED SYNOPSIS OF BATTERY STORAGE PROGRAM



The Battery Storage Program will be essential to increase the 'dispatchable' nature of this additional VRE capacity, hence providing more confidence in moving forward with scaling up grid connected VRE. The storage infrastructure will be located at **42 sites**, all being Eskom properties. Eskom has conducted dispatch optimization and local load flow modelling[27] to determine the impact of the storage assets, by simulating REIPPP and grid constraints, with the overall objective of reaching the Project result targets (capacity and energy of new VRE, tCO2 offset). This work will be refined by Eskom's OE, to ensure that preliminary estimates reach or surpass the Project Development Objectives. Technical due

[26] 60 MW distributed PV implies grid-scale solar PV projects implemented at distribution level and will be fully financed using Eskom funds.
[27] Eskom simulated the storage integration by using PLEXOS, the same modelling tool used by DoE for the IRP (RSA's national energy masterplan). The flow of energy charging the batteries were simulated with Eskom in house tools, to estimate benefits of displacing the clean energy equivalent to four-hour daily battery use.

diligence conducted by energy storage experts[28] hired by the WB validated most of the modelling outputs, and provided recommendations for the way forward (see chapter below on Project due diligence).

Energy integration constraints, location and timing of the new REIPP plants, availability and volume of storage needed and safeguards (environmental, social, safety) for a given site have been the determinants for Eskom sites selection and priority of installation. Priority of sites may evolve, depending on how fast signed REIPPP plant PPAs reach financial closure and on their updated commissioning date.

4.2- Social and Community Benefits

Several decentralized areas where Eskom plans to install solar PV with battery storage are remote ends of distribution lines where supply capacities are low, and potential customers cannot be connected. The addition of solar PV generation with battery storage will help address these issues, thereby significantly contributing to universal access which South Africa aims to achieve by 2025, and supply reliability. This will in turn help communities improve their quality of life through, for example, better education, health and commercial facilities. Rural entrepreneurship and other productive uses could also be developed.

> ***Reinfontein Community-based PV using storage pilot project***. Located in the North-West region at the border with Namibia, Reinfontein Solar PV plus storage sub-project is an emblematic pilot. At 180km from the nearest power generation site, the power supply in the area is very unstable. Eskom is importing – at high cost - power from Namibia to sustain the voltage level, and cannot connect new load in the area.
>
> The project would consist in installing at least 1.2 MW of Eskom solar PV capacity added with at least 1MW of battery; capacity scale-up would be planned, as a land acquisition able to receive 8 MW PV and 4 MW storage is contemplated.
>
> From most recent joint Eskom / Donors mission to Reinfontein, dialogue with the Community representatives (around 9,000 members) confirmed how important reliable energy is for the sustainability of the region, for improved education (avoiding 4 hours of daily bus-ride for 60 children), tourism development (lodging, camping, and hunting), agriculture and pastoring and small entrepreneurship (young professionals leaving the community to work in urban areas).
>
> If the role of the energy storage to maintain reliable electricity service is demonstrated in Reinfontein, replication could potentially allow last pockets of underserved communities to ha electricity access.

5- DUE DILIGENCE AND APPRAISAL SUMMARY

5.1- Project Due Dilligence - Assessment of Battery Program Feasibility

From January to December 2017, Eskom teams and ERSP financiers (WB, AfDB, KFW, AFD, EIB) discussed and refined the program concept, evaluated the conditions under which the program could reach similar objectives as the initial Project,

[28] EDF Store and Forecast, a consultancy firm specialized in design and optimization of battery storage systems coupled with VRE.

and under a constrained available budget. The Eskom teams then assessed the potential barriers that could occur during implementation as follows (along with the progress made):

Environmental: All the sites selected in the proposal were identified to only conduct a basic Environmental Impact Assessment (EIA) assessment that takes about 197 days. There is an Eskom environmental representative for each of the four Distribution Operating Units; Western Eastern, Northern Cape and Kwa-Zulu Natal (KZN). Eskom teams requested for proposals in April 2018 from independent EIA consultants as per DEA requirements. As most of the sites are in the Western Cape, there will be six EIA consultants per group of sites in the WC. One EIA consultant will be appointed for Eastern, Northern Cape and KZN as there are few sites. The EIA will be conducted for each individual site such that each site will have its own EIA approval. Currently, indications are that a full EIA approval is required if the hazardous material volume increases above 500 liters. Based on the high-level analysis the team conducted during the initial phase, indications are that there is no hazardous materials volume of 500 liters or more. Overall, Eskom anticipates that the entire environmental approvals process timeframe is 6 months per site (which will be carried out in parallel). A full EIA will also be carried out for Eskom financed distributed solar PV sites (which could take up to 18 months, but will include the battery storage component).

Regulatory (NERSA license): Batteries have not been classified separately by NERSA and will not be viewed as generating units. Nevertheless, Eskom is engaging with NERSA to obtain more clarity on classification of battery storage systems and on their licensing procedures. NERSA only licenses projects that have allocation in the IRP. Since licenses have already been issued to the REIPPPs from Round 4 and battery storage will be at the Eskom substation level, there will be no regulatory requirements for batteries from the NERSA point of view. For Eskom financed PV being added at the distribution level, there may be a need for some generation licenses whose process for issuance will follow that of the REIPPP, where approval takes around 6 months from bid prices and contractor identification.

Procurement regulation (National Treasury-PPPFA exemption): An exemption like that granted for Kiwano CSP so that the procurement process is consistent with the applicable (and agreed upon World Bank Guidelines) is required. Since it took approximately 8 months from date of application to the Minister of Finance to approval for Kiwano, Eskom started the process early this time, demonstrating commitment to execute this program on time. As of end May, Eskom had already obtained the PPPFA exemption.

Technical (Grid Code): The Grid Code team has included battery technology in the Code and the Code will be finalized, with battery storage, by the end of June 2018

Ministerial Determination (DoE allocation/amendment): For Eskom to commence the development of 60MW of distributed PV, an allocation of 60MW to Eskom will be required in the IRP. Currently, in the IRP 2010 Eskom has an allocation of 100MW for CSP. Eskom is currently engaging Department of Energy (DOE) and NERSA to amend the allocation of 100MW CSP to 100MW PV. Government policy allows such amendment. The risk of this negatively impacting the Project timeline is minimal since implementation of Eskom financed distributed PV is expected to be completed by December 2021 and since Eskom has already commenced the process to amend the allocation.

The teams also conducted technology and market reviews (visiting battery storage manufacturers in USA and China for both Solid State and Flow technologies) to better prepare tendering phases and assess various procurement scenarios.

Based on the various reviews of proposals and discussions with Eskom teams, the WB and AfDB teams assess that Eskom's battery program is technically feasible and supports an important step towards increasing the value and penetration of wind and solar energy into the grid, through demonstrating an approach to managing the variability of these energy sources and making VRE dispatchable[29]. It is in line with the Eskom Corporate Plan, demonstrating ownership of this strategic direction.

Eskom has demonstrated substantial commitment towards the battery storage project, and persisted with its internal approval processes (as shown below):

Item no.	Date	Eskom Committee	Government Depart.	Status
1.	February 19, 2018	Eskom Executive Committee (EXCO)	National Treasury (NT)	Submitted letter to Minister of NT requesting exemption of PPPFA
2.	February 28, 2018	Eskom EXCO	-	Supported the project
3.	March 8, 2018	Eskom Board	-	Approved the battery storage project as a replacement for CSP
			-	ii) Approved the signing of the PPA's of bid windows 3.5 and 4
4	March 214, 018	Group Capital and Investment Committee (GCIMC)	-	Approved the DRA for further development to complete business case (released funding to proceed to project preparation)
5.	April 4, 2018	Eskom	DOE IPP office	All 27 projects of bid windows 3.5 and 4 were signed
6.	April 30, 2018	Eskom	DPE	Draft pre-PFMA notification; submitted end May 2018. Approved.

Additionally, this project is in line with the Eskom Corporate Plan, demonstrating ownership of this strategic direction. Eskom has already progressed in procuring the services of an Owners Engineer to get started on the preparatory works.

Main stakeholder risk that can potentially affect implementation of the Battery Storage Program are related to timely implementation of the REIPP projects and proper prioritization of IPP projects that should be complemented with storage. A close monitoring of REIPPP projects implementation progress is being conducted and selection to prioritize sites will be based on several criteria (land availability, grid configuration, VRE plant capacity, potential safeguards issues). As of June, 6 2018, eight (8) of the twenty-seven (27) IPPs which signed a PPA with Eskom in April had reached financial close. The IPP Office expects the remaining IPPs to reach the same stage by end-July 2018.

The short timeframe for the preparation of IBRD and CTF projects restructuring imposed a fast track due diligence, whose analysis will be strengthened in all aspects of the program, using external support to Eskom, WB and AfDB teams -- to conduct more in-depth analytics and site by site economic evaluation of the program.

5.2- Summary Economic Appraisal

The SA power system is currently in a conjectural power capacity surplus due to a lowering electricity demand growth rate – correlated with the national macroeconomic context. Added to this factor, the relative increase of VRE into the power mix, the evolution of power consumption trends (bigger and faster base to peak load ramp up) and the increasing number of grid-related constraints (bottlenecks at distribution level, aging infrastructure) increases the risk of system failure, and thus the ability for clients to consume incremental electricity. Despite the increase in RE power capacity, the SA power system makes it paradoxically more difficult to phase out large baseload thermal power capacity (coal plants),

[29] Dispatchable generation refers to sources of electricity that can be dispatched at the request of power grid operators or of the plant owner according to market needs. Dispatchable generators can be turned on or off, or can adjust their power output accordingly to an order.

because of the reliability issue. This is the main rationale for implementing Eskom's Battery Storage Program, whose impact should not only contribute to increase the share of VRE into the power mix but also to improve the local and overall system reliability.

An economic analysis has been carried out for the 'battery storage' activity separately, and not for the project as a whole, as the Sere wind pilot has already been implemented. The economic assessment analyzes whether the added renewable energy projects (27 REIPP projects that were recently signed) coupled with the batteries is economically viable, in comparison with the scenario in which the new RE capacity and the batteries would not be in the system (resulting in greater use of open cycle gas turbines – OCGT - to cope with peak ramp up and localized bottlenecks).

The following assumptions were made to simplify the number of possible scenarii: (i) the batteries would store and dispatch 4 hours of daily generation from VRE (ratio wind/solar in VRE mix and estimated generation costs deduced from the REIPPP data on VRE); (ii) only one use of the battery is represented, energy displaced to peak period (other uses like offset intermittency or grid frequency modulation would imply several cycles of charge/discharge per day); (iii) the alternative to new RE injected through battery is OCGT[30] as its energy would be displaced at daily evening peak; (iv) the social cost of carbon (avoided cost due to displacement of CO_2 emissions) used for this analysis is US$ 35 / tCO_2 (based on WB Guidance Note for Social Value of Carbon in Projects, base value, 2020).

The economic rate of return calculated from the project data - and using battery capital costs from the WB storage consultancy EDF Store and Forecast – provides a ERR at 1.2 percent. This is assuming a battery load factor of 90 percent (depleting to 80 percent after 7,000 cycles and 70 percent after 10,000 cycles) and a battery replacement after ten years (based on technology with smallest life time, Lithium-ion battery). If we consider these load factor decreases within time, and a fixed cost of VRE generation in the RE project life cycle, the net present value of the battery program appears to be negative (- US$ 139 million). When we factor in the cost of carbon offset, the ERR moves slightly to 3.1 percent, the amount of energy stored – hence CO_2 offset - being relatively small compared to the investment cost.

As the main purpose of the battery is to maintain / increase the system reliability by managing the VRE intermittency and making VRE a dispatcheable resource, the system cost of failure (and then savings from avoided failure) should also be included into the evaluation; this analysis would require a much more precise least cost dispatch approach and some robust assumptions on the impact of the grid. This more complex analysis is worth doing (ex post, through the technical assistance sub-component), as it would show the real transformational impact of battery storage into the South African grid.

Because of the pioneer role of this battery storage project, its assessment should not be limited to the amount of clean energy enabled and CO_2 offset. The long term mitigation strategy (LTMS) that this innovative technology serves would provide an added value to, as well as the market scale and technology maturity effects on the economic rate of return of the next battery storage project, should be considered. Partial concessional financing of the demonstration project, considering the cataltic role it would provide, should allow a greater flexibility for an increase of the ERR.

6- TIMELINE AND IMPLEMENTATION ARRANGEMENTS

The Eskom implementation unit (PIU) will include two sub-groups, (i) the Project Development team in charge of project preparation, impact assessments and tendering process, and (ii) the Project Execution team in charge of construction supervision and contract management. The PIU will be supported by Eskom staff from Distribution, Energy Dispatch, Environment and Research divisions. Eskom PIU will also be assisted by an engineering firm – the Owner's Engineer (OE)

[30] OCGT generation marginal cost estimated from Eskom annual report 2017at 97c$/kWh.

- knowledgeable in battery storage technology, to ensure an optimal and competitive tender process and construction phase.

Eskom has allocated a dedicated budget line to the PIU – for 2017 and 2018 at ZAR 16 and 14 million, respectively (million (US$ 1.28 and 1.12) - for the storage proposal design, preliminary assessments and field identification of sites to be pre-identified. This budget will be complemented by the Technical Assistance (TA) sub-component under the restructured component 2, to finance supervision of activities and ensure sustainability of the program.

Eskom's implementing agency has been strengthened – since the due diligence conducted by Eskom in Q2-Q3 2017 to refine its energy storage program proposal, to integrate the distributed nature of the proposed activities that would require enhanced field supervision (one Eskom battery storage focal point per region in Eskom Distribution Division).

Procurement instruments would remain identical (International Competitive Bids for all goods and services procured under component 2), but flexible arrangements will be designed at tender level to allow several suppliers implementing in parallel installation of the battery systems. Most importantly, Eskom obtained from SA's Ministry of Finance (on May 08, 2018) the exemption to PPPFA[31] Act for all procurement under the battery program (World Bank Procurement Guidelines will apply).

7.1- Project Schedule

Key milestones and next steps for implementation of Battery Storage Program, subsequent to CTF and IBRD restructuring process as well as internal approval by AfDB of its co-financing being completed in due time, would be as follows, to ensure completion of activities scheduled prior December 30, 2019:

- June 30, 2018: Owner's Engineer appointed;
- August 30, 2018: site by site technical specifications and environmental assessments (Basic Assessment);
- December 30, 2018: Eskom Board approval of the 'business case' (presentation of awarded offer for approval) and Department of Public Enterprises (DPE) approval of draft contract;
- March 30, 2019: EPC contract(s) signed with awarded firm(s);
- December 15, 2019 or earlier: all battery systems planned (totaling at least 175 MW) installed and commissioned;
- December 15, 2021 or earlier: all battery systems planned (totaling at least 335 MW) installed and commissioned.

To complement, some specific actions have already been conducted by Eskom in order to ensure that the new project can be implemented as per the agreed timeline to achieve the target outcomes and to mitigate the main implementation delay risks identified. Among the proactive actions, (i) Eskom included the battery storage technology into its grid code to facilitate further batteries' connection to SA grids, (ii) Eskom discussed and reached agreement with the energy regulator NERSA to define a classification for the battery storage systems (as there is no proper regulatory framework for grid-connected batteries), different from power generation assets, and (iii) Ministry of Finance issued Eskom with a waiver from complying with the requirements of the Preferential Procurement Policy Framework Act.

[31] PPPFA: Preferential Procurement Policy Framework Act.

ANNEX 1 - Country and Sector Context

Second-largest economy in the Africa region, South Africa (SA) is a middle-income country equiped with well developed roads and infrastructure, and sophisticated financial, legal and communications systems. Despite these strong pillars aded with tremendous natural and mineral resources, this 55 million people republic still struggles with high unemployment levels (28%, 68% among young people), inequality and widespread persistent poverty (45% of SA's population under the poverty level). Economic growth has slowered down in the last decade, and is now below Sub Sahara's average drowth rate (3.5 percent).

This economic trend has impacted SA's electricity sector, since power demand growth of Africa's largest power system has stagnated – and energy demand decreased by 6 percent - since 2016, engendering a conjectural surplus above 5,000 MW[32]. Eskom, the state-owned and vertically integrated electricity utility is responsible for most of the generation and transmission assets, and owns almost 50 percent of the electricity distribution network infrastructure. The remainder of the power generation comes from electricity imports, independent power producers (IPPs) and decentralized power distribution. The remainder of the distribution infrastructure is owned and operated by 179 municipalities.

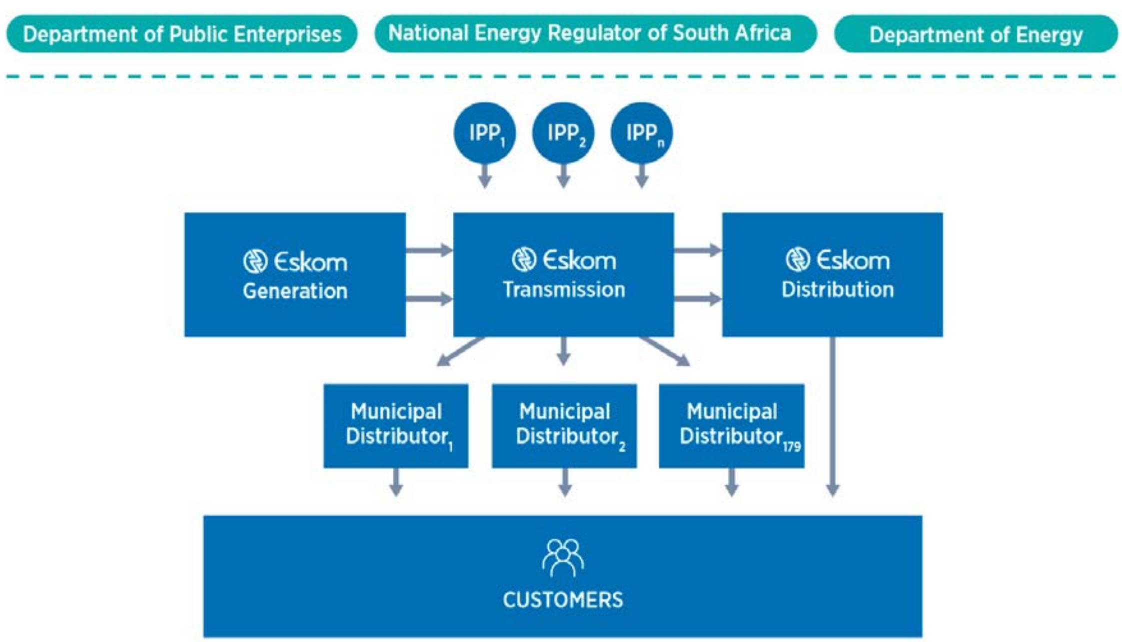


Fig.1 – Structure of South Africa's electricity market (source: Eberhard et al., 2016)

The Department of Energy (DOE) provides oversight over the national electricity sector, with the Department of Public Entreprises (DPE) governing Eskom through a shareholder compact. The electricity sector is regulated by the National Energy Regulator of South Africa (NERSA), who is responsible for tariff approvals as well as licensing of generators, transmitters, distributera and traders.

The Integrated Resource Plan (IRP) is SA electricity sector's key planning guide, forecasting the country's demand profile over 20 years and details how this demand should be met in a cost effective manner. The latest IRP (endorsed in 2011)

[32] SA has 45 GW of installed capacity, 33 GW of peak demand and 265 TWh per annum of consumption.

envisages 19 GW or new renewable energy (RE) capacity to be installed by 2030, out of an total capacity projected at 90 GW. The draft IRP 2016 has not been endorsed, and an updated version may be submitted for public consultation by August 2018.

South Africa's Climate Change Commitment

Sub-Saharan Africa accounts for only 4 percent of global greenhouse gas (GHG) emissions, but SA has one of the continent's largest green house gases emissions, with its indigenous energy resource base dominated by coal (about 77 percent of the national's primary energy, 265MT p.a. or 832 gCO2eq/kWh). In line with the increased global commitment on sustainable development and mitigating climate change, RSA's National Development Plan (NDP) advocates for a greener economy and envisions a transition to a low-carbon, resilient economy and a just society (National Planning Commission, 2012). The recent New Growth Path (NGP) and Industrial Policy Action Plans also incorporate climate mitigation and sustainable growth objectives.

Decommissioning of old and inefficient coal-fired power plant is one of the intended mitigation actions in the NDC submissions to the UNFCC (see graph below). While this is envisaged in the IRP 2011[33], the country is not well-prepared to address the socio-economic impacts that would arise from decommissioning these plants, associated coal mines, and the environmental impacts that these processes would potentially present.

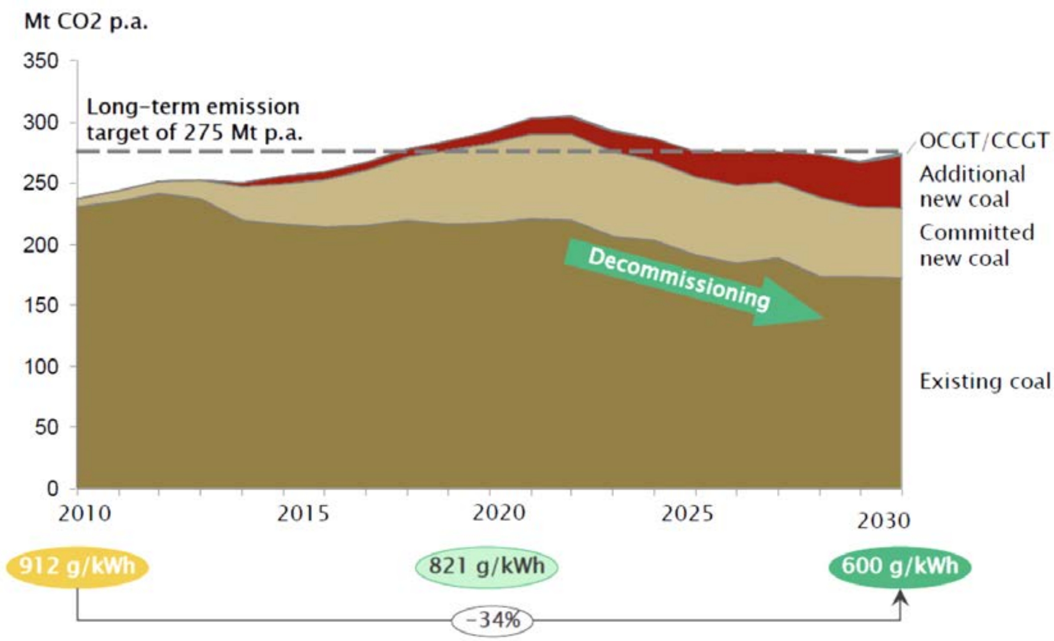


Fig.2 - Coal plants decommissioning targets to reach IRP 2011 target of 275 MtCO2/y (Source: Eskom, OECD, March 2018)

In a conjecture of slow economic growth (hence electricity supply surplus due to low demand growth), potential socio-economic impacts of coal plants decommissioning, lack of knowledge and experience on energy management from variable renewable energy (VRE, wind and solar photovoltaic plants), and low penetraton rate of RE in SA's mix (impacting economics of scale, hence cost of RE) are the as many drivers that can explain SA's slower energy transition than expected.

[33] Coal plants planned for decommissioning are Camden (phase out in 20202024), Hendrina (2020-2027), Komati (2020-2029) and Grootvlei (2025-2028).

Renewable Energy independent Power Producers Program (REIPPP)

The South African REIPPPP is designed as a tender process to facilitate competitive and private investment into utility-scale and grid-connected renewable energy generation. Four bidding rounds (referred to as bid windows [BWs]) were completed between 2011 and 2015. An additional bidding round was held for concentrated solar power (CSP) only. The BWs were highly competitive, receiving 390 submissions, with less than a quarter (92) of these being selected for procurement.

The selection amounted to bids of 6 328 MW, representing ZAF 193 billion (USD 20.5 billion) in investment. Fierce competition has drastically reduced prices over the bidding rounds, and as an outcome of the last tender, solar PV and wind energy seem now to be cheaper compared to Eskom's average cost of supply. Prices for solar PV and wind are also far below the cost of new coal power stations in South Africa (Bischof-Niemz and Fourie, 2016; Eberhard, Kolker and Leigland, 2014). Implementation of the program advances towards adding 7 GW of operational renewable energy generation capacity by 2020, which is the National Development Plan's (NDP's) interim target, and towards adding 17.8 GW from renewable energy by 2030, which is the IRP's longterm target (DOE SA, 2015).

The Small Projects IPP Procurement Programme (SP-IPPPP) was introduced by the DOE SA in 2013. The SP-IPPPPP aimed at projects of 15 MW size each, with the aim to procure a total of 200 MW. Another important difference between the "regular" and small IPP programme is that there are no exclusive demand bands for technologies in the small program; in other words, renewable energy technologies compete against each other in the small IPP programme, whereas this is not the case in the utility-scale program. Simplified rules aimed to allow for less expensive bidder participation in order to encourage small and medium enterprises (SMEs) to participate. The SP-IPPPP offered 50 MW for tender in October 2013 and, after a prequalification phase in March 2014, received 139 MW (29 bids) in November 2014. Of these, 49 MW (10 bids) were awarded in October 2015 (DOE SA, 2016), and an additional 10 projects were awarded in January 2017. Evidence suggests an overestimated market readiness for the first bidding round, resulting in limited competition and bid prices closer to the price caps (Eberhard, Kolker and Leigland, 2014). Subsequent bidding rounds saw a reduction in the volume auctioned and resulted in more competition and lower winning prices.

The REIPPPP was generally regarded as well designed and managed through a separate unit from the DOE, the DOE IPP unit, and the process was seen to be transparent and fair. The DOE IPP Unit is led by a management team seconded from the public-private partnership (PPP) Unit of the National Treasury, which had extensive experience, expertise and credibility with both public- and private-sector stakeholders. In addition, local and international technical, legal and financial transaction advisors provide substantial input.

The key to the REIPPPP's success can be found in the DOE IPP Unit's emphasis on problem solving, rather than an enforcement of administrative arrangements, as well as the largely ad hoc institutional status of the unit (Eberhard, Kolker and Leigland, 2014).

The REIPPPP is well known as the pioneer for renewable energy in South Africa, but it has also loosened the monopoly hold of Eskom through the introduction of IPPs: within four years, IPPs have achieved more investment in South Africa than has the rest of SSA over the past two decades. The REIPPPP is providing valuable lessons for other developing countries looking to design and run competitive auctions for grid-connected renewable energy IPPs.

Auction demand

The South African REIPPPP was designed to allow a range of renewable energy technologies to be bid. Overall development requirements were established through ministerial determinations based on the IRP, which specifies the time, technology and owner of new required generation capacity. The determinations bind the regulator to issue associated licenses. So far, three determinations have supported the REIPPPP, with the first determination in 2011 allocating 3 725 MW to be generated by renewable energy sources from IPPs. As a result of the significant positive response, an additional 3 200 MW (2012) and 6 300 MW (2015) were allocated to renewable energy-based generation. These determinations are differentiated by technologies, including onshore wind, CSP, solar PV, biomass, biogas, landfill gas and small hydro (< 40 MW).

The ministerial determinations have been translated into separate bidding rounds based primarily on the IRP – each again offering specific demand bands per technology.6 Evidence suggests beneficial outcomes from the REIPPPP as a longterm auction programme, as the programme timeframe contributed to attracting a larger number of bidders and supported the development of a local industry (IRENA and CEM, 2015). The next Table provides a breakdown of the capacity offered and awarded by round and technology, including price and investment outcomes.

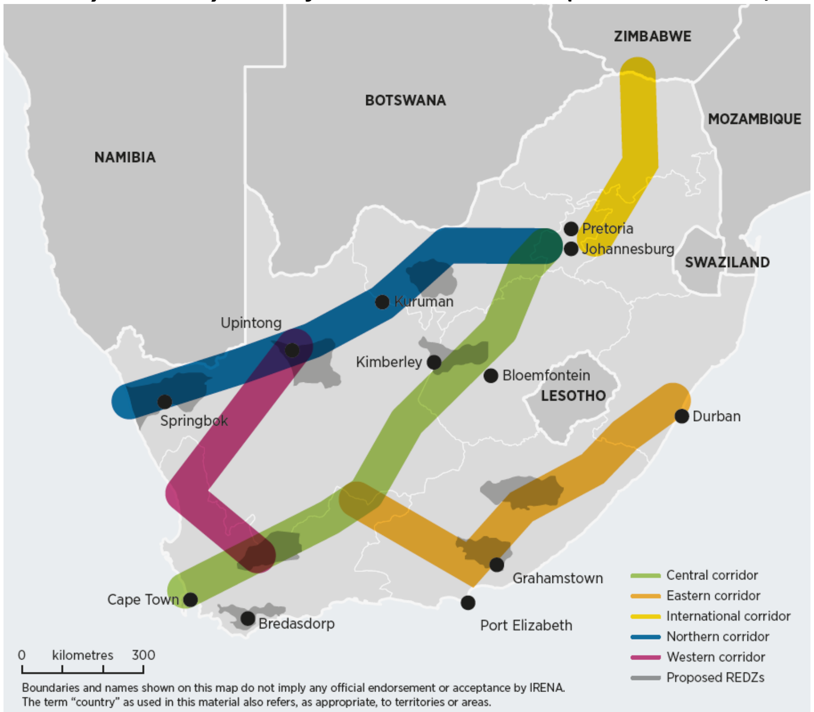
The national utility (Eskom) is the official off-taker charged with signing the 20-year power purchase agreements (PPAs). An intergovernmental framework agreement obliges the regulator, NERSA, to pass on the REIPPPP costs to consumers through the Eskom tariff.

Technology

Due to the multiple technologies featured in the REIPPPP, various technical requirements formed part of the bidding process. Project size constraints were set out for each technological category, and technology-specific PPAs were provided as part of the request for proposal (RFP). Bidders were required to provide independently reviewed forecast energy sales reports, with differing minimum requirements per technology, such as at least one year of site-specific data for onshore wind projects and ten years of data for solar PV. For biomass and biogas projects, bidders had to provide documentary evidence of energy resource certainty by way of a fuel supply agreement or market study that covered at least the project's first two years of operation. Projects were furthermore required to provide evidence that their equipment met international standards, their components met the “proven technology” requirements and certain component models adhered to prescribed certification programme designs, and their projects met minimum prescribed technical availability standards.

The REIPPPP has largely been a location-agnostic auction program, placing the responsibility for site selection and land acquisition/leasing on bidders. Site-specific documentation requirements have therefore been fairly onerous, with bidders required to submit proof of land acquisition (title deed/notarial lease/unconditional land option), various environmental consents (environmental impact assessments, water use applications, civil aviation commissioner consent, heritage authority approval, etc.) and proof of applications for land use change, subdivision and zoning (removed as a requirement from Round 3). These requirements have been costly and time consuming, both for developers as well as the various government departments and authorities involved. Some cases have required upward of 20 permissions and have taken more than a year to process. To speed up the project development process, the government has now established better co-ordination between renewable energy generation and transmission planning and environmental licensing. In 2016, eight Renewable Energy Development Zones (REDZs) and five Power Corridors were approved to guide the locational choices of investment. For these locations, strategic environmental assessments (SEA) are performed prior to bidders' site selection. The SEAs preassess the environmental sensitivities within the development areas, and projects in these areas are subject to simplified environmental impact assessments. These new rules apply from Round 5 onwards and are expected to reduce environmental review and decision-making time from 300 days to 147 days.

- Proposed Renewable Energy Development Zones (REDZ) and Preliminary Electricity Grid Infrastructure Corridors (Source: McEwan, 2017)



Bidders were primarily responsible for securing grid access. Bidders would already have confirmed with the grid provider (Eskom) that there was sufficient capacity in the designated substations and distribution and transmission lines; failure to do so could result in their bid being disqualified. Depending on where projects were located, and on the location of the point of connection, projects could either connect to the transmission system (in which case the grid provider was the Eskom transmission business unit) or to the distribution system (in which case the grid provider could either be a municipality or Eskom distribution).

Preferred bidders would therefore have to sign either a transmission agreement or distribution agreement as part of their PPA with the relevant grid provider. In cases where the grid provider was a municipality, bidders were required to ensure that the relevant agreements (amendment agreement to the electricity supply agreement and an implementation protocol) were in place or would be in place before FC as part of their bids.

In general terms, bidders were responsible for "shallow connection works" – works for the dedicated customer connection of the facility to the system – and the grid operator for connection works on shared assets ("deep connection").8
Shallow connection works could be done in three ways: Eskom-built, self-built (in which the bidder built the connection works and then transferred it to the grid provider) or own-built (in which the bidder retained ownership of the connection works, requiring an additional transmission license or distribution license). Bidders therefore had to obtain (and pay for) a cost estimate letter from Eskom or a municipality – depending on where they intended to connect – that provided an indicative timeline and associated costs for the required ("deep") connection works. Bidders were furthermore expected to provide a signed letter stating that they were able to comply with grid codes prior to the commercial operation date (COD). Bids were required to further clarify which parts of the grid connection works would be performed by the bidder (including a cost estimate). Once bidders were assigned "preferred bidders" status, the cost estimate letter was required to be replaced by an up-to-date and accurate budget quote from Eskom or the municipality.

ANNEX 2 - Project Costs (for Component 2)

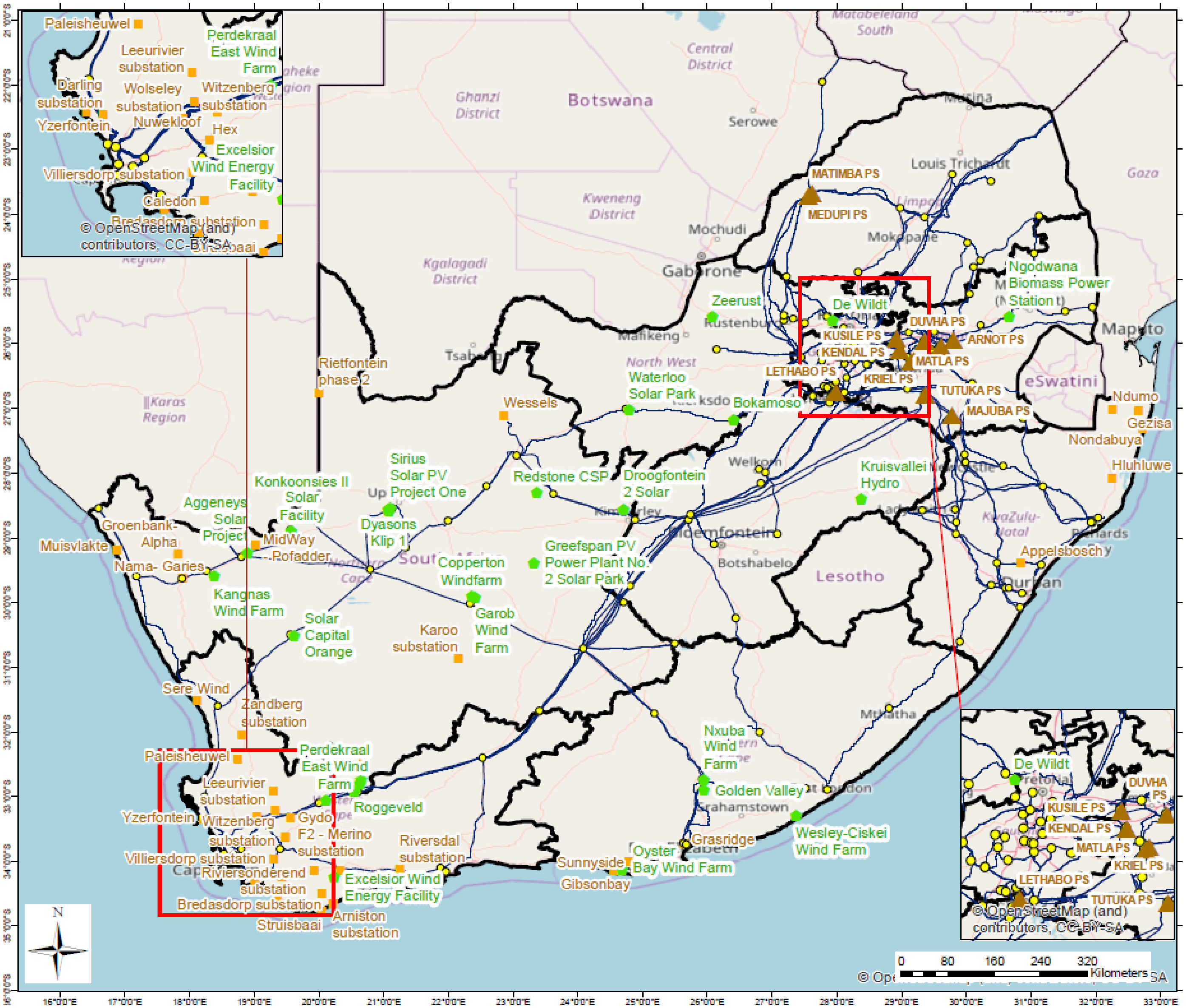
Project Component 2	Costs (US$s m)	Financing Plan (US$ millions)				
		IBRD	AFDB	CTF - WB	CTF - AFDB	Eskom & Other Lenders
Initial Component: Upington Concentrating Solar Power (CSP)						
Turnkey EPC for CSP	**600**	150	150	149.375	49.750	100.875
Owners Development Costs	**10**	0	0	0	0	10
Contingencies @ 25% of Base Costs*	**150**	0	60	0	0	90
Interest During Construction[34]	**22.68**	0	0	0	0	22.68
TOTAL - Component 2 (CSP)	**782.68**	150	210	150	50	222.68
Revised Component: Battery Storage Program						
Turnkey EPC for Battery systems (2019)	**245**	195	0	40	10	0
Turnkey EPC for Battery systems (2021)	**178**	0	0	135	43	0
Technical Assistance (Services)	**45**	0	0	40	5	0
Project Implementation	**8**	0	0	0	0	8
TOTAL - Component 2 (Battery Program)	**476**	**195**	0[35]	**215**	**58**	**8**

[34] IBRD. CTF and identified lenders); excluding Eskom's Cost of Balance Sheet Financing
[35] A ZAR 3 billion (equiv. US$ 240 million) AfDB loan to Eskom is under preparation, to co-finance the battery program by early 2019.

ANNEX 3 - Abreviations and Acronyms

AfDB African Development Bank
AFD Agence Française de Développement
BER Bid Evaluation Report
CDM Clean Development Mechanism
CEO Chief Executive Officer
COO Chief Operating Officer
CSP Concentrating Solar Power
CTF Clean Technology Fund
DPE Department of Public Enterprises
DoE Department of Energy
DEA Department of Environmental Affairs
EA Environmental Assessment
EESP Eskom Energy Storage Program
EIB European Investment Bank
EISP Eskom Investment Support Project
ERSP Eskom Renewables Support Project
EU European Union
GHG Greenhouse Gas
GoRSA Government of Republic of South Africa
IBRD International Bank for Reconstruction and Development (Bank)
ICR Implementation & Completion Results Report
ICB International Competitive Bidding
IEP Integrated Energy Planning
IFC International Finance Corporation
IPP Independent Power Producer
IRP Integrated Resource Planning
ISEP Integrated Strategic Electricity Plan
KfW Kreditanstalt für Wiederaufbau
LRMC Long Run Marginal Cost
MoF Ministry of Finance
MW Megawatt
MWh Megawatt hour
NERSA National Energy Regulator of South Africa
OCGT: Open Cycle Gas Turbine
OE Owner's Engineer
PAD Project Appraisal Document
PIU Project Implementation Unit
PPA Power Purchase Agreement
RE Renewable Energy
REIPPP Renewable Energy Independent Power Producers Program
RSA Republic of South Africa
SBD Standard Bidding Document
SME Small and Medium Enterprise
SA South Africa
SSA Sub-Saharan Africa
TFC Trust Fund Committee
USTDA United States Trade and Development Agency
VRE Variable Renewable Energy
WB World Bank
WBG World Bank Group

ANNEX 4 - Map of Eskom Battery Storage Sites and New REIPPP sites (round 4) by 2020



Legend

- Eskom Coal Power Stations
- Independent Power Producers
- Eskom Substations
- Battery Storage Sites
- Eskom Transmission Power Lines
- Provinces
- SADC Countries

Eskom
ESI - GIS

Komati House 3
Eskom Academy of Learning
Dale Road, Halfway House
Tel +27 11 651 6921
Eskom Holdings SOC Limited
Reg No 2002/015527/06