Executive Summary

Greenchain is a DeFi project whose mission is to connect capital to exponential growth opportunities in clean energy generation thereby accelerating the adoption of the latest technologies in a more sustainable manner.

Addressing Africa's funding Gap

Renewable energy projects attracted investments worth $382 billion globally in 2021, according to the International Energy Agency, but only $13 billion, or three percent of that, funded projects in Africa, highlighting a major funding gap foiling green transition and energy access on the continent.

Our Partners

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SUSTAINSTORAGE

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Why Solar?

South African climate is ideal for solar energy generation due to our high solar irradiation which is considered amongst the best in the world most notably 50% more than that of Spain and 20% more than the USA.

Solar is amongst the most cleanest forms of energy generation that does not impact negatively on the environment thereby assisting in reducing emissions and reducing our dependence on imported fossil fuels.

Solar has a very predictable energy curve as it produces electricity during daylight hours

Solar PV has short lead times as there is no shortage of supply , solar PV systems can be set up faster than any other renewable energy system and can be integrated into the existing grid infrastructure without any major reinforcements which would address the immediate need of the economy.

Solar Energy as a Service (SEAAS)

In recent decades, service-based business models have gained popularity across a wide variety of traditionally product-based industries, ranging from video streaming to regular wardrobe updates. The model typically involves a subscription-based service, the customer can enjoy the benefits of a product without purchasing it outright or directly managing its use.

Solar Energy as a Service lets you buy clean, affordable solar power that is generated on your roof by solar panels that Xstructure owns and manages. We design, develop and manage the entire system and risks for 10-20 years.

Solar Energy as a Service is made possible via a long-term power purchase agreement (PPA). It enables a fast and easy way to produce renewable energy. In our Power Purchase Agreement (PPA), entities agree to purchase electricity from us (instead of the local authority). PPA rates are typically less than current electricity cost.

Solar PV Solutions

Grid-tied PV systems are common due their low cost of entry into the solar PV market. Grid-tied PV solutions are fast to implement with minimal interruption. Grid-tied PV provides you with an alternative power source that is much more cost effective than the electricity you buy from the grid. Grid-tied PV provides you with energy during sunshine hours only. These systems can later be coupled with an energy storage system to provide energy during night-time as well

Hybrid PV systems typically consists of solar panels and an energy storage system. This solution allows you to have electricity during load-shedding or grid-failure events.
Mini-grid and Micro-grid systems typically includes two or more energy generation sources, such as solar PV with a generator, and/or wind, and are generally not connected to a utility grid.
These systems types allows you to have maximum flexibility in how your electricity is used, and provides you with energy security.

Battery Energy Storage Systems as a stand-alone product generally consists of Lithium-Ion type energy storage and battery inverters. These systems are typically large, containerised, plug-and-play solutions, but can also be as small as a UPS system for your office.
These solutions are typically utilised to provide energy security during load shedding or grid-failure events, but can also be used to reduce your peak demand. It can also be used to for arbitrage purposes, where the BESS is charged during off-peak periods, and then discharged during peak periods. Both these options results in significant cost savings.

Energy Services Market Drivers

Four major developments are transforming SA's energy market from a monopoly model to a distributed generation model made up of multiple smaller generators, buyers, and sellers:

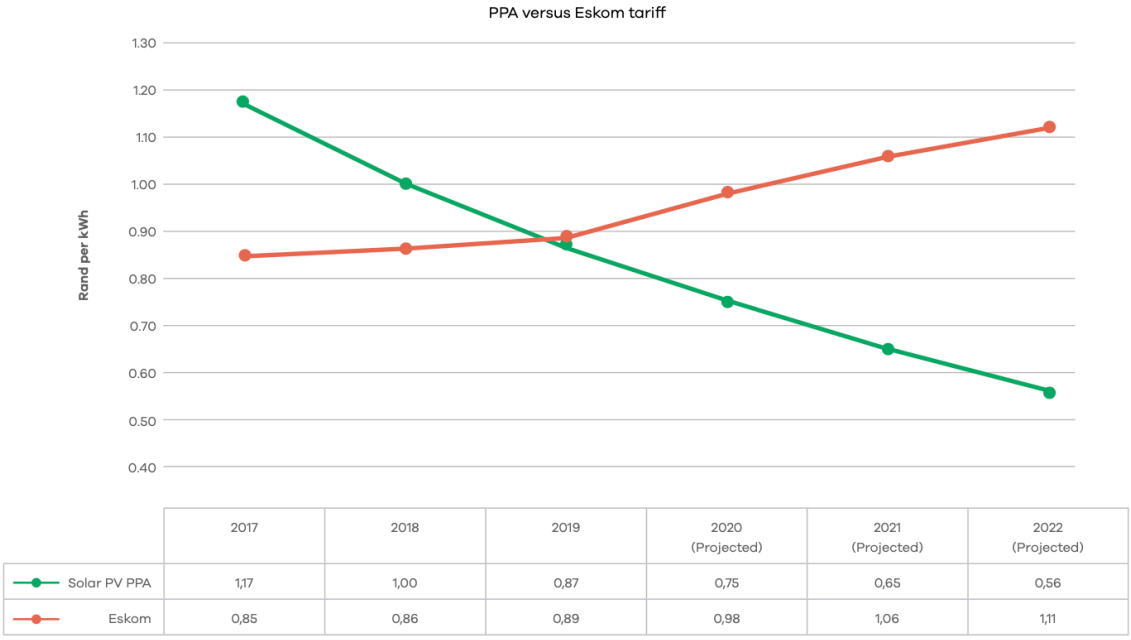
- Rising energy prices(Figure.4)

- Falling costs of RE technologies such as rooftop solar PV(Figure 5)

- Supportive energy policies and regulations by the local and national government

- Energy financing programmes and incentives.

As seen in Figure 1, PPA tariffs reached a point of price parity with average Eskom tariffs in 2019 and the PPA tariff is set to decrease further over the next few years.
In a modelling exercise performed by GreenCape based on actual industry costs, an approximate payback period of five years is achieved for a 250kWp system. As solar PV systems have a lifespan of ~21 years, this means potentially 15 years of free energy.



	2017	2018	2019	2020 (Projected)	2021 (Projected)	2022 (Projected)
Solar PV PPA	1,17	1,00	0,87	0,75	0,65	0,56
Eskom	0,85	0,86	0,89	0,98	1,06	1,11

Figure 1: PPA versus Eskom tariff

Renewable energy technology prices have been dropping steadily since 2010. The global average price was R5.33 per kWh in 2010 (IRENA, 2017). In 2022, the average power purchase agreement (PPA) rate for commercial PV has come down to 86c per kWh. Figure 7 depicts the trend of falling technology prices in the South African rooftop PV market. The South African embedded generation market is currently dominated by rooftop solar PV, given the competitive price, technical maturity, and ease of implementation of this technology.

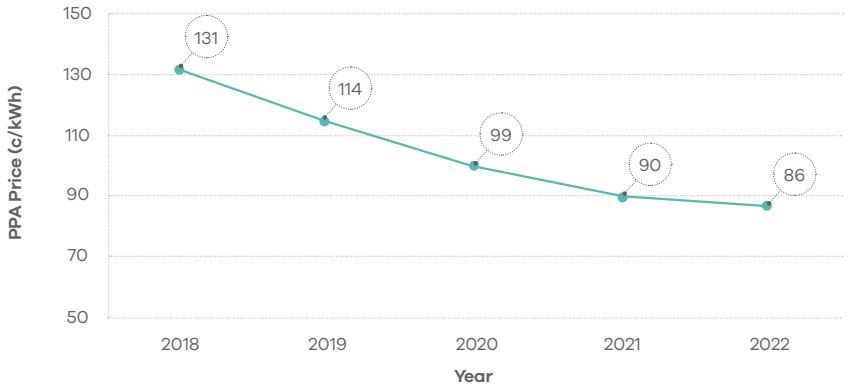


Figure 7: Declining price of rooftop solar PV electricity in South Africa from 2018 to 2022
Source: GreenCape Analysis

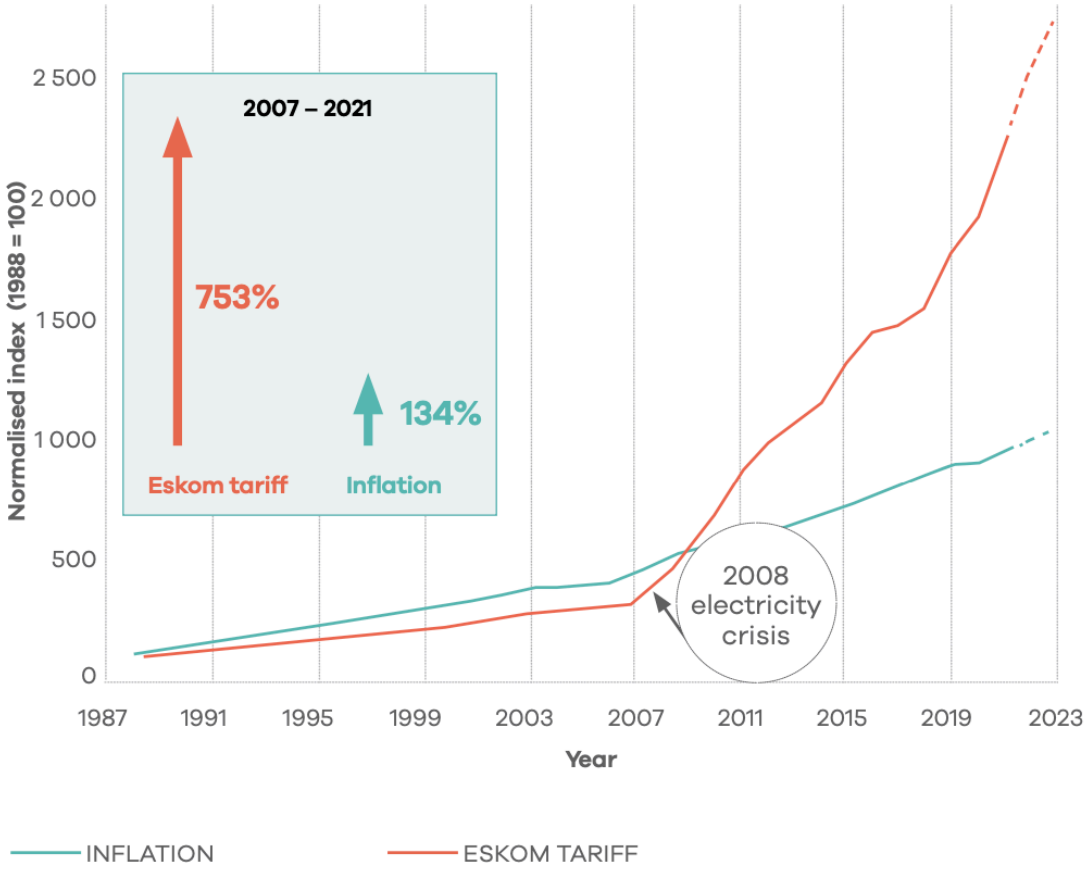


Figure 4: Average Eskom tariff versus inflation (CPI) projected to 2023

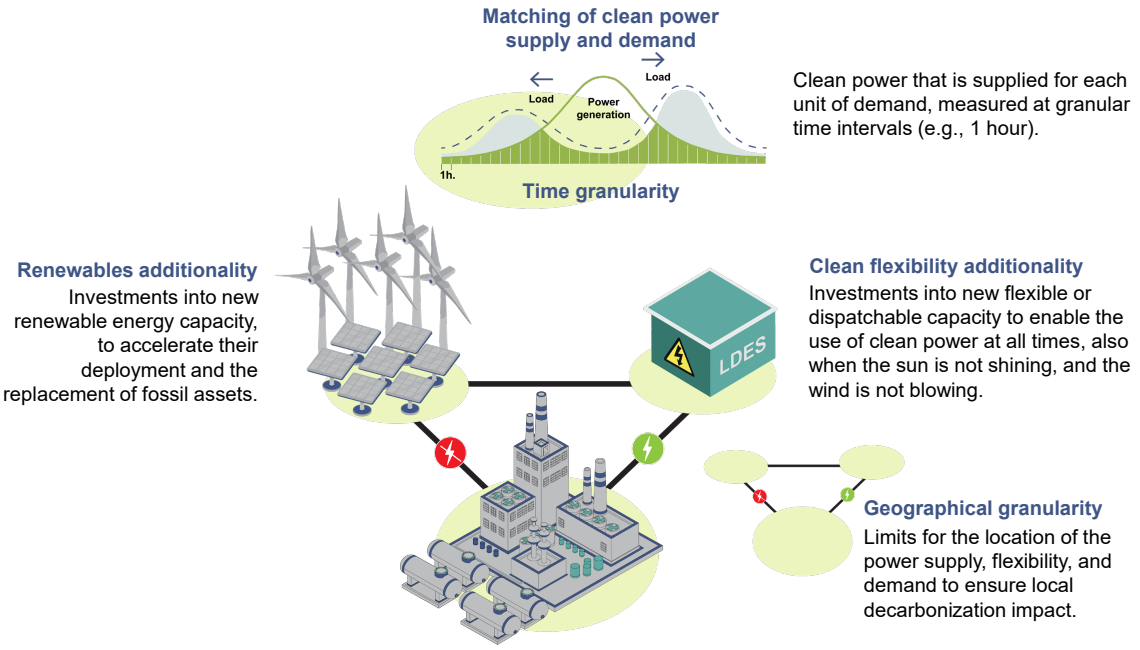
Sources: Statistics South Africa (StatsSA) and Bureau of Economic Research (2021)

Long Duration Energy storage(LDES)

On the new, low carbon electric grid, a new class of flexible, cost-effective technologies capable of storing electricity over long durations is needed to ensure clean energy is always available, even when the sun isn't shining or the wind isn't blowing

LDES solutions enable the shifting of energy from times of high supply to times of high demand, thereby helping preserve system balance and securing its reliability.
LDES can be deployed competitively to store energy for prolonged periods and sustain energy provision for multiple hours, days, or weeks.
LDES can accelerate the build-out of renewables by optimising infrastructure utilisation.

Key dimensions of a 24/7 clean PPA



Source : LDES Council

The energy-shifting capability of LDES has multiple system benefits:

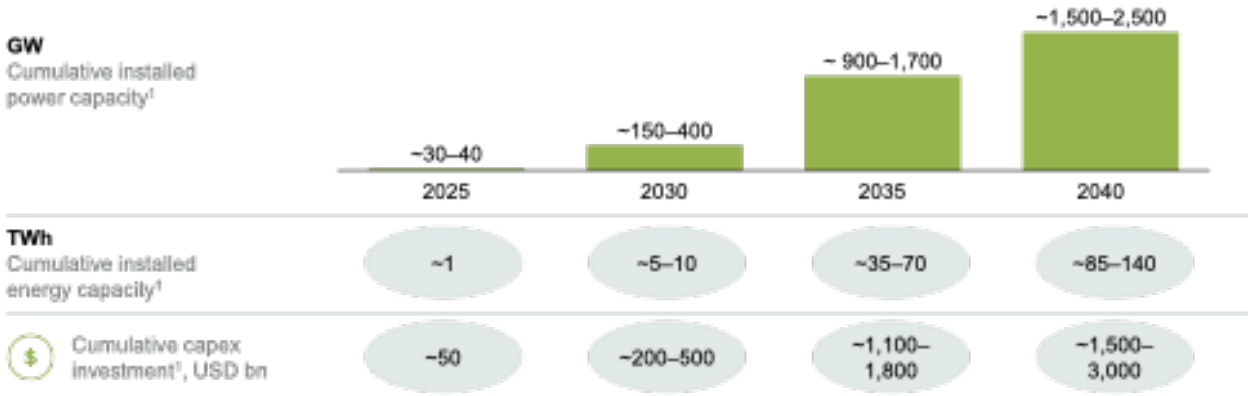
First, it could reduce energy curtailment and related opportunity costs by facilitating supply-side energy storage

Second, it could help improve overall grid utilisation through supply-and-demand-side energy storage, reducing stress on the grid. As a result, LDES can be deployed across the electricity grid (for example, at critical corridors at capacity) to accelerate renewables' development.

Extremely large total addressable market:

The total addressable market for LDES can reach a 1.5 to 2.5 TW scale by 2040 to achieve the required flexibility in net-zero power systems Based on the projected cost trajectories, modelling results suggest that LDES will play a leading role in providing flexibility as power systems approach net zero.

LDES total addressable market and cumulative capex investment by year

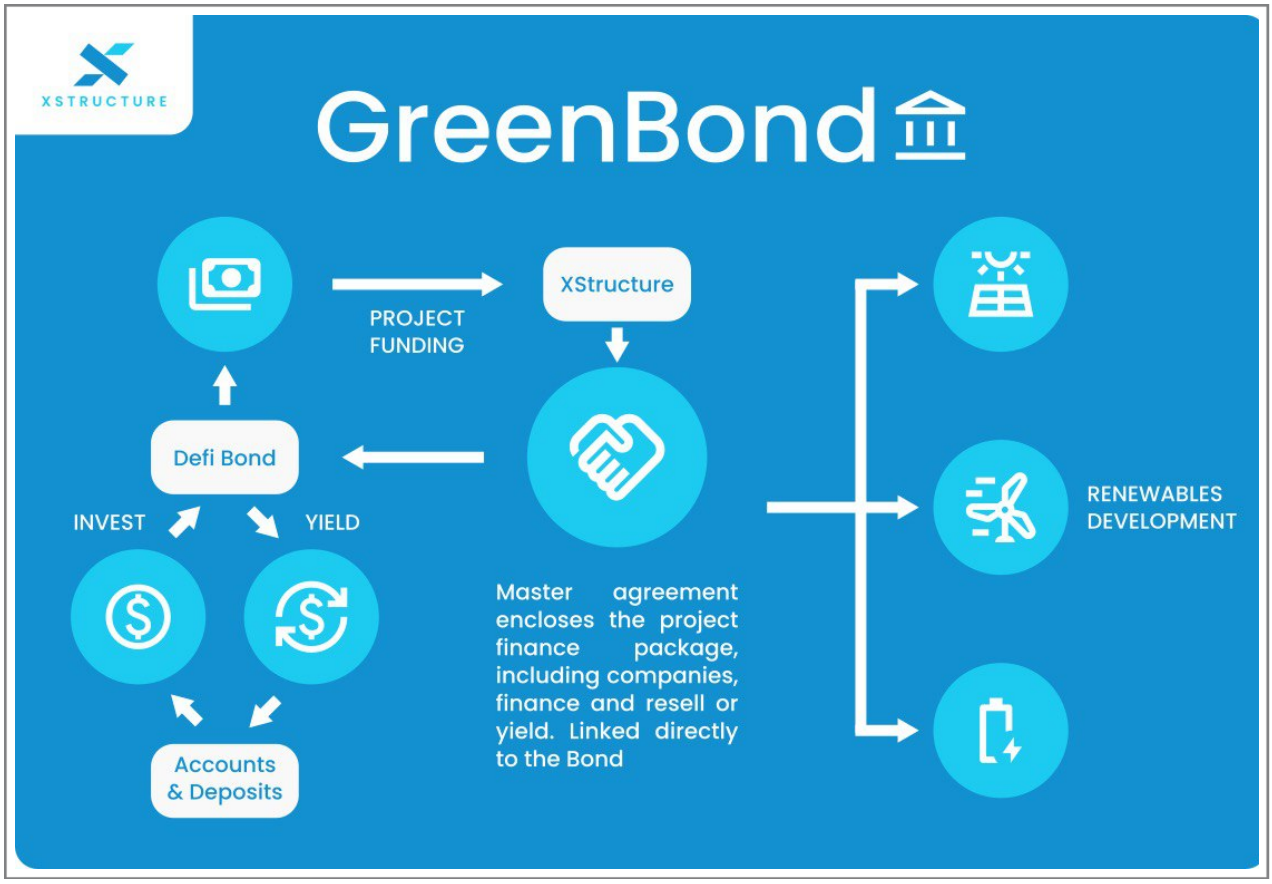


1. Range is LDES central scenario and LDES progressive scenario.

[20] Central scenario: assumes first-quartile costs for LDES, conservative learning rates, and new-build nuclear capped at previous peak, and retired as planned. Progressive scenario: assumes first-quartile costs for LDES, aggressive learning rates, no new-build nuclear, and retired as planned.

Net-zero power: Long duration energy storage for a renewable grid | LDES Council, McKinsey & Company

Our Project technical details



https://github.com/greenchaincapital/GreenBond/

https://github.com/greenchaincapital/GreenBond-dApp

www.xstructure.tech

Green Bond Contract on Arbitrum (ERC4626 compatible) Bond design:

- Arbitrum deployment
- ERC4626 guidance

- Accept [USDC, USDT, Curve2CoinStablePoolToken(USDC/USDT)] tokens for deposits for ease of investment
- Treasury Tokens are USDC / USDT (low risk)
- Rewards are fixed at 10% per year pro-rata
- Minimum lock-up period of investment (6 months)
- All balances are in terms of Curve 2Pool (USDC/USDT) LP value, which mitigates dpeg attacks