GreenCape

Industry Brief

2020

Energy Security in South Africa: **the business case for energy storage**

Main Insight

The current energy crisis in South Africa, coupled with the decreasing cost for energy storage systems, will see the market for back-up power as a replacement for diesel generation and solar PV hybrid increase.

If a quarter of new build solar PV systems installed have a storage component coupled to it there could be a potential storage market of roughly 200MWh per annum which can be translated to roughly R2 billion market size in a year.

This industry brief highlights:

1. The emerging business case for hybrid solar PV and energy storage systems
2. The available energy storage technologies in the South African (SA) market
3. Case studies that demonstrate the business case.

Context

- SA had the worst year of loadshedding on record in 2019 (1352 GWh, 530 hours), with up to Stage 6 load shedding being implemented.
- This is having significant impacts on the economy and it is expected Loadshedding is to continue for the next 3-5 years unless decisive actions are taken.

Current South African energy storage technology trends

- There are several technologies making inroads in the SA market in the back-up power and energy security market,
- Lithium-ion (Li-ion) and Lead Acid battery technologies, which are the most tried and tested, remain the leaders in this market
- There are other storage technologies available, but they either don't have existing pilot projects in SA, or they haven't shown promise in medium to large scale storage applications when compared with their direct competitors

Table 1: Energy storage technologies in the South African market

Technology	Use case	Key benefits	Current barriers	Cost ranges R/kWh
Lead Acid Batteries	UPS, back-up power	Inexpensive, tried and tested technology. It dominated the early battery market and is a mature technology.	Low energy density, bulky, environmentally unfriendly, limited full discharge cycles.	R200 – R1000
Lithium-ion	UPS, back-up power, utility-scale storage	Low maintenance, high energy density, has a very prominent presence in the market, constantly evolving and improving.	Transport limitations, ever evolving chemical combinations and improvements, high cost.	R4 000 – R10 000
Vanadium Redox Flow Battery	Back-up power, utility-scale storage	The battery has a very high depth of discharge, and almost unlimited storage potential (the size of the electrolyte tanks can be increased).	Market entry.	Ranges left out due to limited market penetration
Super Capacitors	UPS, back-up power	100% depth of discharge. Unlimited charge and discharge, robust for travel. 45-year life expectancy.	10-year warranty on electronics. High self-discharge.	R10 000 – R15 000
Hydrogen	Back-up power, utility-scale storage	A clean form of energy.	Requires a hydrogen economy to increase the overall use case.	Ranges left out due to limited market penetration

Hydrogen storage and Vanadium redox flow batteries haven't made the needed market penetration due to them needing a specific use case analysis for feasibility and the systems are generally purpose built. These cases are generally for large capital utility-scale applications and the project feasibility is determined by the levelised cost of storage (LCOS) over the lifetime of the project.

Early stage analysis shows that the lithium-iron technology has the potential to have the most prominent presence in the market. The current dominating technology is Lithium Iron Phosphate (LiFePO.4), mainly due to the low cost to manufacture, defined performance ratings and proven operational stability.

The majority of the Li-Ion installed base is being used in off-grid applications where the end user either has limited or no access to utility power or where energy security is crucial for business continuity. These solutions are usually in the form of a hybrid mini grid where there is renewable generation (usually solar PV), diesel generation and battery storage coupled as a system (see this case study). There has also been an increase in high income residential and business installing energy storage systems to curb the impact of load shedding.

How financially viable are Li-ion batteries?

Table 2 below shows a breakdown for the pricing ranges of the various sized Li-Ion systems. The table presents the capital costs in a rand per kWh vale (R/kWh). The majority of installations are turnkey with an outright capital cost for the installations. Very few projects have been installed using a power purchase agreement model where the battery storage solutions are sold as a service.

Table 2: Pricing markers for Li-Ion

System size	Capital cost of system (cost per kWh storage)
< 15 kWh	R6 000 – R10 000
< 800 kWh	R5 000 – R9 000
> 800 kWh	R4 000 – R8 000

The business case for Li-ion and solar PV

An office block with a very high energy demand and roof space for a 100kWp solar PV system is investigating options for energy independence. The full energy generated by the Solar PV system will be required as their daily load exceeds the energy that would be generated by a 100kWp system. They are looking to have a limited form of energy security for running all the businesses in the block on critical and limited services (WiFi, servers, computers, telephones and some lighting) to ensure that they can continue to work during periods of load shedding.

A 100kWp Solar PV system with a 80kWp and 180kWh Li-Ion energy storage system which gives roughly 2 hours of storage was modelled based on the latest pricing points gathered by GreenCape (see Figure 1).

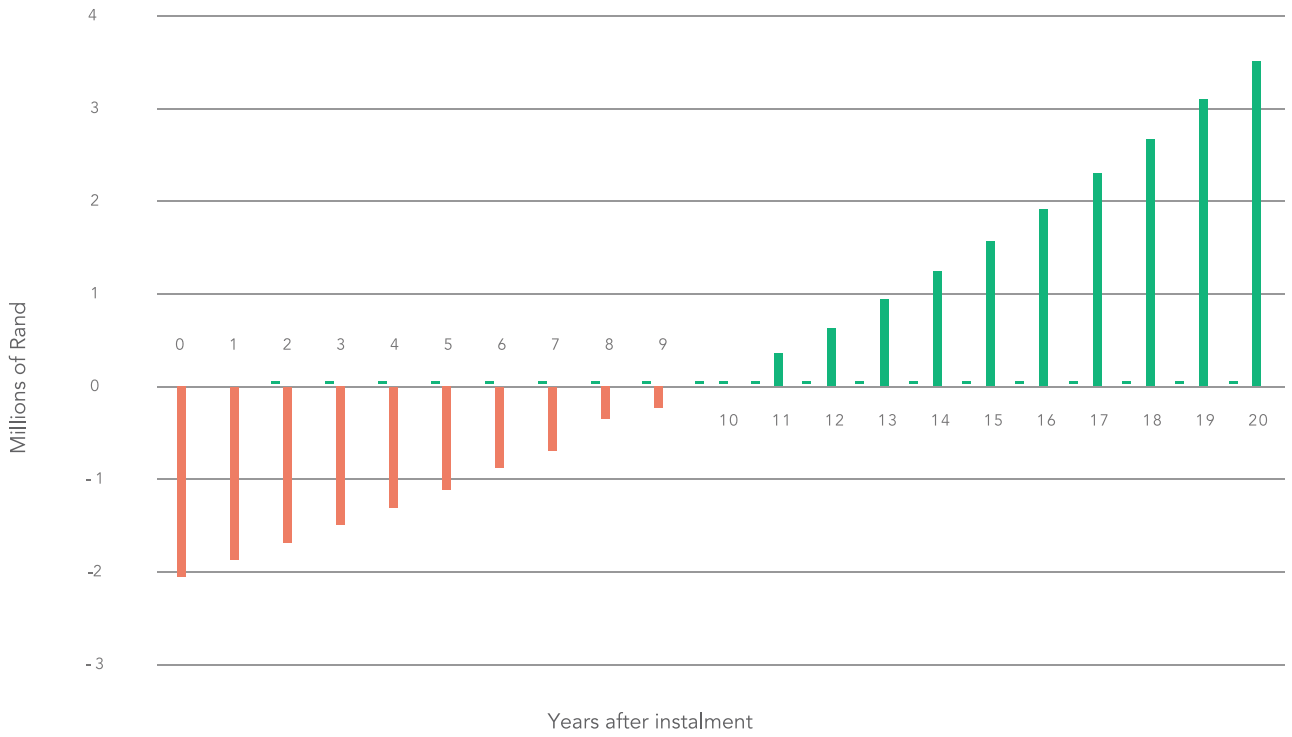

Figure 1: The modelled payback period for a hybrid 100kWp solar PV and 80kWp and 180kWh Li-ion energy storage system.

The current business case for a 100kWp solar PV system, without energy storage, has a payback period of between 4-7 years (assuming all the energy generated is consumed by the customer and deducted form their energy bill as savings). If Li-Ion energy storage is added in a solar PV Hybrid case, on our models the capital cost of the installation will be doubled but the system will show a return on investment after 8-12 years. The payback is depends on the size of the storage system. The system size depends on the type of services that need to run during load shedding. In this model the payback period is only based on the solar yield of the system and not any of the stacked benefits that can be extracted from energy storage use cases. The return of investment period can be reduced significantly if the loss of business operations and additional stacked benefits are taken into account.

Apart from being energy independent during times of load shedding, these systems provide free energy after the conclusion of the payback period.

01 Case Study

Site name	Canadian Farm	
Location	Lephalale Limpopo	
System size (kW + kWh)	200 KW 1200kWh	
Technology used	**Description**	**Quantity**
Batteries	7.4kWh Solar Md lithium Ion Batteries	156
Inverters	8 kVa Inverters SMA 50 KW Gird-tied Inverter	21 2
Dimensions of installation	40ft Containerized solution	
Annual energy stored (kWh)	2200kWh	
Site electricity cost reduction (%)	100%	
Pay back period (Years)	7 years	

02 Case Study

Site name	Botha Huis	
Location	Mosselbay	
System size (kW + kWh)	13.2kWp	10.24kWh / 8.2kWh useable
Technology used	**Description**	**Quantity**
Solar modules	270W 60 cell polycrystalline	49
Batteries	BYD B-Box	2x 2.56kWh units
Battery Inverter	8kVA	1
Annual energy yield (kWh)	2019: 15 018.1kWh	
Annual energy stored (kWh)	2019: 3 312.2kWh (included in above)	
Site electricity cost reduction (%)	70%	
Payback period (Years)	+-8.5Years	

Source: Solareff

Need help exploring solar PV and energy storage options for your business to be safe during the energy crises?

It is expected that the current energy crisis will continue for the next 5 years with definite load shedding expected to continue for the next 12 – 18 months.

If you are in assessing your options for becoming energy independent at home or at work, find find an accredited installer to do an assessment: https://www.pvgreencard.co.za/customers/

Next steps

To find out more, contact GreenCape: energy@greencape.co.za; (021) 811 0250.
For additional energy services information visit GreenCape's Energy Services webpage (**www.greencape.co.za/content/energy-services**)

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