SOUTH AFRICA

Energy Services

MARKET INTELLIGENCE REPORT

2025

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Market Intelligence Report 2025

ENERGY SERVICES

GreenCape

GreenCape is a non-profit organisation that works at the interface of business, government, and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Working in developing countries, GreenCape catalyses the replication and large-scale uptake of these solutions to enable each country and its citizens to prosper.

Partnering for Accelerated Climate Transitions (PACT)

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List of abbreviations and acronyms

BESS	Battery Energy Storage System
BTM	Behind-the-meter
CBAM	Carbon Border Adjustment Mechanism
CI&A	Commercial, industrial, and agricultural
COP	Conference of the Parties
CSRD	Corporate Sustainability Reporting Directive
CS3D	Corporate Sustainability Due Diligence Directive
dtic	Department of Trade, Industry and Competition
EG	Embedded generation
EPC	Engineering, procurement & construction
ERAA	Electricity Regulation Amendment Act 38 of 2024
ES	Energy services
ESG	Environment, Social, and Governance
EU	European Union
HS	Harmonised System
ITAC	International Trade Administration Commission
LCOE	Levelised cost of energy
LCOS	Levelised cost of storage
Li-ion	Lithium ion
MIR	Market Intelligence Report
MWp	Megawatt peak
NMD	Notified Maximum Demand
NERSA	National Energy Regulatory of South Africa
PACT	Partnering for Accelerated Climate Transitions
PV	Photovoltaic
PPA	Power Purchase Agreement
PR	Procurement round
SALGA	South African Local Government Association
SARS	South African Revenue Service
SEC	Securities and Exchange Commission
ToU	Time of Use
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
USD	United Stated Dollar
ZAR	South African Rand

Exchange rate used: 1 USD = 17.90 ZAR

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EXECUTIVE SUMMARY

This Market Intelligence Report (MIR) provides updates on the opportunities, barriers, and regulations discussed in the 2024 Energy Services MIR with a specific focus on opportunities and barriers for embedded solar PV and behind-the-meter (BTM) battery storage for the commercial, industrial, and agricultural (CI&A) sectors.

The term "energy services (ES) market" refers to three interrelated energy market segments in South Africa:

- embedded generation (EG),
- energy storage, and
- energy efficiency.

The EG segment is dominated by the rooftop solar photovoltaic (PV) market, while the energy storage segment is largely driven by lithium-ion (Li-ion) battery technology. The energy efficiency market, however, has experienced limited development and growth and is therefore not considered an opportunity in this MIR.

Key developments influencing the market in 2024/25

- The primary drivers for embedded solar PV in the commercial, industrial, and agricultural (CI&A) sectors are more diverse than mitigating the impacts of loadshedding. These drivers increasingly include goals such as cost savings, price stability, enhanced energy security in response to infrastructure challenges, and decarbonisation.

- The number of South African municipalities enabling EG continues to grow. As of the end of 2023, of the 257 municipalities in South Africa, 71 currently permit EG connections, and 67 have established formal application procedures for customers to obtain the necessary authorisations for installations.

Opportunities for embedded solar PV are supported by a variety of financing mechanisms. Commercial banks have developed dedicated financing portfolios, while alternative debt finance providers, backed by investment funds, have also entered the market.

These mechanisms support CI&A customers with asset finance and installation companies with working capital. Additionally, power purchase agreements (PPAs) and lease structures remain effective alternatives to outright equipment purchases, particularly for corporate and capital-constrained customers who prefer to transfer performance and investment risk to service providers.

Embedded solar PV installations, along with behind-the-meter (BTM) energy storage solutions in the CI&A sectors, are expected to remain attractive investment opportunities in the short to medium term. The investment opportunities are summarised in Table 1, and illustrated in Figure 1, according to the ease of market entry and the market growth potential.

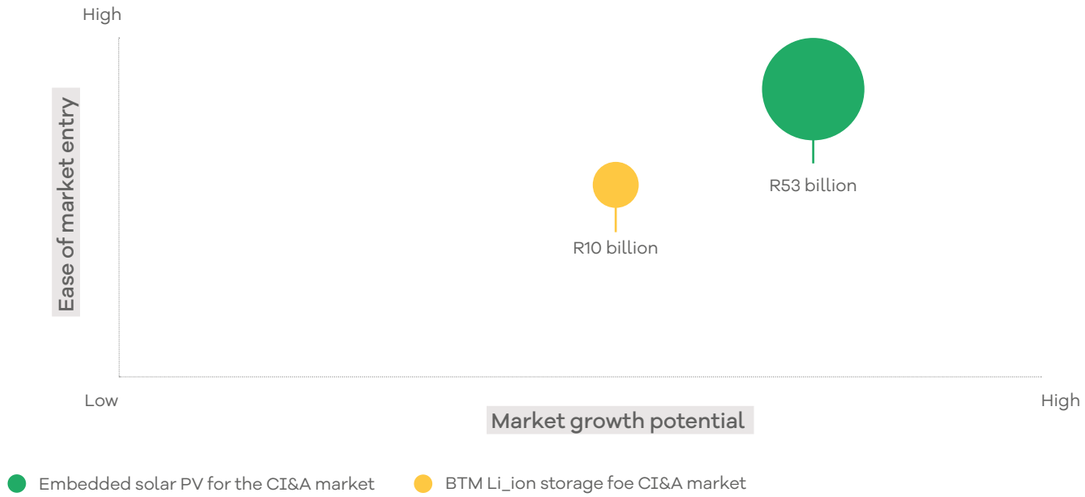
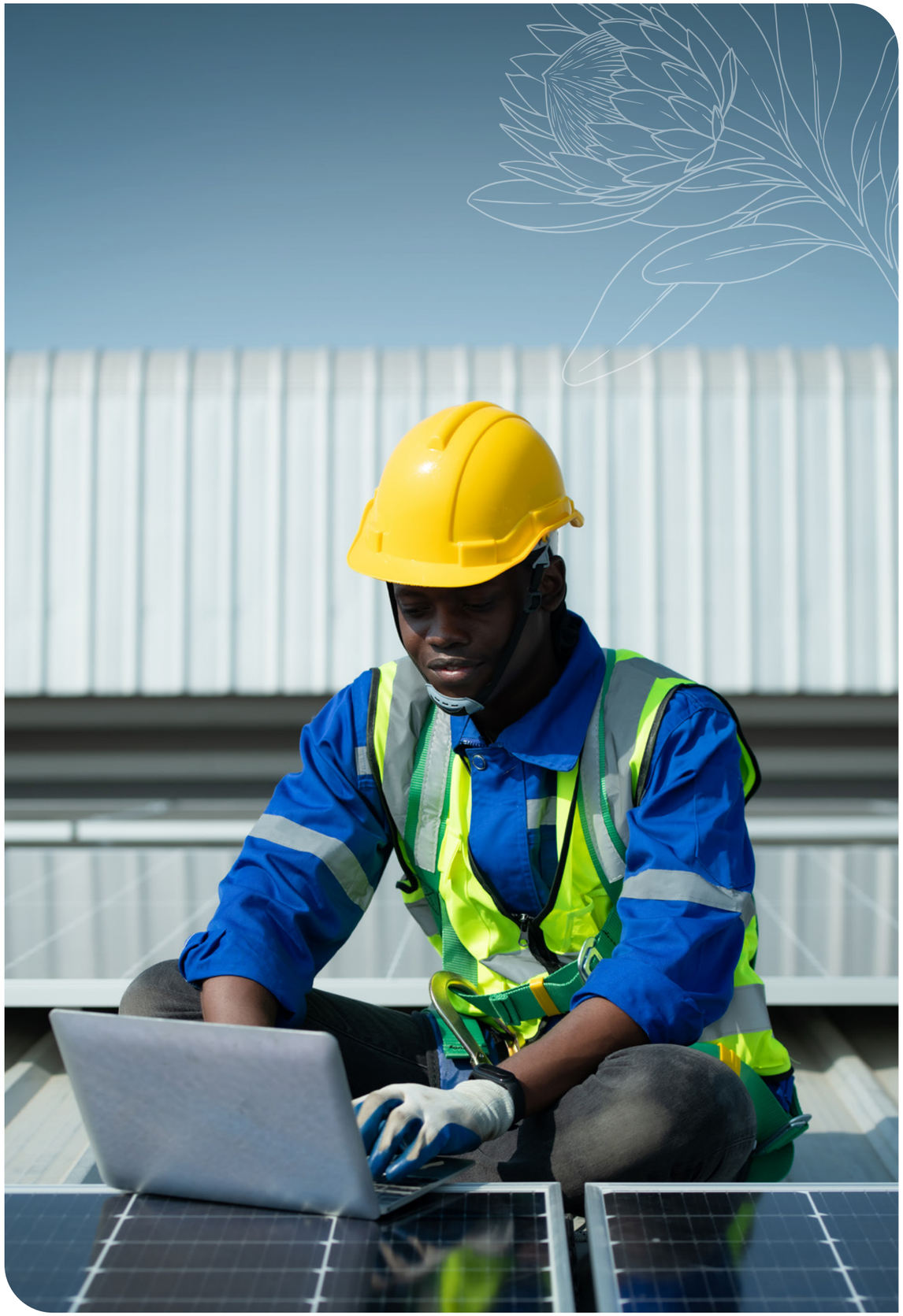
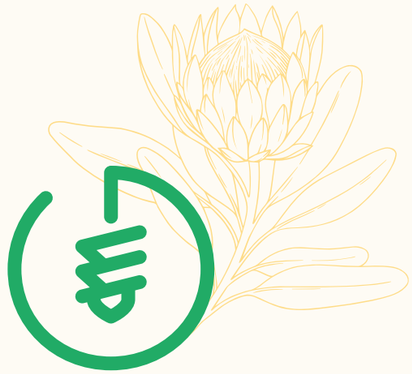


Figure 1: Market potential for energy services investment opportunities

Table 1: Summary of opportunities in the energy services market

OPPORTUNITY	INVESTABLE MARKET SIZE	KEY DRIVERS	BARRIERS	STAKEHOLDERS	TERM	MACRO CONTEXT
Embedded solar PV for commercial, industrial and agricultural market	3.8 GW or R53 billion by 2030 760 MW or R10.6 billion per year	• Demand for improved electricity price stability and savings driven by rising cost of electricity • Availability of attractive financing mechanisms including commercial debt, power purchase agreements (PPAs) and lease agreements • Enabling regulatory environment such as municipal EG frameworks and feed-in tariffs • Demand for carbon emission reductions	• Challenges with distribution infrastructure • Institutional capacity constraints resulting in diverse due diligence processes • Increased administrative burden on municipalities leading to delays in approval	• Renewable energy developers • EPC companies • Commercial banks • Investment and equity funds • PV equipment manufacturers and distributors • National Treasury • Land Bank • Department of Agriculture, Land Reform, and Rural Development • South African Revenue Services (SARS)	Short to medium term	• Increased emphasis on decarbonisation from export markets
BTM Li-ion storage for commercial, industrial and agricultural market	R10 billion by 2030 or R2 billion per year	• Demand for energy security. • Improved cost competitiveness of Li-ion battery energy storage • Flexibility of battery technologies allows a ddditional value-stacking such as peak shaving, load shifting, and tariff arbitrage.	• High exposure to equipment import delays • Emerging regulatory environment, especially related to safety and quality	• RE developers • EPC companies • Commercial banks • Investment and equity funds • Battery original equipment manufacturers, assemblers, and distributors	Short to medium term	• Over reliance on imports for key components facing delays from international shipping challenges; as well as local port inefficiencies.





WHAT'S NEW?

2024

MARCH

Wheeling Framework - President Ramaphosa confirmed that the National Wheeling Framework has been submitted to National Energy Regulatory of South Africa (NERSA) for approval. Municipalities must create enabling environments, including updates to systems to allow for wheeling.

Eskom[1] suspended loadshedding[2] - Loadshedding was a key driver for the small scale embedded generation (SSEG) market; the suspension of loadshedding thus especially impacting the residential demand for solar PV and battery storage. Significant consolidation is taking place amongst the installers, triggered by the reduced demand, which is also indicative of the market maturing.

JULY

Climate Change Act 22 of 2024 (Climate Change Act) - The Climate Change Act, was signed by President Ramaphosa and is awaiting implementation. Its goal is to support the creation of an efficient response to climate change and a sustainable transition to a low-carbon, climate-resilient economy and society in South Africa.

10% import duty on solar PV modules - In July 2024, the International Trade Administration Commission (ITAC) of South Africa imposed a 10% import duty on solar PV modules to provide protection and promote local manufacturing. A corresponding rebate provision was also introduced, allowing importers to receive duty relief when local manufacturers cannot meet demand, thereby preventing potential slowdowns in solar PV adoption due to supply shortages or increased costs.

JUNE

Municipal tariffs challenged - An urgent application brought before the High Court in by Afriforum against the NERSA (and other respondents) resulted in the judgement that the tarrif increases by about 110 of the electricity distributors were unlawful as the municipalities had not submitted the required cost-of-supply studies. The NERSA and the South African Local Government Association (SALGA) successfully appealed the findings at the Supreme Court of Appeal in September to overturn the High Court's decision. However, Afriforum continues to pursue legal challenges to the tariff calculation methodology implemented by NERSA.

AUGUST

The Electricity Regulation Amendment (ERA) Bill was signed into law. The ERA Bill establishes a competitive electricity market framework and, among others, aim to make it easier to produce and sell electricity in South Africa.

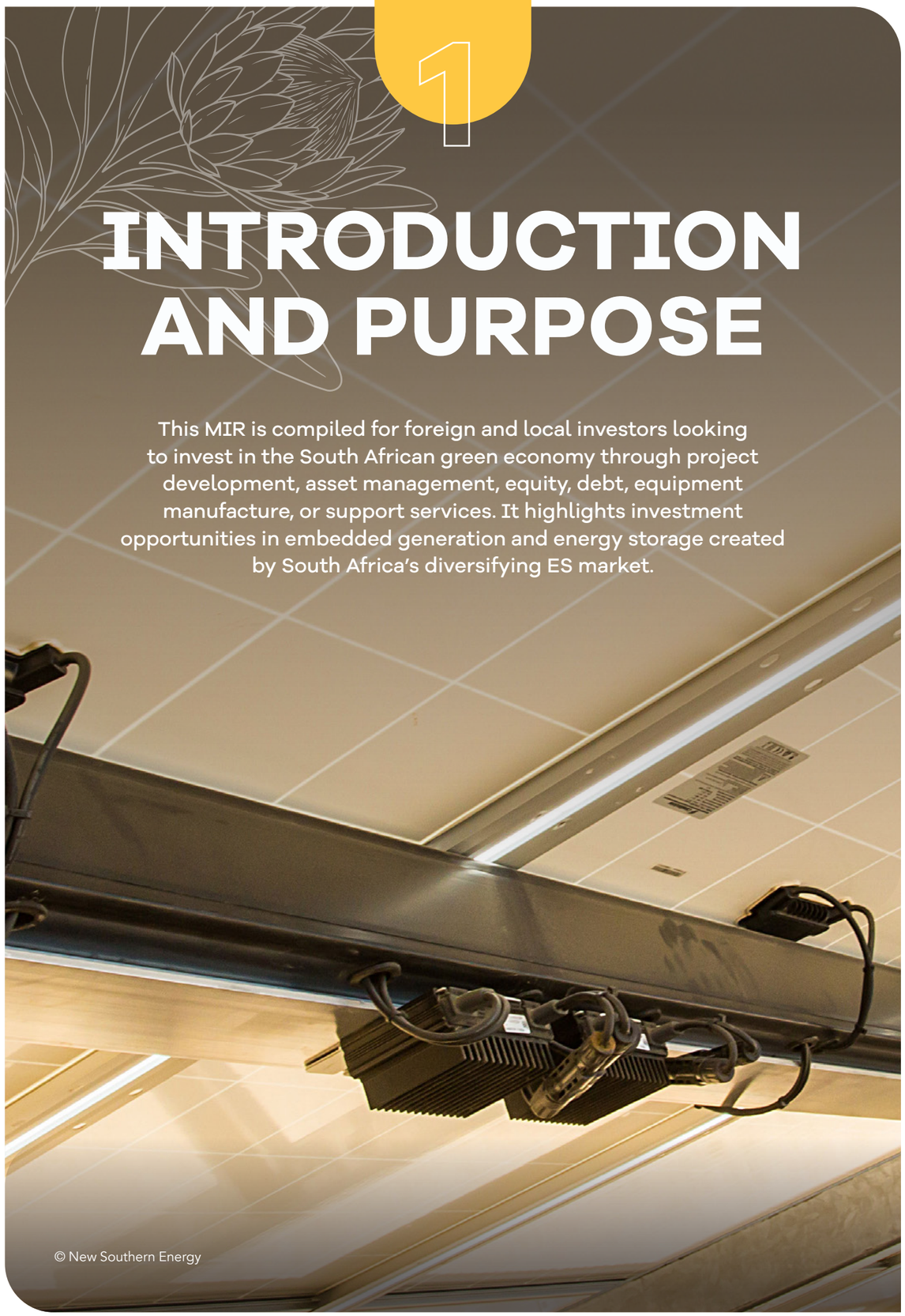
1 Eskom is South Africa's state owned electricity provider.

2 Loadshedding is a controlled demand reduction mechanism implemented by Eskom to protect the national electricity power system from a total blackout.

1

INTRODUCTION AND PURPOSE

This MIR is compiled for foreign and local investors looking to invest in the South African green economy through project development, asset management, equity, debt, equipment manufacture, or support services. It highlights investment opportunities in embedded generation and energy storage created by South Africa's diversifying ES market.



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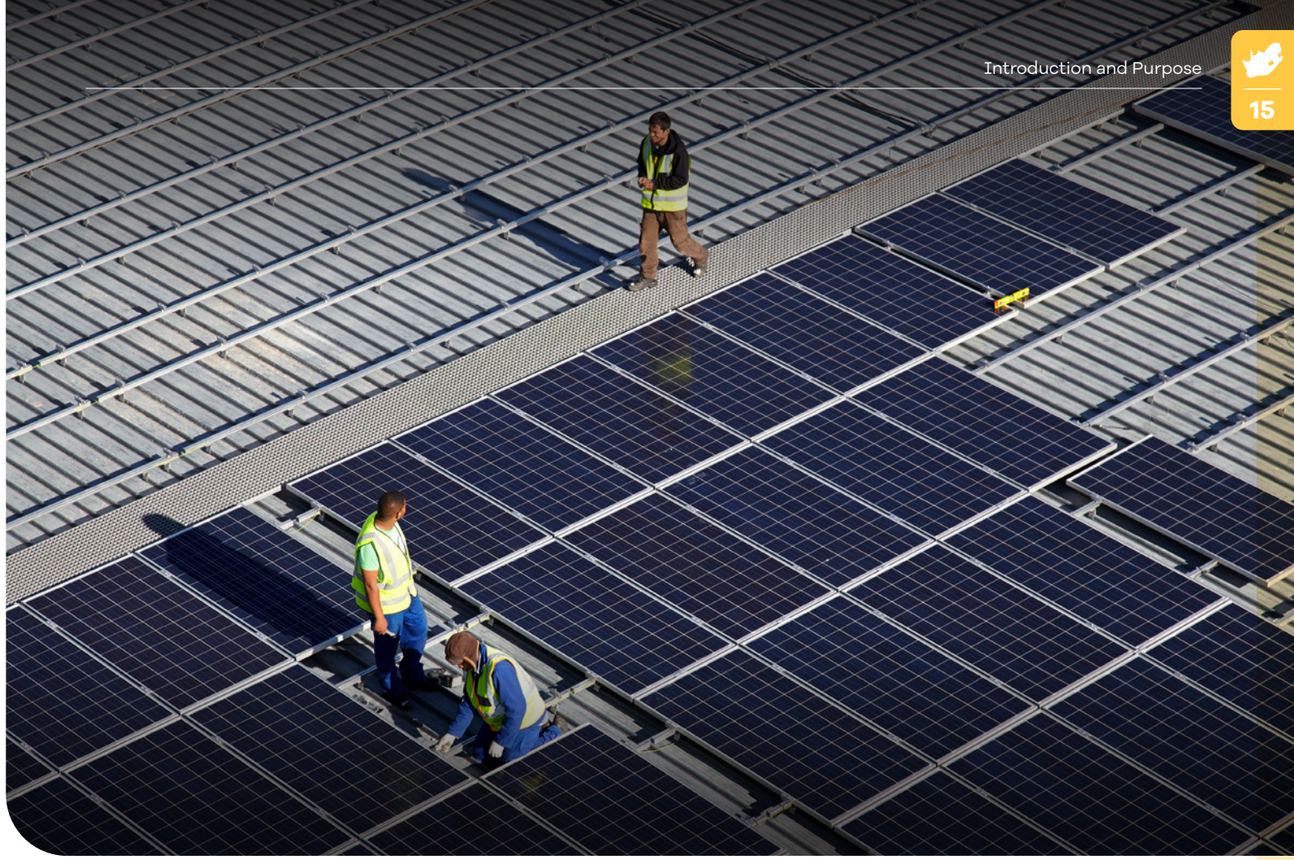

South Africa's ES market for the CI&A market segment continues to grow, driven by factors other than loadshedding. These drivers increasingly include goals such as cost savings, price stability, enhanced energy security in response to infrastructure challenges, and decarbonisation. The long-term stability and growth of these opportunities will however be linked to factors such as the continuation of demand and appropriate regulatory and quality assurance mechanisms.

The improvement in loadshedding has reduced the immediate demand for residential small-scale embedded generation (SSEG). Prolonged periods of loadshedding greater than stage four[3] are a strong driver for the investment decision of a residential client and can result in "boom & bust" cycles when loadshedding is suspended and demand decreases in response. As a result, many established residential installers target the CI&A segment where there has been consistent growth.

In addition to energy efficiciency and residential SSEG, the following opportunities are not explored in this report due to slow market growth and/or significant barriers: energy-as-a-service, smart grid devices and carbon offsets.

This document sets out the market opportunities in the ES market in South Africa. A sector overview, historical trends, policy overview and other datasets traditionally included in this document are now available through the associated online portal.

By navigating the opportunities, drivers and barriers provided in the report, investors are expected to be able to unlock substantial investment opportunities.

Note: GreenCape's Large-scale Renewable Energy MIR explores investment opportunities into renewable energy projects greater than 1 MW and excludes rooftop solar PV. The large-scale renewable energy market is thus not covered in this Energy Services MIR.

For questions, queries, or to access GreenCape's services, contact the ES team at energysectordesk@greencape.co.za

CONTACT THE RENEWABLE ENERGY SECTOR DESK

3 Loadshedding is classified into stages, each stage represent the amount of GW of demand reduction that is required. Each stage has a schedule for power outages, the higher the stage the more hours of blackout in a day. Stage 4 represents 4 GW of demand reduction which roughly corresponds to 5 hours without electricity per day.

2

MARKET OPPORTUNITIES

The evolving South African energy landscape creates opportunities for investors, financiers, project developers, component manufacturers, and suppliers in the energy services market.

This section covers two key opportunities, namely embedded solar PV and behind-the-meter (BTM) **battery energy strorage installations for the commercial, industrial, and agricultural (CI&A) sectors.** Each section is structured as follows:

THE INVESTMENT OPPORTUNITY

Describes the nature of the opportunity as well as the size of the market and how it is anticipated to grow.

MARKET DRIVERS

Covers those factors that enhance the development and increase growth of investment opportunities into energy services projects.

MARKET BARRIERS

Covers those factors that reduce the attractiveness and increase the risk of the investment opportunities.

2.1 Embedded solar PV for the commercial, industrial, and agricultural sectors

Large energy users in the CI&A sectors have shown an increase in demand for embedded solar PV systems, driven by increasing electricity tariffs, energy security concerns and increasing pressure towards low-carbon energy. Embedded solar PV systems are adaptable and capable of being installed in multiple configurations, whether on existing rooftop spaces, ground-mounted setups, carports, or other available surfaces. This flexibility allows businesses and other users to customise PV installations to their specific site layouts, as described in Table 2. Sustained efforts towards implementing enabling policies and the development of a diverse array of financing mechanisms have aided growth in the sector.

Table 2: Configuration of embedded solar PV installations

TYPE OF PV SYSTEM	DESCRIPTION
Rooftop	Most common type of system due to the availability of roof space, typically accommodating 200 Wp per m².
Rooftop **(with asbestos replacement)**	Asbestos Abatement Regulations 2020 phase out this roofing type, requiring roof replacement. Financiers and insurance providers often avoid funding installations on asbestos roofs due to long-term risks.
Ground-mounted	Suitable if there is available land area and is more prevelant outside of urban centres.
Carport	This became more prevalent as a secondary approach when rooftop space is no longer available. Installations depend on the parking area and the influence of existing vs. required parking infrastructure on mounting costs and offers the added benefit of providing shade.
Floating	Applicable if there is a compatible body of water; there is a cost premium that arises from the required floats, with a limited number of installations in South Africa

2.1.1 INVESTMENT OPPORTUNITY

There are potential investment opportunities in project development, installation, and asset management for embedded solar PV systems for applications in the CI&A sectors. Between 2023 and 2024, the embedded generation sector achieved a 25% compound growth, adding over 2 GW to the total installed capacity—the largest annual increase to date. This surge was primarily driven by the record-high levels of loadshedding experienced in South Africa in 2023. The market's growth is also spurred by increasing demand for clean energy, particularly from international markets that require South African businesses to decarbonise to remain competitive.

Embedded solar PV development in the CI&A space is expected to grow by 3.8 GW by 2030. The investment value of this growth is estimated as R53.2 billion[4]. With the reduction in loadshedding, the growth trend is espected to stabilise at an average of 760MW or R10 billion per year, with an expected slowdown in growth towards 2030, as illustrated in Figure 2.

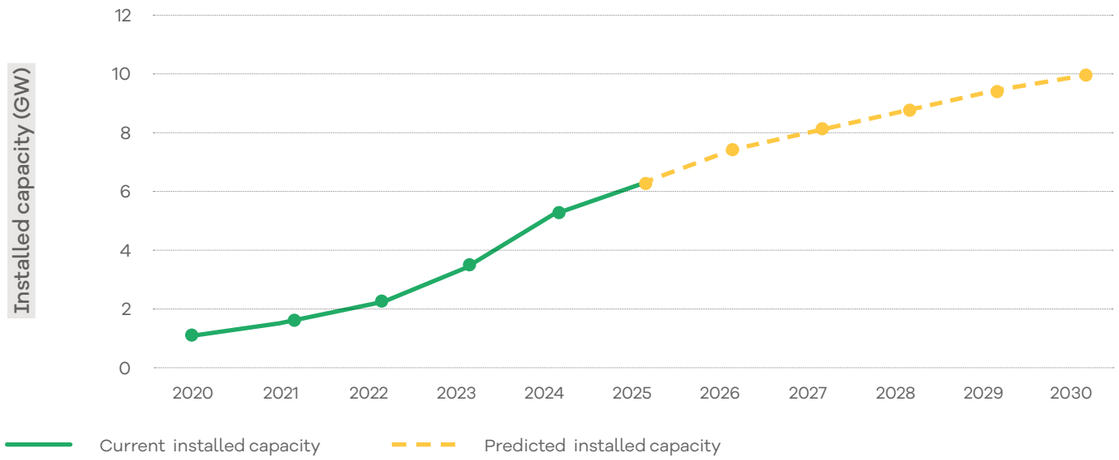

Figure 2: Cumulative market size by 2030 for embedded solar PV
(Sources: GreenCape analysis based on data from Eskom 2024)

2.1.2 DRIVERS

The installation of embedded solar PV systems for CI&A customers is driven by a need for price stability, more reliable electricity supply and lower-cost electricity. Access to embedded generation is also enabled through a variety of financing mechanisms. The push for renewable energy uptake in South Africa is also being driven by several international and local carbon commitments and regulations that aim to reduce carbon emissions. The investment case for these systems is enhanced by the enabling regulations of distribution operators.

2.1.2.1 Rising electricity costs

Rapidly rising electricity prices have increased the demand for more affordable alternative energy sources. A comparison of Eskom's historical price increases to South Africa's inflation rate as reflected by the consumer price index (CPI), reveals that electricity prices for CI&A customers have risen over 600% in nominal terms, illustrated in Figure 3 for the period from 2009 (Eskom 2024a). This consistent increase in tariffs and long-term price uncertainty has motivated customers in the CI&A sectors to invest in embedded generation to save on their electricity costs and improve their predictability of cost over a longer term.

4 This assumes the total installed cost of solar PV is R14/Wp.

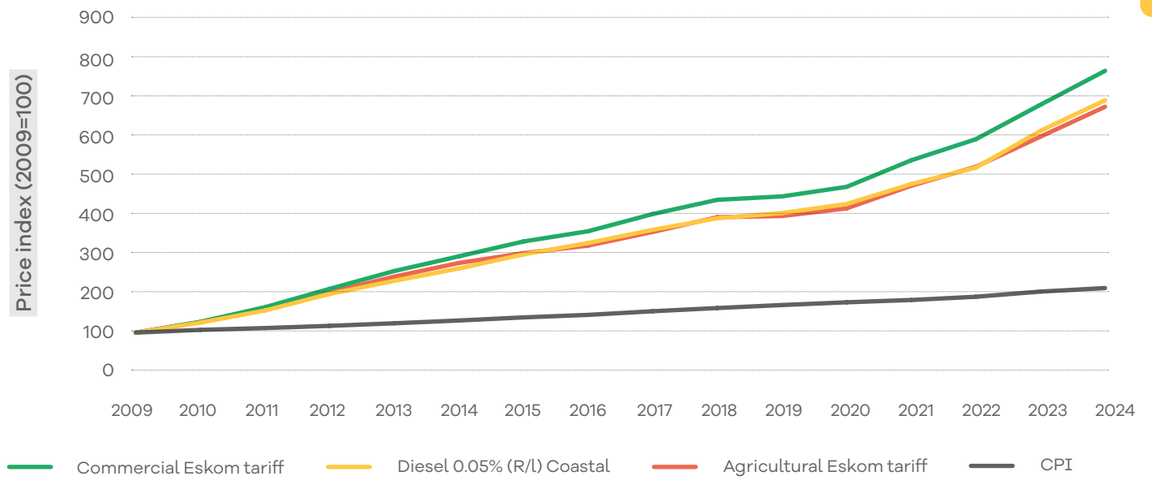

Figure 3: Price indices (2009 = 100) of Eskom average price increases for CI&A customers
(Sources: Eskom 2024a, Statstics SA 2024)

In contrast to rising electricity tariffs, PV installation costs have generally trended downward. The difference between Eskom's average cost per kWh and the levelised cost of electricity[5] (LCOE) of embedded PV translate to savings of between 40% and 60% for electricity offset by embedded solar PV for energy users in the CI&A sectors. The actual savings realised will depend on the tariff structures and usage patterns of the customer.

Changing tariff structures

To accommodate the shift in how the electricity sector operates, a more flexible tariff regime will be required to accommodate the changing generation profile and drive further investment into the electricity sector. Eskom requested changes in NERSA's tariff calculation methodology and is especially focused on dynamic and cost reflective tariffs with flexibility in adjusting tariff components on an individual basis (Eskom 2022). Currently, tariff increases are applied as a single percentage increase on all tariff components. Changes in tariff structures could have a significant impact on long term financial viability of renewable energy projects.

2.1.2.2 Availability of attractive financing mechanisms

A variety of finance mechanisms are available to CI&A organisations that seek to access renewable energy. Most commercial banks offer some form of standalone product for solar PV finance as well as having them incorporated into existing products. Power purchase agreements along with debt financing and rent-to-own are the most prevalent financing mechanisms currently available. An overview of the most popular financing options for embedded solar PV installations is provided in Table 3.

5 LCOE is a measure of the equivalent cost of the electricity provided by a system over its lifespan

Table 3: Finance options for embedded solar PV

Financing option	Structure
Outright purchase	The owner takes responsibility for operating and maintaining the system and system performance.
Debt finance	The buyer borrows capital to install the system and owns the system once the lender has been paid back. It allows for the preservation of the business's capital and liquidity. However, this require businesses to have a have a track record of creditworthiness.
Rent-to-own, solar lease agreement	The customer rents the system and ownership is transferred to the customer at the end of the lease agreement. The customer is not responsible for system performance risk.
Power purchase agreement (embedded)	The system is managed by a third party from whom the customer buys power at a predetermined cost. The customer benefits from a cheaper tariff without upfront investment or responsibility for asset.

The most recent pricing benchmarks for embedded (rooftop) PV are provided in Table 4. This illustrates the impact of economies of scale on the costs of embedded PV systems as well as the typical ranges for the various financing mechanisms for embedded PV that are currently available. Price multipliers for alternative configurations for embedded PV systems are also presented.

Table 4: Benchmarks for embedded PV 2024/25.
(Source: GreenCape analysis)

PROCUREMENT OPTION	<100KWP	100KWP-500KWP	500KWP-1MWP	>1MW
Outright purchase R/kW installed capacity	R 13.50 - R 16.50	R 12 - R 15	R 11.50 - R 14	R 11 - R 13.50
Debt finance	Above amortized plus risk-dependent interest, typically below prime. See [GreenCape's Green Finance webpage]			
Lease-to-own (10 years) per month excl. annual escalation	R 7 000 - R 30 000	R 25 000 - R 120 000	R 100 000 - R 200 000	>R210 000
Power purchase agreement	Negotiable tariff of up to 30% cheaper than existing Eskom/municipal tariff with CPI-related tariff increase of +-7% per annum.			
Cost multiplier for different PV configurations	Rooftop	Rooftop with asbestos replacement	Ground-mount	Floating	Carport
	1.00	1.30 - 1.50	1.10 - 1.20	1.50 – 1.75	1.25 – 2.00

South Africa's well-developed energy finance ecosystem enables a broader market to access solar PV, offering businesses a variety of financing options that cater to their specific needs. This improved access to procuring embedded PV solutions is expected to drive significant growth in the market.

2.1.2.3 Enabling regulations by distribution utilities

The distribution networks in South Africa are operated and regulated by municipalities and Eskom with oversight from NERSA. As Figure 4 shows, there are 257 municipalities in South Africa and 71 of these municipalities permit EG connections, and 67 have established formal application procedures for customers to obtain the necessary authorisations for installations. Additionally, 43 municipalities (26%) include EG tariffs in their official tariff books (SALGA 2023). These tariffs are typically lower than the cost of electricity purchased from the grid, as they are based on the rate municipalities pay for bulk electricity from Eskom. This means the feed-in portion of the tariff ranges from 32c/kWh to 130c/kWh, averaging around 86.9c/kWh. These tariffs allow embedded generators to sell excess power. Furthermore, high and medium-voltage customers that are located in Eskom distribution areas have the option to make use of energy banking or offset tariffs offered by Eskom. These incentives allow for higher utilisation rates of the PV installation and are especially relevant for agricultural and industrial users who experience fluctuations in energy demand depending on the season or day of the week and are typically connected to Eskom.

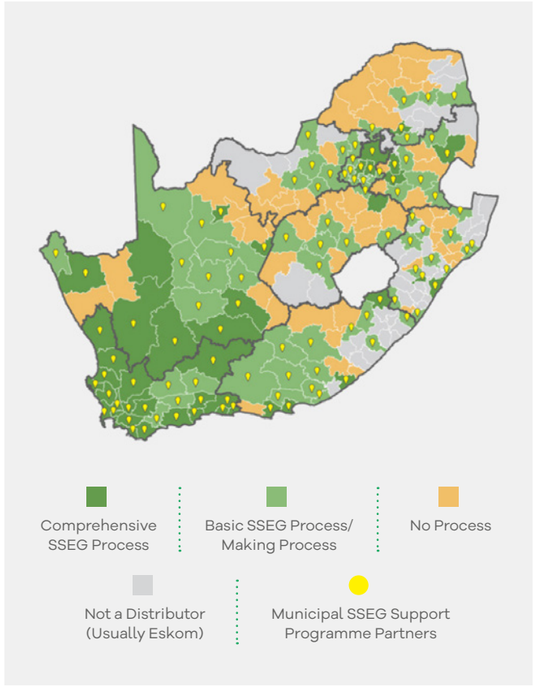

Figure 4: Municipal processes for embedded generation around South Africa
(Source: SALGA 2023)

2.1.2.4 Demand for carbon emission reductions

Amidst a global push for reducing carbon emissions, local businesses are subject to pressures to decarbonise through international commitments and regulations, as well as supply chain due diligence and ESG reporting requirements. To meet the demands of trade partners, businesses operating in these global supply chains have been looking at measures to reduce the carbon intensity of production including through procurement of embedded generation systems and typically solar PV to reduce carbon emissions related to their energy usage.

South Africa's key trading partners: the European Union (EU), the United Kingdom, the United States[6], and China, have regulations in place that require businesses to adhere to stricter sustainability standards. The EU's Corporate Sustainability Reporting Directive (CSRD), Corporate Sustainability Due Diligence Directive (CS3D), and the Carbon Border Adjustment Mechanism (CBAM) all place significant emphasis on the environmental impacts across entire value chains, including upstream and downstream carbon emissions, pushing businesses, among others, to lower their carbon footprints to maintain market access. China's new corporate sustainability reporting guidelines, implemented in 2024, set the stage for mandatory sustainability disclosures for public companies, reinforcing the global trend toward environmental accountability (Wesgro, 2024).

6 The United States' Securities and Exchange Commission's climate disclosure rules were introduced in 2024, however it is under legal challenge and risks removal in 2025.

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The EU's CBAM regulation came into effect on 16 May 2023, with a transitional phase from 1 October 2023, to 31 December 2025. During this time, importers must report embedded emissions, with full implementation and mandatory EU CBAM certificates starting 1 January 2026. Initially targeting carbon-intensive products like cement, steel, and electricity, CBAM will later expand to other goods. This regulation will impact South African exports to the EU (European Commission 2023).

These requirements collectively heighten the need for South African exporters to meet international sustainability requirements. By transitioning to solar, businesses can reduce emissions related to energy consumption, thereby complying with international sustainability requirements, maintaining their access to these key global markets, and benefiting from cost savings and energy security.

2.1.3 BARRIERS

With the rapid uptake of embedded solar PV, challenges evolve with regards to pressure on distribution network operators to manage the rollout on their infrastructure and to carry out the necessary vetting and registration processes in a timely fashion.

2.1.3.1 Challenges with distribution infrastructure

As the rollout of embedded generation continues, it is anticipated that the challenges faced by distribution operators will continue and potentially intensify, with issues associated with managing the grid in areas with a high level of embedded generation penetration becoming increasingly prevalent

While governing frameworks such as NRS 097-2-1[7] play an important role in maintaining safety and stability in the grid, they are not designed to maximise embedded generation within distribution grids. The current regulations typically require conservative calculations of maximum export capacity by summing the inverter capacities of both PV and battery systems, even though, in practice, these systems are rarely designed to export at full capacity simultaneously. This can limit the size of installations unnecessarily.

The distribution grid, managed by municipalities, faces issues with ageing infrastructure that can create bottlenecks and delays in connecting new renewable projects. The Just Energy Transition (JET) Implementation Plan[8] states that a total of R 200 billion in municipal distribution grid maintenance is required for a successful energy transition (The Presidency Republic of South Africa 2023). This amount includes provision for addressing a large backlog in distribution maintenance as well as grid upgrades to enable the energy transition. Aging infrastructure can lead to unreliable power supply and inefficiencies, and inconsistent governance and tariffs, can complicate renewable energy integration and increase costs, thus affecting project viability.

2.1.3.2 Limits on the administrative capacity of municipalities

The speed and magnitude at which embedded solar PV has been rolled out in South Africa placed pressure on distribution operators (e.g. municipalities, Eskom) to manage the effects of these systems on their grids. This challenge is exacerbated by a lack of compliance to the registration requirements. Furthermore, embedded generators who wish to feed excess power into the grid require the necessary metering infrastructure to be in place.

The management, registration and approval of new PV installations place an additional administrative burden on distribution operators that may face resource constraints to carry out this work which could lead to a backlog of applications and a delay in commissioning of systems. Similarly, the nature of the registration process and regulatory framework for embedded generation varies between the different municipalities.

7 NRS 097-2-1 is a South African regulation titled, "Grid interconnection of embedded generation", and focusses on the interconnection between generators and the grid.

8 The JET Implementation Plan is South Africa's roadmap to shift towards a low-carbon economy while ensuring that the transition is equitable and inclusive. It outlines measures to reduce carbon emissions, promote renewable energy, and support affected workers and communities, especially those reliant on high-carbon industries, by facilitating reskilling, social development, and job creation in sustainable sectors.

2.2 Behind-the-meter Li-ion energy storage

Behind-the-meter (BTM) Li-ion battery energy storage systems (BESS) are installed on-site and integrated with the premises' electrical system. In most cases, BESS is installed in parallel to solar PV systems by the same companies. The suspension of loadshedding in April 2024 resulted in a demand reduction for BESS. However, energy security remains a concern due to the ageing power plants and distribution network, affecting power quality and availability.


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2.2.1 INVESTMENT OPPORTUNITY

Li-ion batteries have become the most common form of BTM storage due to their reliable backup power capabilities and numerous value-stacking opportunities. Their adoption has been driven by the decreasing cost of technology, along with improved performance, higher energy efficiency, and longer lifespan compared to alternatives like lead-acid batteries. Li-ion batteries also offer lower operating costs, require less maintenance, and are more cost-effective over time, making them highly attractive in regions with escalating energy costs.

Despite the recent decline in the market, the CI&A sectors continues to see growth in both solar PV and BESS installations, reflected in the value of Li-ion battery imports illustrated in Figure 5.

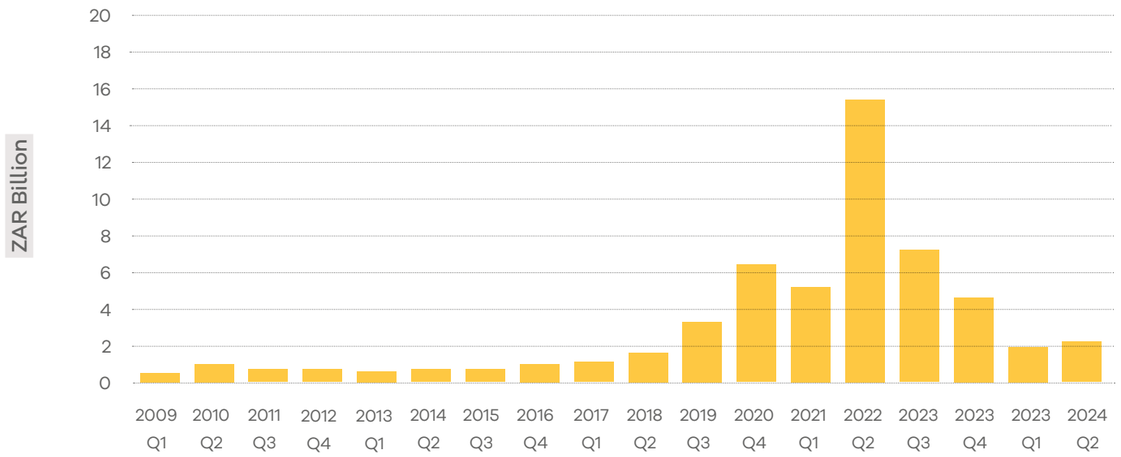

Figure 5: Lithium-ion battery imports[9] 2020-2024
(Source: South African Revenue Services)

9 Data sourced using Harmonised System (HS) code 85076000

Assuming a continued reduction in the prevalence of loadshedding, the growth in the BTM storage market for the CI&A sector in South Africa is expected to stabilise at about 400MWh per year or R2 billion[10] per year. The market growth by 2030 is expected to be 2GWh or R10 billion.

2.2.2 DRIVERS

Demand for lithium-ion BESS will continue through its strong business case, the development of value-stacking use cases and its positioning as a supporting component that enable more effective renewable energy implementation for the purposes of decarbonisation.

2.2.2.1 Li-ion batteries as a preferred energy security solution

Dependence on on the national grid, which has been affected by issues like loadshedding and capacity constraints, has led to significant disruptions for local businesses. Renewable energy projects allow companies to generate their own power, and, when paired with backup technology, reduces reliance on the unstable grid and improves the quality of the power supply. These systems also help stabilise voltage and frequency, minimising the risk of power quality problems that could damage equipment or disrupt operations.

Li-ion BESS have become the preferred technology for backup power for many businesses due to their long life spans and efficient operation. These features offset the high capital cost and improve the business case of Li-ion BESS over its lifespan, resulting in an improved levelised cost of storage (LCOS) when compared to other technology, as can be seen from Figure 6.

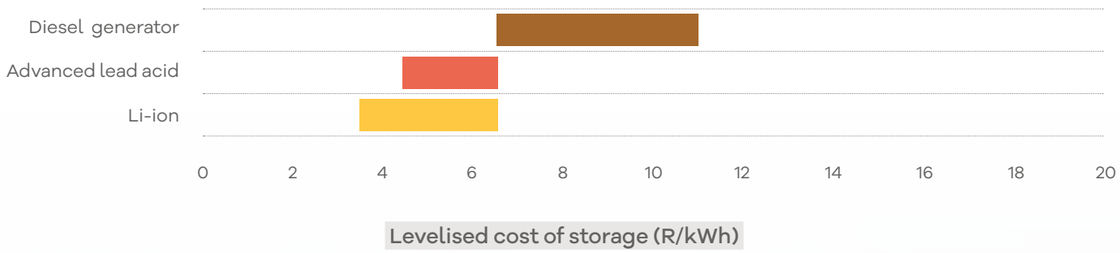

Figure 6: Levelised cost of storage (LCOS) comparison of backup technologies (Source: GreenCape Analysis)

The future of loadshedding and its impact on the market remains uncertain as Eskom continues to rely on its ageing coal power fleet. The combined effects of Eskom's improving performance, the connection of new generation capacity to the grid, and a decrease in overall grid demand will determine whether loadshedding persists in the coming years. However, the long-term risk of supply and demand imbalances due to ageing infrastructure remains a concern for businesses. In 2024, some areas have been affected by another type of planned outage called "load reduction".

Unlike loadshedding, load reductition occurs in areas where transformers are at risk of damage from overloading. This new source of potential power instability, along with regular outages and grid disruptions, is prompting businesses to invest in backup power solutions like Li-ion storage, regardless of loadshedding.

10 This assumes a total installed cost of R5 000 per kWh of BESS.

2.2.2.2 Market development for value-stacking use cases

Value stacking refers to the practice of using BESS for multiple purposes, each of which generates additional value or savings. Instead of using the storage solely for one function, like backup power, the system can be "stacked" with several revenue-generating or cost-saving functions, making it more likely to be financially viable. The value stacking options are:

- **Peak shaving:** Batteries are charged during low-demand periods and discharged during high-demand periods, thereby reducing the peak energy demand from the distribution network. Peak shaving is most impactful on tariffs that utilise Notified Maximum Demand[11] (NMD). If customers exceed the NMD they are penalised with elevated network and transmission network charges. Peak shaving can reduce the risk of exceeding NMD and potentially allow facilities to reduce the NMD to benefit from lower tariffs.

- **Tariff arbitrage:** The battery storage unit is charged during off-peak periods and discharged during peak periods to take advantage of the difference in tariffs. For example, on an Eskom Megaflex Time-of-use[12] (ToU) tariff with a long-distance transmission zone (>900 km) and low voltage (<500 V), the off-peak rate during high demand season is R1.07 /kWh whereas the corresponding peak rate is R6.52 /kWh (Eskom 2024b). As a result, a CI&A energy user on a ToU tariff is a prime candidate to take advantage of this use case.

- **Load shifting:** Battery technology allows the reduction of electricity demand over one period and increases the demand over another period to improve energy management. This is especially suited for customers with solar PV systems where the production risks exceeding the demand of the facility. Where municipalities have low feed-in tariffs or do not allow the electricity to feed into the grid, shifting the load using batteries could become a viable use case.

- **Power quality:** BESS can enhance power quality in BTM installations. Static support provides reactive power to regulate voltage and improve power factors in sites with inductive loads, while dynamic support involves active power control to address frequency variations and voltage dips. BESS can quickly respond to power quality disturbances, improving system reliability and reducing losses. Moreover, they can help integrate renewable energy sources by smoothing out fluctuations in power generation.

11 NMD is the demand capacity measured in kilo-volt-amperes that Eskom customers request. NMD is implemented on most of Eskom's tariffs and .

12 The TOU tariffs are energy charges that the utility suppliers use during different TOU periods throughout a 24-hour period and different demand seasons.

The business case for the value-stacking of BESS improves as the LCOS gets closer to parity with the price of Eskom electricity. As demand-side initiatives will be a necessary part as intermittent renewable generation takes a larger share of the utility electricity generation mix, Li-ion batteries will become an integral part of delivering services in an updated market model.

2.2.2.3 Global market trade dynamics driving demand

The impact of sustainability and carbon emissions targets on global trade is impacting business decision-making processes. Collectively decarbonisation policies are driving companies towards implementing solutions that can contribute to decarbonisation and traceable supply chains. Energy storage enhances the integration of renewable energy in CI&A sectors by addressing the variability and intermittency of sources like solar and wind. This increases the ability of individual users to respond to global market trade dynamics linked to carbon policies.

By storing excess energy generated during peak production periods, user can access clean energy even when generation is low, such as during cloudy days or at night. This enables a more consistent and reliable renewable energy supply, reducing dependence on fossil fuels and helping these sectors lower operational emissions. Additionally, storage supports energy efficiency, cost savings through demand management, and improved grid stability, allowing companies to align with sustainability goals while ensuring uninterrupted operations.

2.2.3 BARRIERS

The BESS market faces substantial barriers to investment, primarily due to its reliance on imported components amid ongoing trade challenges, which can disrupt supply chains and increase costs. Additionally, South Africa's regulatory environment is still in its early stages and has yet to fully align with rapidly advancing energy storage technologies.

2.2.3.1 High reliance on imported components

South Africa is reliant on imported components for the BESS sector. This creates both cost-competitive and logistical constraints. Long lead times on imported equipment, largely due to inefficiencies at South Africa's ports, are a consistent challenge for local value chain actors. According to the World Bank's Container Port Performance Index 2023, South Africa has four container ports, which scored the following rankings out of 405 assessed ports, which includes other African ports (World Bank 2024)[13]:

- Port of Cape Town: 405th
- Port of Durban: 399th
- Port of Ngqura located in the Coega Special Economic Zone, Gqeberha: 404th
- Port of Port Elizabeth located in Gqeberha: 391st

To mitigate these delays, suppliers often need to carry larger inventories, which can strain their cash flow and increase the working capital required for technology providers to remain competitive. Additionally, quality issues with imported components have been reported within the industry. These substandard components raise concerns about non-compliance with international standards and undermining trust in the supply chain and raising safety concerns.

Figure 7 illustrates the breakdown of Li-ion cell and battery imports into South Africa over the past five years. It highlights the market's heavy reliance on Chinese imports, with nearly 40% of all Li-ion cells and batteries coming from China. This dependency poses a risk to supply chain stability and price security, particularly in the face of changing political and trade conditions, as well as fluctuations in exchange rates.

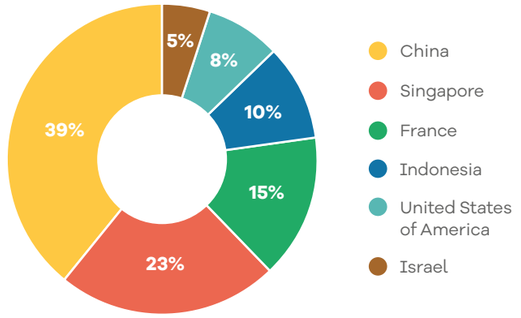

Figure 7: Li-ion cell and battery imports into SA by country (2019-2024, Q2)
(Source: SARS data accessed through Trademap 2024)

2.2.3.2 Emerging regulatory environment

The lack of clear policies, regulatory frameworks and standards for BTM Li-ion storage creates barriers to the growth of BTM Li-ion storage installations. One of the most pressing challenges is the limited guidance on battery installations in national safety and installation standards[14]. The thermal runaway phenomenon in Li-ion batteries presents a fire hazard that, coupled with the industry's nascence, increases risks for both installers and owners. Unlike other industries, where safety protocols for hazards like fires are well-established, standards for handling and mitigating Li-ion fires are still under development internationally. This lack of clarity regarding safe practices and fire suppression protocols leads to uncertainty, making businesses hesitant to invest in BTM Li-ion storage systems.

A lack of understanding of these risks in the banking and insurance industries can make it more difficult and expensive for companies to access finance and insurance for BTM storage installations. Moreover, the limited guidance and application/awareness on battery installations within electrical installation standards and building standards highlights the need for amendments to better cover BESS. Implications for positioning of batteries, and the need for appropriately trained and skilled personnel during installation, as well as the use of quality components are some of the key challenges in the market.

13 Transnet, which manages South Africa's ports, has challenged the World Bank's assessment and there is currently an agreement to give South Africa the data used by the World Bank to make this assessment.

14 SANS 10142-1 "The wiring of premises — Part 1: Low-voltage installations" is being amended to include additional battery installation requirements

3

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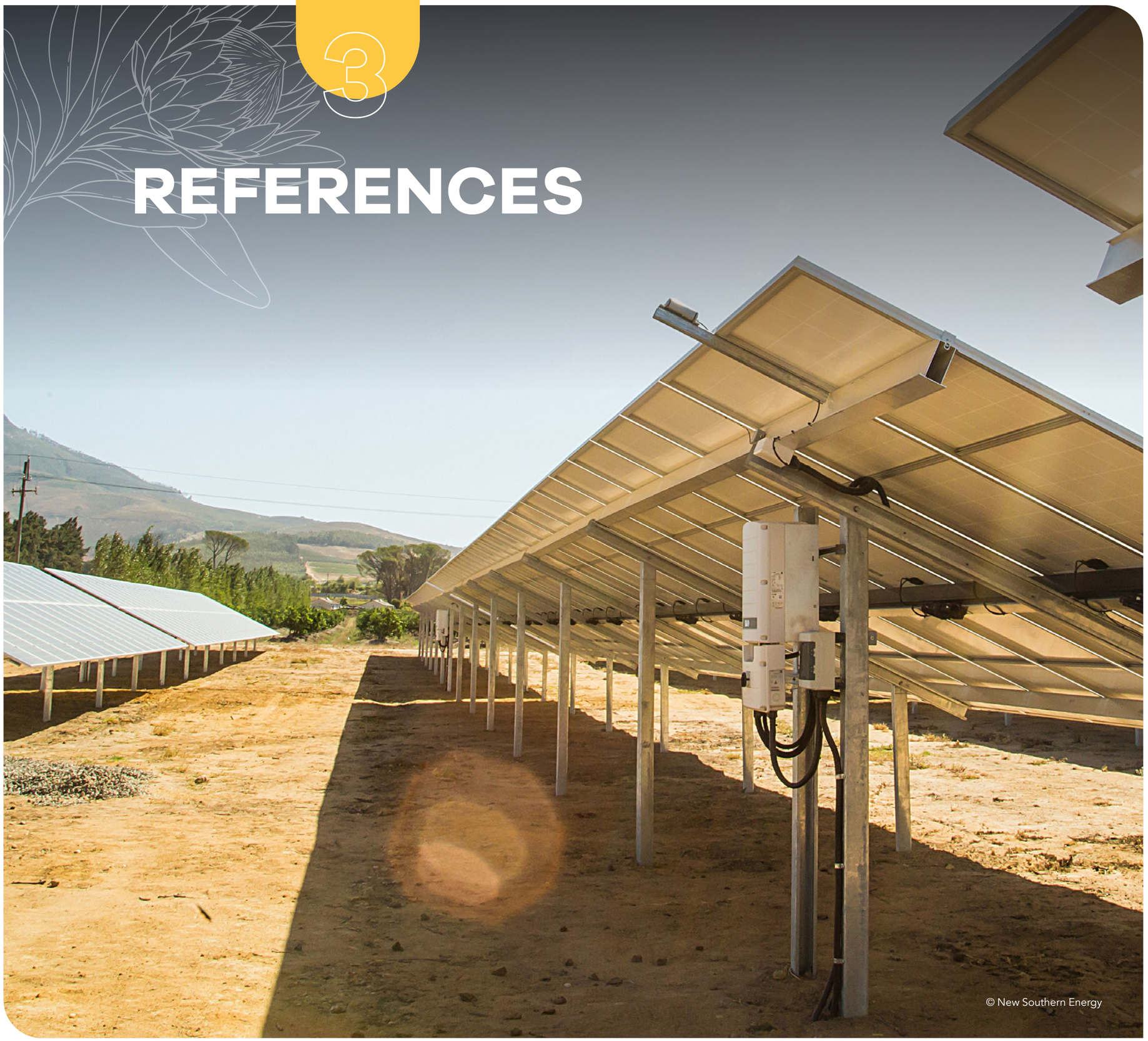
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In order to make our printed reports shorter, and to keep up with policy changes, we've moved the sector overview and policy sections, which were traditional chapters in our MIRs, online. These sections will now be updated in real time and can be accessed by clicking on the button below. Our PDF reports and printed booklets have been shortened to focus more directly on the emerging opportunities in the sector. We hope these changes improve your reading experience.

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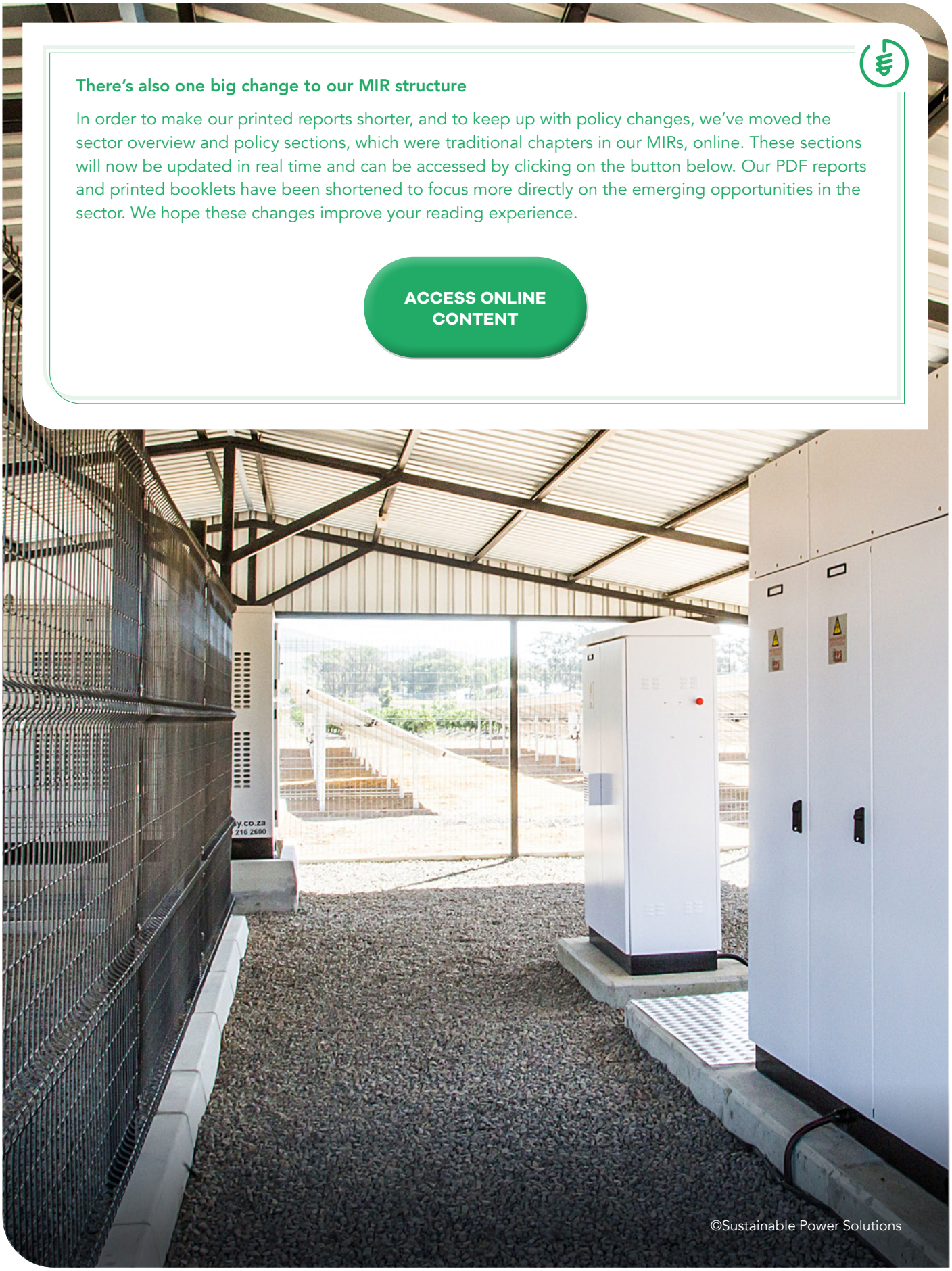

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