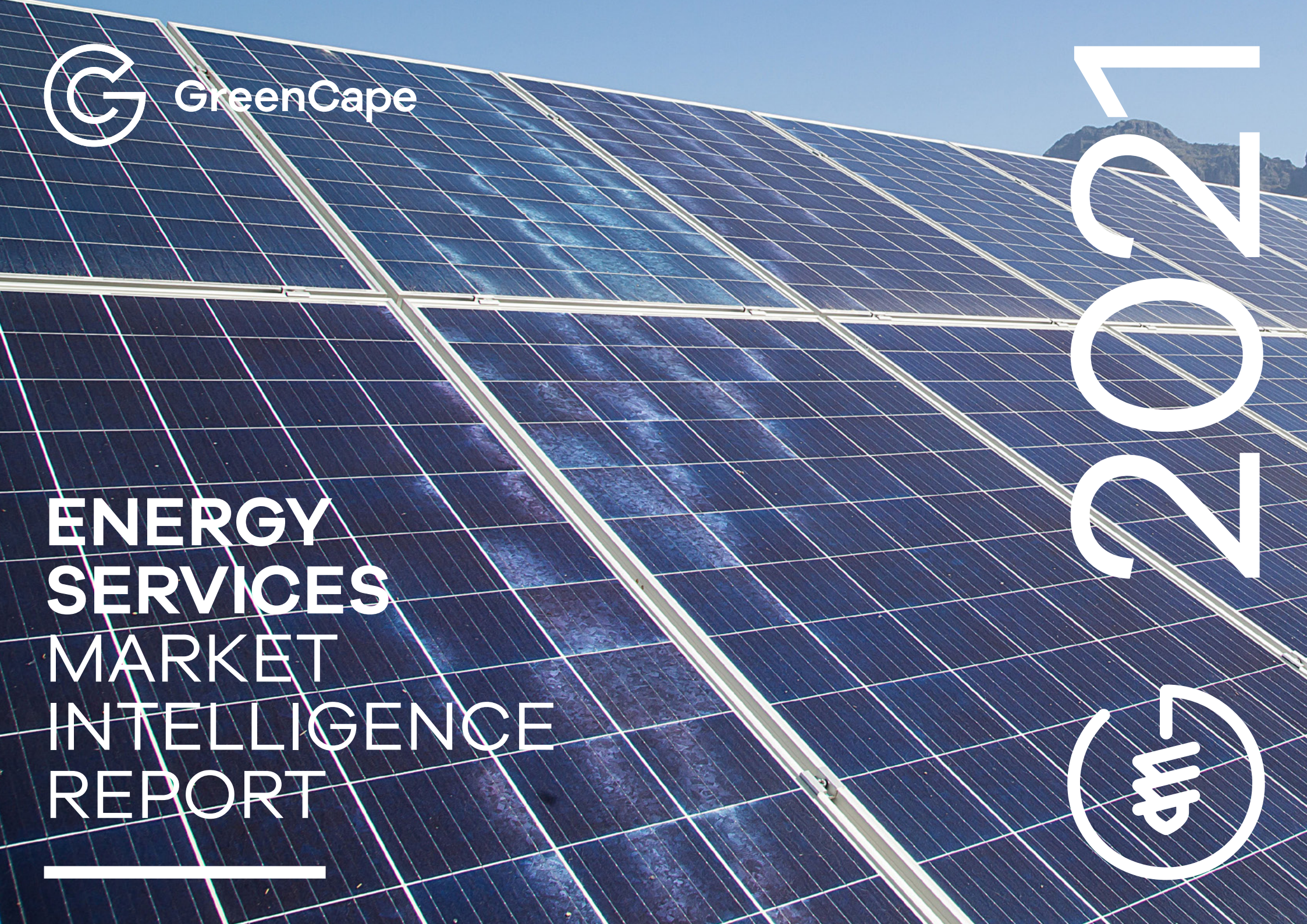

GreenCape

ENERGY SERVICES MARKET INTELLIGENCE REPORT

2021

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.

Acknowledgements

This market intelligence report was produced in partnership with the Western Cape Government Department of Economic Development and Tourism. We thank Argon Poorun (lead author), Jack Radmore, Bruce Raw, Reshmi Wolvers and Johan Strydom for the time and effort that they have put into compiling this market intelligence report.

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LIST OF ABBREVIATIONS AND ACRONYMS

AEEE	Alliance for an Energy-Efficient Economy
BEE	Bureau of Energy Efficiency
BTM	Behind the meter
CAGR	Compound annual growth rate
Candi	Commercial and industrial
Capex	Capital expenditure
CCT	City of Cape Town
CMVP	Certified measurement and verification personnel
CO^2e	Carbon dioxide equivalent
COTS	Commercially available off-the-shelf
CPI	Consumer price index
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated solar power
DFI	Development Finance Institution
DMRE	Department of Mineral Resources and Energy (National)
DoE	Department of Energy (National)
DPE	Department of Public Enterprises
dti	Department of Trade and Industry
EAF	Energy availability factor
EE	Energy efficiency
EEMS	Energy Efficient Monitoring System
EG	Embedded generation
EOI	Expression of interest
EPC	Engineering Procurement Construction
EPCM	Engineering Procurement Construction Management
ERA	Electricity Regulation Act
ES	Energy services
ESC	Energy supply contracting
ESt	Energy storage
ESCo	Energy services company
GOF	Green Outcomes Fund
GW	Gigawatt
GWh	Gigawatt-hours
HVAC	Heating Ventilation and Cooling
IEA	International Energy Agency
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Plan
kW	kilowatt
kWh	kilowatt hours
kW_p	kilowatt peak
LCOE	Levelised cost of electricity
MIR	Market Intelligence Report
Mt	Megatonnes
MW	Megawatt
MWh	Megawatt hours
MW_p	Megawatt peak
MYPD	Multi-year price determination
NBI	National Business Initiative
NCPC-SA	National Cleaner Production Centre South Africa
NEES	National Energy Efficiency Strategy
NERSA	National Energy Regulator of South Africa
O&M	Operation and maintenance
OEM	Original equipment manufacturer
PACE	Property Assessed Clean Energy
PAYS®	Pay As You Save®

PPA	Power purchase agreement
PQRS	Power quality and renewable services
PSEE	Private sector energy efficiency
PV	Photovoltaic
RE	Renewable energy
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
RFP	Request for Proposal
SABIA	South African Biogas Industry Association
SAESA	South African Energy Storage Association
SALGA	South African Local Government Association
SANEDI	South African National Energy Development Institute
SAPVIA	South African Photovoltaic Industry Association
SASGI	South African Smart Grid Initiative
SAWEA	South African Wind Energy Association
SMEs	Small- and medium-sized enterprises
SMME	Small-, medium- and micro-sized enterprises
SONA	State of the Nation Address
SSEG	Small-scale embedded generation
StatsSA	Statistics South Africa
TOU	Time of use
TWh	TerraWatt hour
UNIDO	United Nations Industrial Development Organization
UPS	Uninterruptable power supply

Exchange rates used: 1 US Dollar = R16.23 (October 2020)

EXECUTIVE SUMMARY

This market intelligence report is compiled for foreign direct and local investors that are looking to invest directly in the South African green economy through project development, asset management, equity, debt, equipment manufacturing, or support services. It highlights investment opportunities in embedded generation and energy efficiency, created by South Africa's diversifying energy services market.

The term 'energy services' is used to describe two key energy market segments in the South African energy space, namely (i) small-scale embedded generation (SSEG), which includes rooftop solar photovoltaic (PV) systems and energy storage, and (ii) energy efficiency. These market segments are increasingly bolstered by offerings in the energy finance sector, which in and of themselves also present opportunities to financial investors.

There are five main factors driving growth in the energy services market:

South Africa's above-inflation electricity price rises; national energy insecurity; decreasing technology costs; supportive policies, regulations, and tariffs; and well-adapted finance options, have all played an important role in driving the growth of the energy services market.

Despite the systemic shocks caused by the COVID-19 economic lockdown, the well-established South African Energy Services market continues to grow at an increasing rate.

The national embedded generation market for installations, operation and maintenance of **rooftop solar PV** has been identified as an important part of the country's immediate efforts towards energy security.

It showed remarkable resilience with full development pipelines holding the expected growth trajectory through 2020 close to the saturation point of 500 MWp annual installed capacity. As such, the market is still expected to reach a total capacity of 7.5 GW by 2035 at an estimated market value of R75 billion.

This steady growth, which translates to the potential creation of ~1 250 jobs, is significant, considering the national expanded unemployment level reaching 42.0%.

In 2020 the SA energy storage market saw a surge in demand from the commercial and agricultural sectors.

The flexibility of application use-cases and the increasing relevance of load-shedding-related risk will lead to an increasingly prevalent role of the storage segment in energy service provision. The market is expected to rise to ~ R31 billion, with 6.5 GWh installed energy capacity by 2030.

Energy efficiency was the hardest hit by the economic shutdown period of the lockdown. Unlike the embedded generation segment, decreased demand appetite and access to stockpiled equipment led to a market contraction, with many companies being forced to limit their workforce.

Significant untapped potential still lies in this market for investors and businesses, as it serves as an important, favourable option going forward in optimising energy costs. The estimated market by 2035 is ~ R21 billion.

Solar PV installation in Cape Town CBD. ©GreenCape

Within the embedded generation market segment, there are four emerging opportunities for investors:

Rooftop PV model diversification for the commercial and industrial (Candi) sectors: A strong business case is driving increasing maturity, concentration, and competition in the market. Hence, developers are extending the types of offerings, such as O&M-only contract rebuys and system bundling. This provides attractive, alternative access to the market for new entrants and smaller players.

Solar power purchase agreements (PPAs): Although access to finance has improved with commercial banks having developed dedicated solar portfolios and spesific financial mechansims, corporate and capital-constrained customers are opting to transfer the performance and investment risk onto the service provider, whilst also ensuring a long-term fixed reduced tariff.

There is significant opportunity in partnering with engineering, procurement and construction companies (EPCs) to back the investment in meeting this demand.

Solar PV for energy resellers: In traditional resale, property development owners (residential estates or shopping malls, for example) can benefit from bulk electricity, discounted from municipalities. They can then sell it to their tenants at the retail rate instead of the potentially less preferential individual unit tariffs. Similarly, the property developer can install a solar PV system, benefiting from a reduced power purchase agreement rate. They can then 'on-sell' the electricity generated by the PV system to tenants at a rate equivalent to the higher residential or commercial tariff, depending on the development.

In-house capacity building: Property development owners who have identified the significant potential for rooftop PV across their available portfolio are entering the market by developing in-house delivery capacity. This allows them to circumvent contractual arrangements with EPCs and reduce project costs. The growth potential of this opportunity is highly attractive for early-funding partners who can assist in backing such projects.

Within the energy storage market segment, there is an emerging opportunity for investors:

Behind-the-meter (BTM) battery storage: The need for energy independence and resilience, in light of on-going load shedding, is driving demand in back-up power and uninterruptible power supply (UPS) applications, particularly in commercial, industrial and agricultural applications where the opportunity costs of energy insecurity are high. This opportunity is still small due to the prohibitive high cost of batteries, though it is expected to grow significantly as lithium-ion battery prices continue to decrease over the next 5 to 10 years.

Within the energy efficiency market segment, there are two emerging opportunities for investors:

Smart metering and demand-side management: Development in smart metering technologies and increasing awareness of the opportunity to both reduce commercial and residential electricity bills and improve revenue collection result in growing penetration over standard prepaid meters in municipalities.

Aggregated interventions for commercial new builds and retrofits: The end of the private sector energy efficiency (PSEE) programme in 2015, growth of the rooftop PV market, and tight margins against operational and contracting costs have led to a decline in energy-efficiency market participation, despite this being an attractive intervention for consumers. However, there has been a resurgence in centralised solutions for medium to large commercial buildings, particularly in water heating, which presents the opportunity to aggregate benefits and project return.

Ground mounted solar PV installation at Marlenique Estate.
©New Southern Energy

SUMMARY OF MARKET OPPORTUNITIES

Opportunity	Key drivers	Requirement and barrier	Expected timeframe	Macro-environment
Candi rooftop PV diversification	• Smaller rooftop PV projects are bundled together to reach a scale where they become attractive to larger investors • Renewal of O&M contracts after 2-5 years (project dependent) • Enables international project developers and investors to establish a footprint in South Africa	• Competition can drive instances of cost-cutting and installations of sub-par systems • Regulatory uncertainty	1-5 years	• Load shedding and security of supply are major concerns • Eskom and municipal electricity tariffs on the rise
Solar PPAs	• Energy user does not need to raise upfront capital • Long-term future energy cost stability • Transfer performance and maintenance risk to the installer • Option to buy system can be negotiated at a later stage	• Offered at a premium in comparison to buy-own model • Complexity in negotiating PPA contracts	1-5 years	• COVID-19 economic contraction has led to businesses being conservative with their balance sheets • Eskom and municipal electricity tariffs on the rise
PV for energy resellers	• PPA financing • Wheeling frameworks are emerging • Reduction of carbon footprint	• Regulatory uncertainty • Lack of standardisation in PPA contracts • Home-owners association approval	5-10 years	• 3-5 solar PV tenders per month nationally in the last year — green building industry on the rise • Eskom and municipal electricity tariffs on the rise • National energy insecurity • The carbon tax bill currently in effect at R120/tCO_2 with increases scheduled from 2022 onwards
In-house capacity building	• Easy access to commercial finance • Access to a large portfolio of properties and available roof space • Circumvent PPAs	• Regulatory uncertainty • Bridging the gap in technical expertise	5-10 years	• Increasing awareness of strong PV business case on medium to large commercial properties • Eskom and municipal electricity tariffs on the rise • The carbon tax bill currently in effect at R120/tCO_2 with increases scheduled from 2022 onwards

Opportunity	Key drivers	Requirement and barrier	Expected timeframe	Macro-environment
Behind the meter (BTM) battery storage – 1.5 GWh	• Easy access to commericial finance • Access to a large portfolio of properties and available roof space • Circumvent PPAs	• Regulatory uncertainty • Bridging the gap in technical expertise	5-10 years	• Increasing awareness of strong PV business case on medium to large commercial properties • Eskom and municipal electricity tariffs on the rise • The carbon tax bill currently in effect at R120/tCO2 with increases scheduled from 2022 onwards
Smart metering and demand-side management	• Complex time-of-use tariffs • Developments in technology for wider accessibility and ease-of-use • Standardisation of smart meter regulations (NRS 049) • Monitoring and bill reduction as a service • Reduces rates of tampering and theft through real-time alerts	• Willingness to transition from standard prepaid meters • Privacy concerns • Uncertainties in municipality-wide implementation	1-5 years	• Utilities lose between 10 and 45% of revenue to tampering and copper cable theft • Eskom and municipal electricity tariffs on the rise • The carbon tax bill currently in effect
Aggregated interventions for commercial new builds and retrofits	• Legislative and regulatory changes for green buildings (SANS10400-XA) • The requirement of a 50% limit on electricity used for water heating is driving the shift to centralised energy solutions particularly in building retrofits. • 12L tax incentive • Falling cost of energy-efficient technologies	• Target market education and business development	1-5 years	• COVID-19 economic contraction has led to the businesses being conservative with their balance sheets • Eskom and municipal electricity tariffs on the rise

WHAT'S NEW?

CLICK HERE TO WATCH A SUMMARY OF THE 2021 ENERGY SERVICES MIR OPPORTUNITIES

This MIR provides an update on the opportunities, barriers, and regulations discussed in the 2020 Energy Services MIR. It also outlines emerging opportunities and barriers in small-scale embedded generation, energy efficiency, and energy storage.

What happened in 2020

- **Feburary:** The new draft Energy Efficiency Standards (SANS10400-XA 2nd edition) were published for public comment.
- **March:** Phased national lockdown in response to the COVID-19 pandemic led to a halt in economic activity and the delivery of energy projects from 26 March 2020 to 31 May 2020 (2 months).
- **March:** Amendments to Schedule 2 of the Electricity Regulation Act 4 of 2006 were gazetted on 26 March 2020. It exempts certain power generation facilities of less than 1 MW in size from the requirement to have a generation licence. If an installation meets the criteria as stipulated in the amended schedule, the installation can be registered with NERSA, instead of requiring a licence. It is expected that distribution operators, i.e. municipalities or Eskom, would be in charge of registering the installations and report to NERSA.
- **May:** Draft low voltage wiring code SANS 10142-1-2 – Part 1-2: Specific requirements for embedded generation installations connected to the low voltage distribution network in South Africa were released for public comment. It stipulates additional special requirements for low voltage small-scale embedded generator installations connected to the electricity grid.
- **July:** The City of Cape Town (CCT) launched a Small Scale Embedded Generation Feed-in Incentive (R0.25/kWh)
- **January – December:** Rolling blackouts (load shedding) continued with Eskom unable to match current demand with available supply.

State of the Nation Address 2020

In the State of the Nation Address (SONA 2020), President Cyril Ramaphosa announced measures that the government would take to rapidly and significantly change the trajectory of energy generation in the country, including:

- **Bringing more renewable energy**, natural gas, hydropower and battery storage into the energy mix through the Integrated Resource Plan 2019.
- **Procuring emergency power** from projects that can deliver electricity into the grid within 3 to 12 months of approval.
- **Generating own-use power.** NERSA will continue to register small-scale distributed generation for own use of under 1 MW, for which no licence is required.
- **Enabling municipalities to produce their power** directly or procure from independent power producers (IPPs).

This MIR updates the 2020 report and highlights the following:

- updates on the state of small-scale embedded generation in South Africa;
- updates on the state of energy storage in South Africa;
- updates on the state of energy efficiency in South Africa;
- opportunities for players within the Energy Services market;
- Energy Services market drivers and barriers;
- COVID-19 lockdown and its impact on the Energy Services market; and
- the influence of changes in policy and regulations such as the IRP on future opportunities.

Gouda Wind Farm.

INTRODUCTION AND PURPOSE

In response to changing demands, energy service providers are broadening their market offerings. The South African Energy Services market holds opportunities for equipment suppliers, project developers, technical advisors, and financial investors.

Over the past 10 years, the concept of energy services (ES) and energy services companies (ESCos) has evolved and matured in several markets around the world, including South Africa.

This market intelligence report provides potential investors in the small-scale embedded generation, energy storage, and energy efficiency markets with a greater understanding of market opportunities in South Africa, taking into account the size of the opportunities, the level of risk involved, and current barriers.

The global *energy as a service* market is projected to reach USD 86.9 billion by 2024 from an estimated USD 52.0 billion in 2019/20, at a compound annual growth rate (CAGR) of 10.8%. This growth can be attributed to factors such as new revenue generation streams for utilities, increasing distributed energy resources, decreasing cost of renewable power generation and storage solutions, and the availability of tax benefits for energy efficiency projects. (MarketsandMarkets 2019)

The report is compiled for foreign direct and local investors (persons or organisations) that are looking to invest directly in the South African green economy through project development, asset management, equity, debt, equipment manufacture, or support services.

In what follows:

- The **sector overview** (Section 2) provides a national economic overview of the ES market, including:
  - the market context (small-scale embedded generation, energy storage, and energy efficiency);
  - four major market drivers in the South African ES market;
  - market sizing (small-scale embedded generation, energy storage, and energy efficiency);
  - key players in the South African ES market.
- This is followed by an overview and update of **policies, legislation, and governance** (Section 3) that guide and affect the ES market.
- In Section 4, **emerging opportunities and their related drivers and barriers** are highlighted, followed by sections that outline various **finance and investment incentives** (Section 5), present the case for the **Western Cape as a potential greentech hub** for Africa (Section 6), and explain **GreenCape's work within the green economy** (Section 7).

CLICK HERE TO EMAIL GREENCAPE'S ENERGY SERVICES SECTOR DESK

Manufacturing job opportunities in the SSEG market. ©GreenCape

SECTOR OVERVIEW

Rising electricity prices, national energy insecurity, dropping technology costs, supportive energy policies, and incentives are prompting consumers to explore alternative energy options driving the growth of the Energy Services (ES) market in South Africa, and creating a thriving value chain.

Solar PV installment
in Cape Town
©GreenCape

This section provides an overview of the national ES context, covering market developments, key industry players, and the size of the market. The term "energy services" is used to describe three interlinked energy market segments in the South African energy space, namely small-scale embedded generation, which is currently dominated by rooftop solar photovoltaic (PV) systems, energy storage, and energy efficiency. Figure 1 (to the right) breaks down the three interlinked energy market segments.

Energy efficiency improvements – street light retrofitting. ©City of Cape Town

Figure 1: Energy Services interlinked market segments

Small-scale embedded generation

- Generation facilities of less than 1 MW.
- Located at residential, commercial or industrial sites, where electricity is generally consumed.
- Installed on the customer's side of the electricity meter.

Energy storage

- Energy storage systems are technologies in which electric energy is loaded and, when needed, discharged for consumption.

Energy efficiency

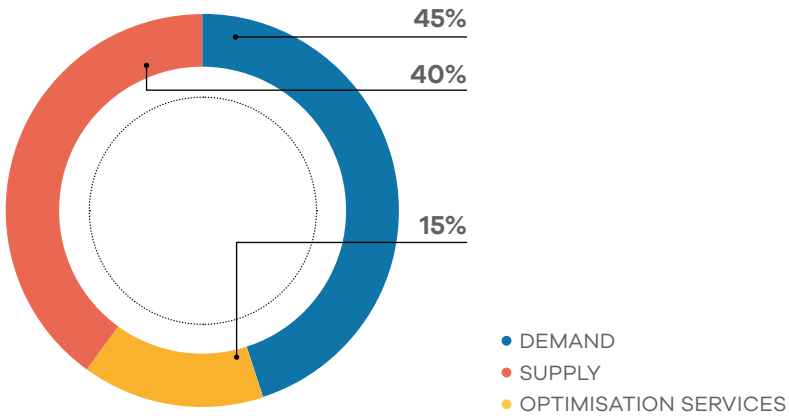
- Implementation of behaviour change or technology to reduce energy consumption, while producing the same or greater outputs.

2.1. International Energy Services market

The global ES market is projected to reach USD 86.9 billion by 2024 from an estimated USD 52.0 billion in 2019, at a compound annual growth rate (CAGR) of 10.8 per cent (MarketsandMarkets 2019). This growth can be attributed to factors such as new revenue generation streams for utilities, increasing distributed energy resources, decreasing costs of renewable power generation and storage solutions, and the availability of tax benefits for energy-efficiency projects.

When breaking this down into specific services, the market for energy services is divided into supply, demand, and optimisation services, as seen in Figure 2. With a global focus on renewable energy (lower costs, reduced carbon footprint), it is projected that the supply portion of the market will dominate market growth over the next five years. On a sector basis, the commercial, agricultural, and industrial segments are projected to register the fastest growth over the next five years.

Figure 2: Global Energy Services Market Share
(MarketsandMarkets 2019)



2.2. South African market context

Within a global landscape context, the South African ES market remains nascent; however, each of these global trends can be observed in the local market.

2.2.1. South African electricity landscape

South Africa's electricity supply is currently dominated by coal-fired power generation. The country has coal-fired generation stations with an installed capacity of between 36.5 GW and 40 GW. This represents more than 80% of the country's total installed capacity, amounting to 48 GW (The Department of Energy 2019). These stations are primarily owned and operated by Eskom, the national power utility. Eskom supplies ~95% of South Africa's total electricity demand. The remaining 5% is met through municipalities, imports, and independent power producers (IPPs).

There has been distinct demand flattening since 2010, resulting in reduced dependence on coal-based electricity (87% in 2010 versus 79% in 2019) (Wright & Calitz, 2020). However, a historic imbalance of supply and demand in South Africa's single buyer energy model over more than 10 years has resulted in intensive load shedding experienced country-wide during 2019 and the first half of 2020. An estimated 1.3 TWh was loadshed during these periods (Wright & Calitz, 2020). Load shedding has been driven by a combination of factors, including:

- delayed commissioning and underperformance of newly built coal generation capacity;
- degradation of the existing Eskom coal fleet energy availability factor (EAF) declining from ~94% in 2002 to 67% in 2019/20.

2.2.2. The development of the Energy Services market in South Africa

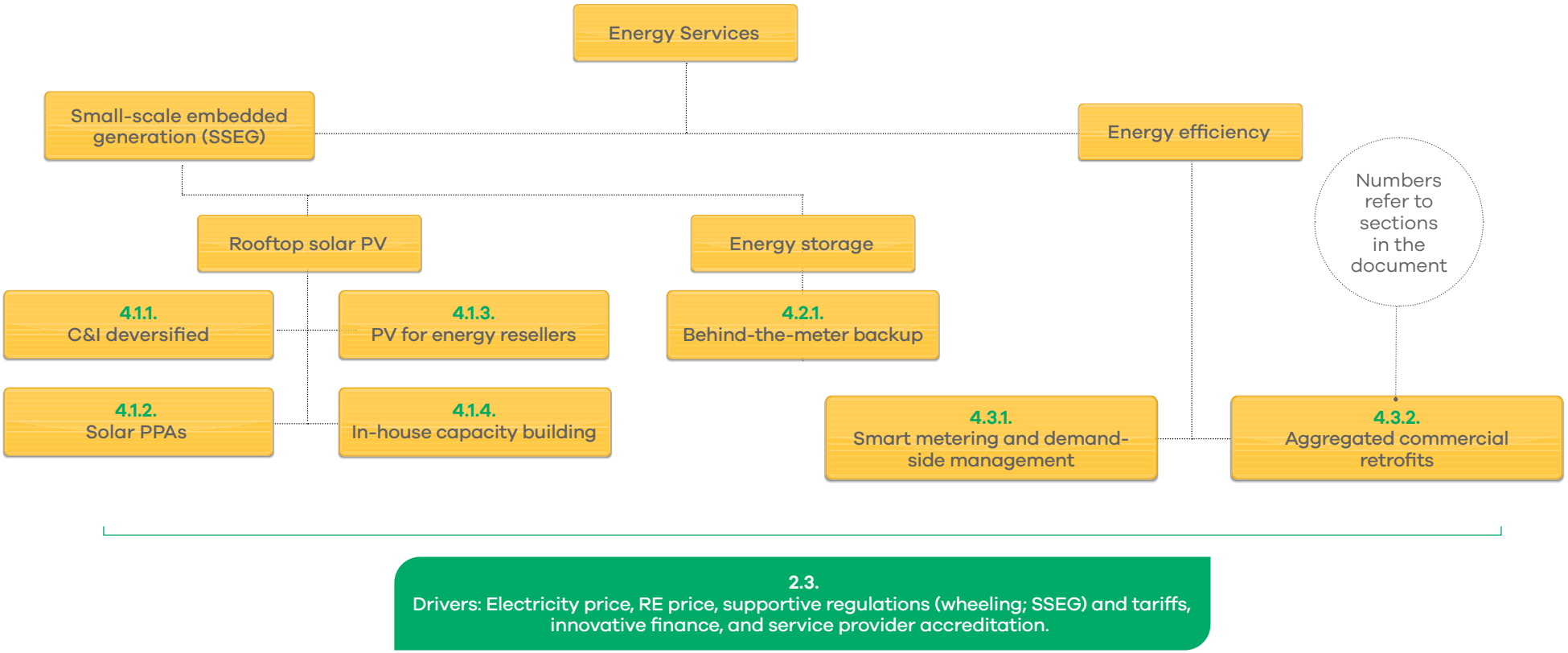
As detailed above, the South African electricity market is currently managed on a single operator model by Eskom, a state-owned entity. Eskom is responsible for generation and transmission, and also controls a minority share of the distribution market.

This single operator model is designed to support developing electricity markets in need of structured long-term infrastructure investments (with 10 to 15-year construction timelines), and diverse demand balancing of centralised generation facilities.

South Africa's dependence on this single operator model has decreased over the past 10 years with the introduction of new technologies, which are cheaper, capable of being decentralised, and more low-carbon. The growth of this decentralised market is evidenced by the evolution of the small-scale embedded generation and energy storage markets. Continual increases in the cost of traditional electricity supply have also led to improved demand efficiencies (energy efficiency).

The sections that follow detail the market context (small-scale embedded generation, energy storage, and energy efficiency), four major market drivers in the South African Energy Services market, and key players in the South African Energy Services market, as shown in Figure 3 below.

Figure 3: Energy Services sector overview



2.3. Energy Services market drivers

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

- rising energy prices;
- national energy insecurity;
- falling costs of renewable energy technologies such as rooftop solar PV;
- supportive energy policies and regulations by the local and national government; and
- energy financing programmes and incentives.

In turn, these developments, discussed in more detail below, create significant opportunities for energy services investors and businesses, in particular equipment suppliers, project developers, technical advisers, installers, and financial investors.

2.3.1. Rising electricity costs

Rapidly rising Eskom electricity prices have created a sizeable demand for viable alternative energy sources in South Africa.

Figure 4 compares Eskom price increases to the more conservative increase in South Africa's inflation rate as reflected by the consumer price ndex (CPI). The average standard Eskom tariffs have risen by almost 300% since 2007. Historical data from both Eskom (2019) and StatsSA (2019), shown in Figure 4, reveal that while inflation has almost doubled since 2009, Eskom prices have tripled over the same period.

Figure 4: Average Eskom tariff versus inflation (CPI) projected to 2022

Sources: Statistics South Africa (StatsSA) and Eskom (2019)

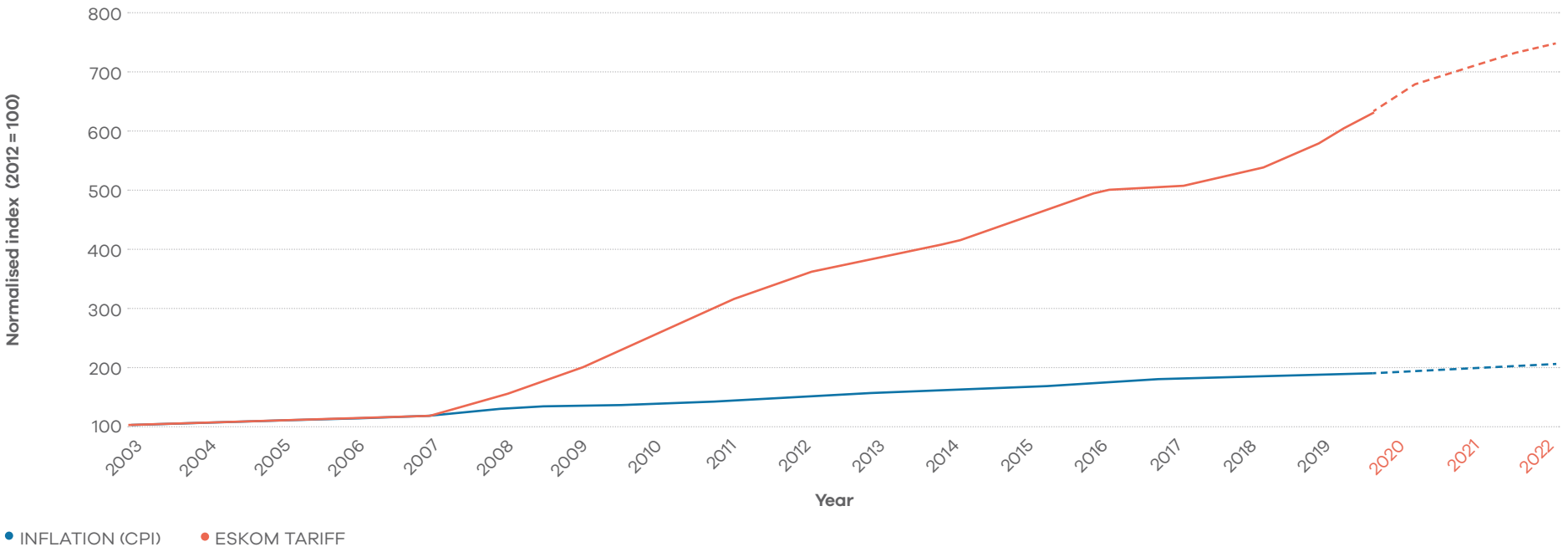


Table 1: Eskom price increases 2010-2020

Year	Average price increase (%)	Inflation (%)	Inflation-adjusted price (c/kWh)
2010	24.80	4.26	67.18
2011	25.20	4.99	80.45
2012	24.80	5.62	88.90
2013	16.00	5.76	90.25
2014	8.00	6.09	91.65
2015	8.00	4.58	94.30
2016	8.00	6.34	96.08
2017	8.20	5.27	99.23
2018	5.20	4.62	99.32
2019	13.90	4.13	108.79
2020	3.90	2.43*	116.72

Furthermore, as can be seen in Table 1, the National Energy Regulator of South Africa (NERSA) has approved an above CPI increase for Eskom for the past 10 years.

The average standard Eskom tariff will increase from 116.72 c/kWh to 128.24 c/kWh in 2021— an increase of 9.8%. This is on top of the 5.22% tariff increase the power utility has already negotiated for the same year, which will bring the total price hike to about 15%.

2.3.2. Falling costs of renewable energy technologies

Renewable energy technology prices have been dropping steadily since 2010. For example, the global average price for solar PV in 2018 was R1.22 kWh, down from R5.33 kWh in 2010 (IRENA 2019). It represents a ~77% drop in eight years.

The most significant decreases in average cost have been in solar PV and wind technologies. Figure 5 shows the levelised cost of electricity (LCOE) per renewable energy technology in South Africa's utility-scale Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)[1], and Eskom average tariff trajectory 2010-2020 (Rand/kWh).

[1] For more information on the REIPPPP, please see the GreenCape Utility Scale Renewable Energy Market Intelligence Report

Figure 5: Levelised cost of electricity (LCOE) per renewable energy technology in South Africa's utility-scale programme, and Eskom average tariff trajectory 2010-2020 (Rand/kWh)

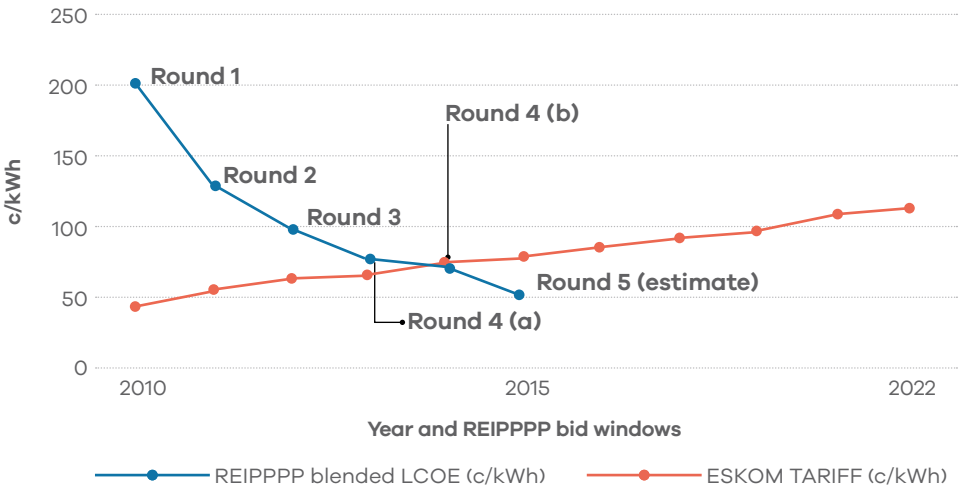


Figure 6: South African small-scale solar PV price in 2018-2022

This trend of falling technology prices is also present in the South African small-scale embedded generation (SSEG) market.

Currently, the South African SSEG market is dominated by rooftop solar PV, given the competitive price, technical maturity, and ease of implementation of this technology.

Figure 6 shows the trajectory of falling prices for small-scale solar PV installations from 2018 – 2020 (real) and 2021 — 2022 (estimates).

Technological maturaty, improved finance, reduced costs of metering, and professional sign-off will be the main drivers of cost reductions over the next two years.

In 2020, the small-scale solar PV levelised cost of energy is already less than R1 kWh, as seen in Table 2 below.

Table 2: South African solar PV price in 2020

System size (kWp)	Capital cost of the system (R/kWp)	PPA tariff (LCOE)
< 100 kWp	R12 000 – R15 000	0.90c – R1.20
< 500 kWp	R9 000 – R13 000	0.80c – R1.00
> 500 kWp	R8 000 – R12 000	0.60c – 0.90c

As these prices continue to drop across a variety of ES technologies, the financial case for investment into ES interventions improves.

This financial case is also supported by national energy insecurity, as it is expected that load shedding will continue for the next three to five years as new generation capacity is procured and brought into operation.

2.3.3. Supportive energy policies and regulations by local and national government

The regulatory environment has a direct impact on investment opportunities, market growth, and job creation. To lower demand on the national grid, and to reduce carbon emissions, the national government has put in place several energy policies and incentives to encourage energy-efficiency interventions and alternative energy generation.

Section 3 (legislation, regulation, and policy) and Section 5 (funding opportunities and incentives) discuss these in more detail. Regulatory developments as described in Section 3 facilitate the growing uptake of renewable energy options, particularly in the <1 MW space – from rooftop solar PV systems, and small-scale wind energy installations, to the uptake of bioenergy. Similar to the amendments to licensing regulations and guidelines from the Department of Mineral Resources and Energy (DMRE) and NERSA, changes in municipal regulation of SSEG installations have contributed to increasingly conducive market conditions for investors, project developers, equipment suppliers, and technical advisers. Three major changes are taking place on the local government level:

1. **The Department of Mineral Resources and Energy (DMRE) has approved the capacity for municipalities to buy electricity from independent power producers (IPPs)**. In the Amendment of Electricity Regulation Act 4 on New Generation Capacity gazetted by the DMRE, municipalities in good financial standing will now be allowed to formulate an energy plan that does not rely solely on the government-run Eskom. A specific ministerial determination, like the one that enabled the various IPP programmes, may still be needed to allow municipalities to purchase directly from IPPs. Currently, there is no precedent for this.

   However, the City of Cape Town (CCT) has requested such a determination[2], and Ekurhuleni municipality released a Request for Proposal (RFP) for IPP generation in the second half of 2016, followed by Buffalo City in 2019.

[2] The City of Cape Town has committed to purchasing ±520 MW of renewable energy over the next 15 years, with the majority of the other metro-municipalities also having committed to purchases of a similar scale.

More recently, Merafong municipality in October 2020 published an Expression of interest (EOI) for solar PV clusters. The success of such a programme would ultimately rest on a ministerial determination being made. Accordingly, the ongoing changes in legislation around generation licensing and own-use present opportunities for municipalities to increase their participation in the generation sector, and thus their energy autonomy.

2. **Increasing off-take agreement options under third party grid access regulations for small-scale embedded electricity generators**

a. Electricity wheeling[3], as allowed by the National Regulator and implemented by local municipalities, will allow generators to wheel their electricity to a willing buyer anywhere in the municipality or country. This is currently being implemented by City of Tshwane, Nelson Mandela Bay Metropolitan Municipality, the City of Cape Town, Stellenbosch, Drakenstein and Eskom.

b. The release of regulations that allow private sector energy trading[4] has opened the market to private sector power purchase agreements and on-sales to private consumers using the national and local distribution networks. There is currently only one licensed energy trader in South Africa, but there are numerous other entities currently applying to the National Energy Regulator of South Africa (NERSA) for trading licences. It is expected that in 2021 there will be multiple electricity traders operating in South Africa.

These new off-take options present an opportunity for high and medium voltage commercial and industrial customers with high energy bills, and buildings that currently are not able to install rooftop PV. The associated costs for making use of a local distribution utility network remain high (30 c/kWh – 90 c/kWh off-peak vs peak time).

In addition to enabling renewable energy technologies, the off-take options detailed above would provide a platform for municipalities to engage and retain customers. Through offering an additional avenue to prosumers[5], municipalities would propose a new service to electricity generators as well as consumers interested in procuring clean energy.

3. **The country-wide rollout of national small-scale embedded generation rules, regulations, and tariffs** to promote the safe and legal uptake of SSEG for own use[6].

[3] Wheeling is the transportation of electrical energy from a generator to a separate electrical load, by making use of municipal or Eskom grid infrastructure and power purchase agreements (PPAs).

[4] Electricity trading is the transportation of electrical energy from a generator to a separate electrical load, by making use of municipal or Eskom grid infrastructure and power purchase agreements (PPAs). The difference is that a private sector electricity trader or third party will purchase the electricity, pay the local municipality/Eskom to wheel it over their network, and sell it to a willing customer.

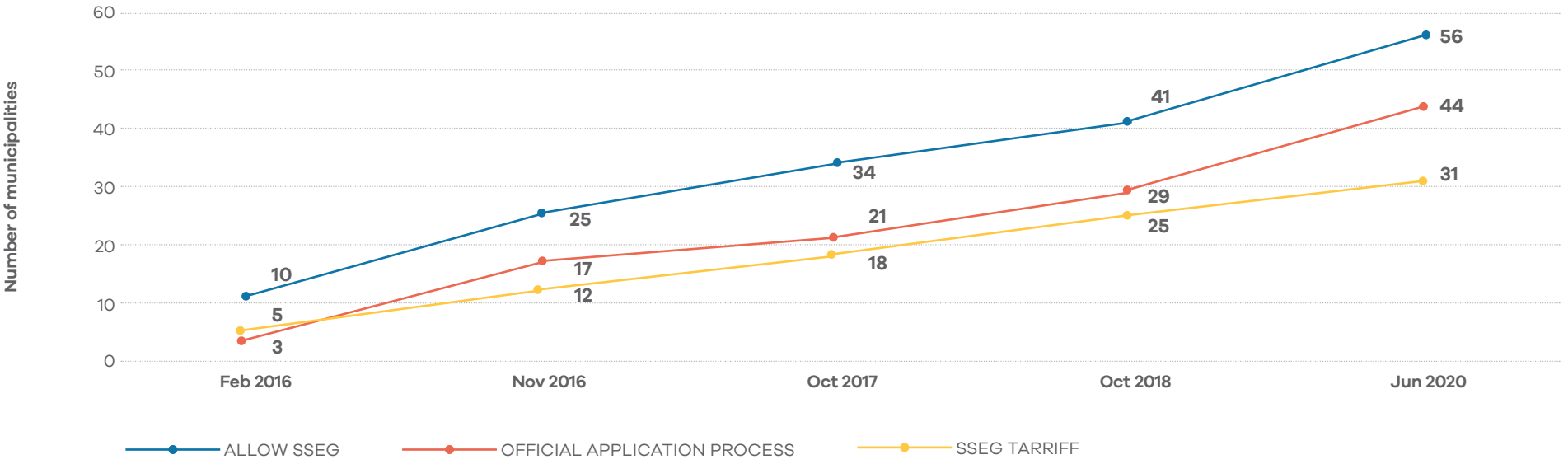
[5] A prosumer is an entity or person who produces and consumes a product, in this case electricity.

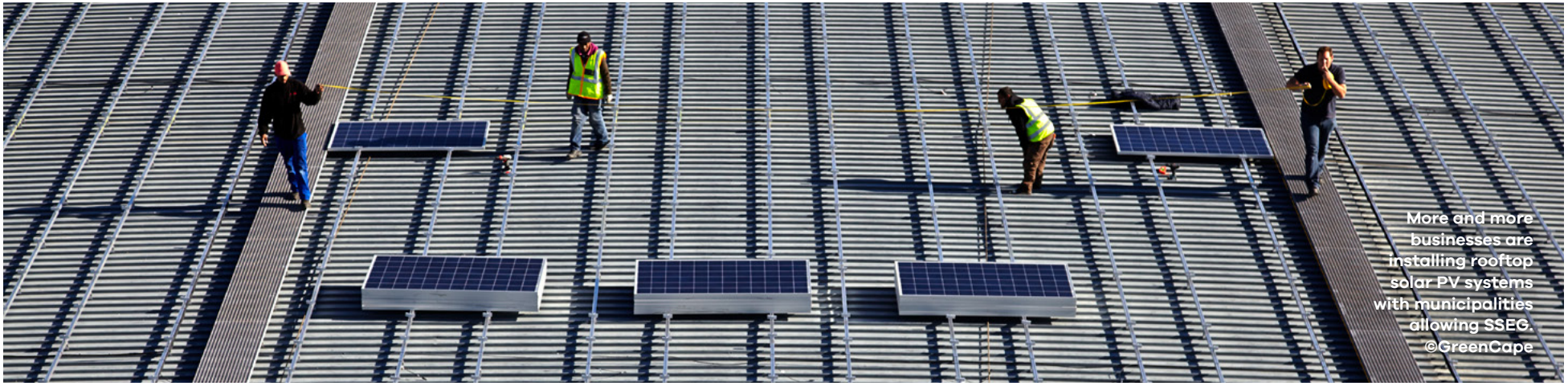
[6] The generation of electricity on the load site where it will also be consumed.

Figure 7 shows the upward trend of municipalities adopting SSEG processes from 2016 to 2020.

Figure 7: Uptake of SSEG processes in municipalities

Source: SALGA 2020





More and more businesses are installing rooftop solar PV systems with municipalities allowing SSEG. ©GreenCape

Table 3 represents the best level of information obtained by the South African Local Government Association (SALGA) on the uptake of SSEG processes in municipalities by October 2020. It gives a regional breakdown of municipalities that allow SSEG installations on their distribution network, those that have a formal application process, and those that have NERSA-approved SSEG tariffs. This allows them to credit customers for excess electricity exported onto their distribution networks. The table also shows the percentage of the national registered SSEG systems in each province.

Table 3: Provincial SSEG uptake summary

Source: SALGA 2020

Provinces	Number of municipal electricity distributors in the province	Number of municipalities allowing SSEG installations	Number of municipalities with official application processes	Number of municipalities with SSEG tariffs	Percentage of national registered SSEG systems
Eastern Cape	22	6	6	2	4
Free State	No data				
Gauteng	9	4	3	2	46
KwaZulu-Natal	25	3	2	1	13
Limpopo	16	6	5	1	1
Mpumalanga	14	4	4	3	6
Northern Cape	24	9	4	3	2
North West	13	2	2	0	6
Western Cape	25	24	18	19	23
TOTAL	165	58	44	31	–
% of licensed distributors:	38	28	20	–	–

Table 4 gives a more detailed overview of the municipalities that allow SSEG installations within their municipalities, either on a case-by-case basis or through an application process.

Table 4: List of municipalities allowing SSEG to connect to the grid

Source: SALGA 2020

Province	Municipality	Allow SSEG onto the network?	Have an official SSEG application process?	Have a NERSA approved SSEG tariff?
Eastern Cape	Buffalo City	Yes	Yes	Yes
	Dr Beyers Naude	Yes	Yes	No
	King Sabata Dalindyebo	Yes	Yes	No
	Kouga	Yes	Yes	No
	Makana	Yes	Yes	No
	Nelson Mandela Bay	Yes	Yes	Yes
Gauteng	Ekurhuleni	Yes	Yes	No
	Johannesburg	Yes	Yes	Yes
	Tshwane	Yes	Yes	Yes
	Rand West City	Yes	No	No
KZN	Umhlathuze	Yes	No	No
	eThekwini	Yes	Yes	Yes
	Greater Kokstad	Yes	Yes	No
Limpopo	Ba-Phalaborwa	Yes	Yes	No
	Elias Motswaledi	Yes	Yes	No
	Ephraim Mogale	Yes	Yes	Yes
	Greater Tzaneen	Yes	Yes	No
	Polokwane	Yes	Yes	No
	Thaba Chweu	Yes	No	No

Table 4: Continued...

Province	Municipality	Allow SSEG onto the network?	Have an official SSEG application process?	Have a NERSA approved SSEG tariff?
Mpumalanga	Mbombela	Yes	Yes	Yes
	Emalahleni	Yes	Yes	Yes
	Govan Mbeki	Yes	Yes	Yes
	Msukaligwa	Yes	Yes	No
Northern Cape	!Kheis Municipality	Yes	No	No
	Gamagara	Yes	Yes	Yes
	Hantam	Yes	No	No
	Kai!Garieb	Yes	No data	Yes
	Karoo Hoogland	Yes	Yes	No
	Nama Khoi	Yes	No	No
	Sol Plaatjie	Yes	No data	Yes
	Thembelihle	Yes	Yes	No
	Ubuntu	Yes	Yes	No
North West	Matlosana	Yes	Yes	No
	JB Marks	Yes	Yes	No

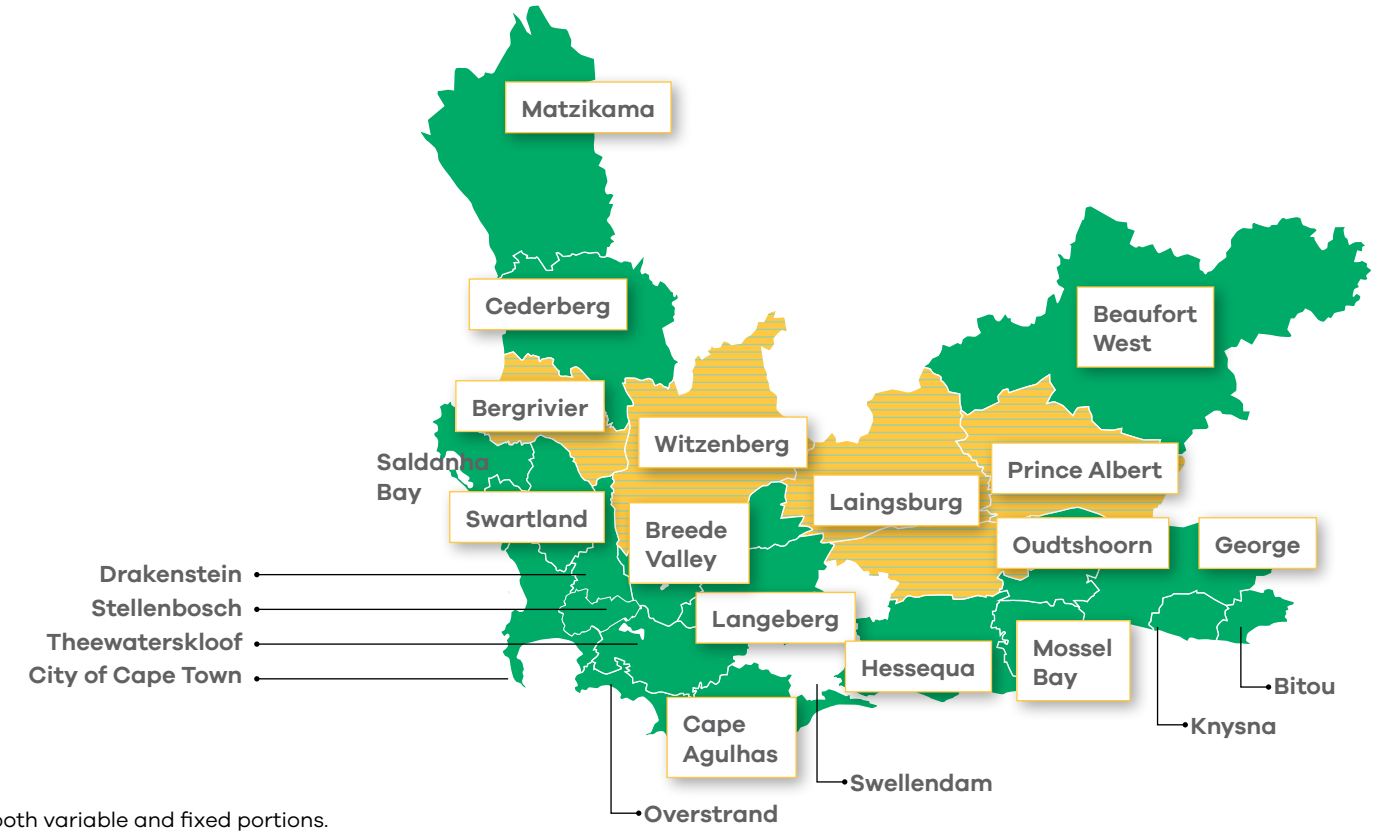
Figure 8 gives a more detailed overview of the Western Cape municipalities that allow SSEG installations within their municipalities, either on a case-by-case basis or through an application process. There is a large range of SSEG tariffs across the municipalities listed in Table 4 and Figure 8.

While the average tariff remains low, there is still a viable business case, built on the value of self-consumed electricity. Figure 9 below details the current feed-in tariffs across the municipalities in the Western Cape. There is currently no guarantee on the structure and cost of municipal consumption and feed-in tariffs from year to year.

Municipalities are moving tariffs to be more cost-reflective[7], with the bulk of their costs accounted for by energy time-of-use purchases from Eskom. Figure 10 below details the current fixed portion of Western Cape municipal SSEG tariffs.

In 2020 the City of Cape Town implemented a 25c/kWh SSEG feed-in tariff incentive above the existing feed-in tariff. This is available for a year for all new customers, and means the feed-in tariff would be as high as R1/kWh.

Figure 8: Western Cape municipalities allowing SSEG to connect to the grid



[7] Two part tariffs with both variable and fixed portions.

Figure 9: Western Cape municipal SSEG feed-in tariffs

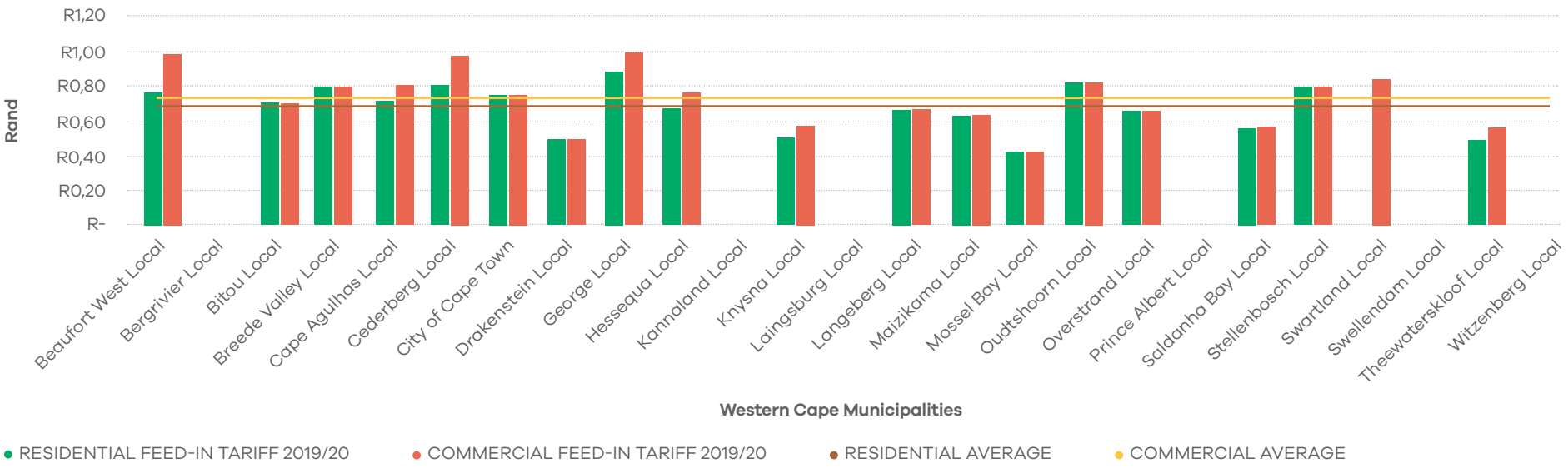
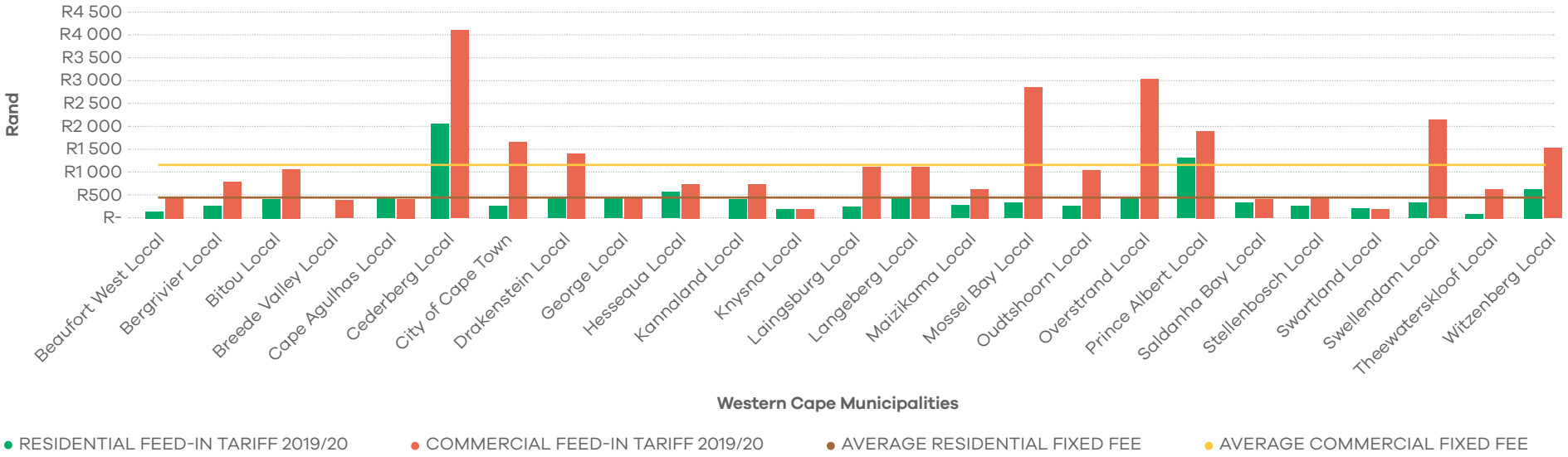


Figure 10: Western Cape municipal SSEG fixed tariff portion



Overall, these changes at municipal level complement legislative updates on a national level, e.g. the gazetted Integrated Resource Plan 2019, and future changes such as the unbundling of the national utility, Eskom. Together these changes herald a freer, more 'liberalised' electricity market, in which all stakeholders are empowered in their energy choices.

2.3.4. Energy finance – facilitating the right type of finance into the sector

The growth of the South African ES market is aided by "green" energy finance offerings that facilitate the tailored finance solutions for the energy sector. Several exciting finance mechanisms are being tested in the market.

- **Property assessed clean energy (PACE):** PACE is a financing mechanism that enables low-cost, long-term funding for energy efficiency, renewable energy, and water conservation (resource efficiency) projects installed by ESCos on properties. The investment is recovered as a portion of the monthly rates collected by the respective municipality.

- **Pay as You Save® (PAYS®):** PAYS® is an inclusive financing solution that allows all utility customers to access cost-effective energy efficiency upgrades and distributed renewable energy assets, regardless of income, credit history, or renter status (The Lab 2018). This is particularly important for financing programmes that aim to serve market segments that are hard to reach. Of the three mechanisms listed here, this is the least developed in South Africa.

CLICK HERE TO ACCESS THE PAYS INDUSTRY BRIEF

- **The Green Outcomes Fund:** The Green Outcomes Fund (GOF) is a first of its kind structure, which incentivises local South African fund managers to increase investment in green small-, medium- and micro-sized enterprises (SMMEs).

FOR MORE INFORMATION ON GOF, PLEASE VISIT THE GOF WEBSITE

Financing for SSEG, specifically rooftop solar PV, is underpinned by thousands of small contracts with consumers. Traditionally, commercial banks have favoured big solar/wind farms because they are generally based on contracts with investment-grade utilities and international companies. Only in the past two years have the majority of the commercial banks started to provide tailored mechanisms for rooftop solar PV investments.

Commercial and residential debt largely remains closely tied to strong individual credit scores and existing bank-customer relations. However, in 2017, the big five banks in South Africa started to focus on rooftop PV's unique financing needs, providing more targeted, patient, and affordable finance packages for commercial and residential solar PV. The inclusion of the commercial banking sector may reduce some opportunities for less traditional investors such as equity funds; however, it could unlock the SSEG opportunity for end-users and installers, engineering, procurement and construction contractors (EPCs), and ESCos by providing accessible and affordable financing.

Banks' offerings include mechanisms that cover 70% to 100% of capital costs with a five- to ten-year loan repayment. However, by making use of pre-selected EPCs and meticulous energy audits, banks ensure that financed projects are designed so that the customer's savings generated from the solar installation are greater than the loan repayments. This results in a positive cash flow.

2020 saw commercial banks' SSEG risk profiles improving, resulting in reduced finance costs. Commercial banks have seen significant growth of successful projects on their loan books with portfolios tripling in the past two years.

As a result, perceived risk is stabilising, and finance offerings are becoming more competitive. The commercial banks are also exploring new approaches to loan collateral. Whereas in the past security has been tied to the asset or balance sheet of the client, financiers increasingly prefer agreements which tie security to the property on which the asset is installed.

Amortising debt is still the most cost-competitive form of finance for invest-to-own scenarios. However, financiers have noted that PPAs, whilst more expensive, are growing for the following main reason — cash flow stability. A PPA provides a clear indication of electricity costs, and the client does not always want to own the system or take on the performance risk. This is especially true for large corporate clients.

ACCESS TO INNOVATIVE FINANCE INDUSTRY BRIEF

2.4. Key players

Figure 11 shows the Energy Services (ES) value chain and key players in the value chain, with the roles of specific actors outlined in Table 5.

The value chain is based on the stages of a generic energy intervention, showing the types of services or products provided by key players during an energy service provision. This represents a simplified view of the value chain. In practice, the roles of these actors often shift with relative fluidity. For example, the boundary between a project developer, Engineering, Procurement and Construction (EPC) company, and installer is often blurred, with players taking on different roles depending on the size, cost, ease of implementation, or other project-specific factors.

The green economy has the potential to create a wide range of decent jobs. ©GreenCape

Figure 11: Energy Services market value chain

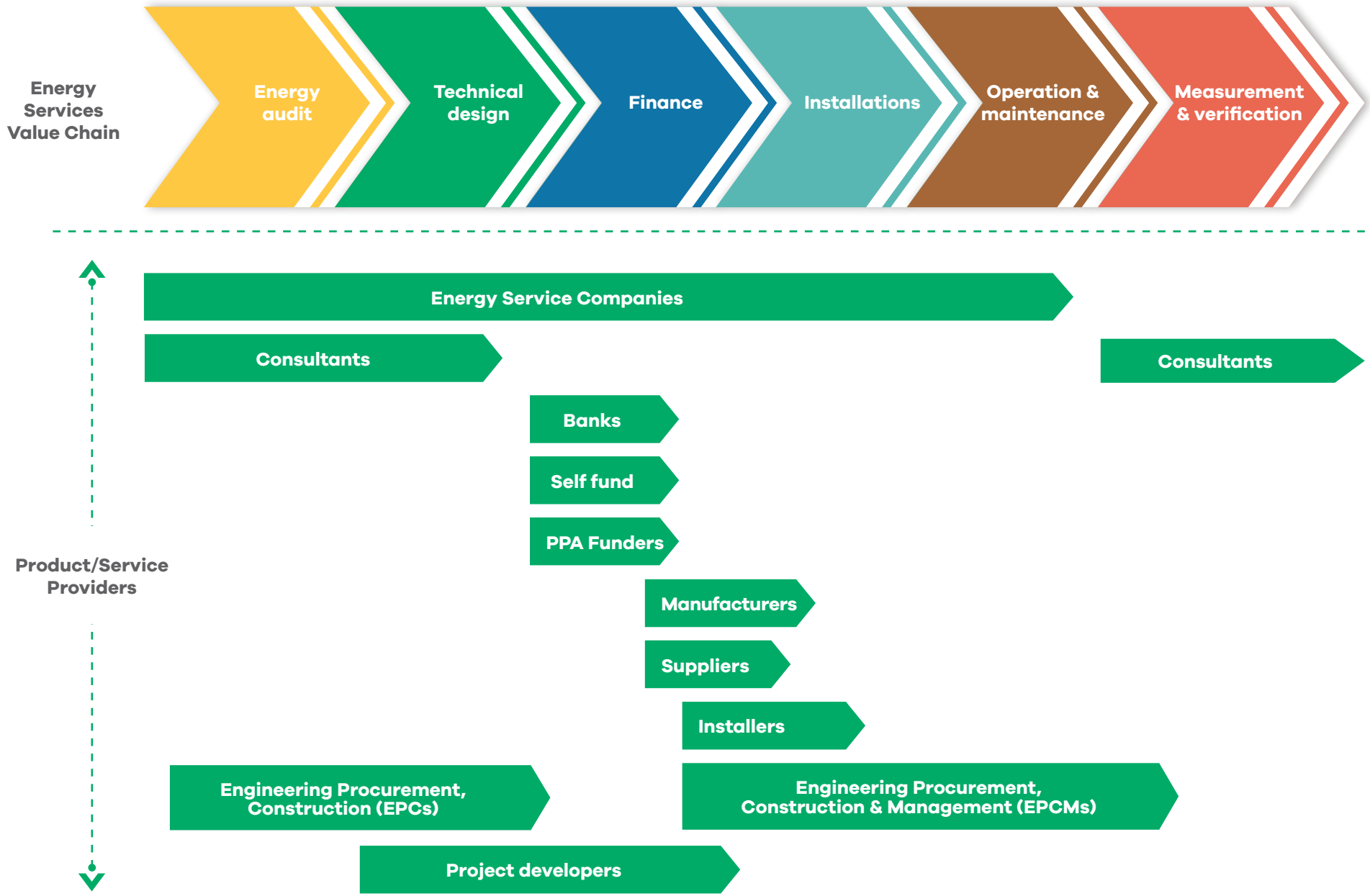


Table 5: Roles of key players in the Energy Services value chain

Key player	Role
Energy services companies (ESCos)	ESCos are active across the whole value chain, aside from measuring and validation, as independent consultants also perform this function. There are two generic ESCo-type energy contract models: • **Energy supply contracting** (ESC), which delivers units of energy. • **Energy performance contracting**, which provides energy savings determined by comparison to an established and agreed-upon baseline.
Consultants	Consultants include energy auditors, planning engineers, certified measurement and verification personnel (CMVP), accountants, and lawyers.
Financiers	Financiers provide funding and financing mechanisms to realise projects. • **Project finance** – commercial banks (commercial and asset funding), self-funded individuals (with cash reserves) and PPA financiers (such as private equity funds, debt facilities). • **Funding for ESCos** (not detailed in the diagram) – commercial banks, private equity funds, corporate foundations, private and family foundations, and venture capitalists.
Manufacturers and suppliers	Manufacturers and suppliers include technology suppliers or original equipment manufacturers (OEMs). They manufacture and supply equipment, and form part of typical energy efficiency or supply interventions.
Installers	Most energy service companies, EPCs and project developers make use of specialised installers for both energy efficiency and SSEG (technology specific).
Engineering, procurement and construction (EPC) company	EPCs design interventions, procure and install tailored turnkey energy efficiency and/or renewable energy solutions.
EPCM (Engineering, Procurement, Construction Management)	Under an EPCM contract, the owner maintains more control of the project. The contractor manages the construction project, but only under the direction of the owner. With an EPCM contract, the owner is responsible for hiring suppliers, construction workers and other contractors, and the EPCM contractor will manage these contractors.
Project developers	Project developers handle tasks that focus on moving the project along toward successful completion. In the ES value chain, they play more of a business development role as they focus on, for example, project design and procurement, but make use of specialised installers.

As with much of South Africa's green economy, the Energy Services value chain is dominated by small- and medium-sized enterprises (SMEs). As the market continues to develop, disruption will be a feature of this nascent economic sector. Adapting to this type of rapid growth is easier for SMEs, as pre-existing corporate structures and sunk investment do not hamper them. That said, their growth could be stifled by their inability to scale up or down fast enough to take advantage of opportunities.

2.5. Energy Services market size

Using the total available market for the small-scale embedded generation (solar rooftop PV systems) installed in the country, energy storage, and capital leveraged in energy efficiency interventions implemented by South African energy users, **South Africa's total available ES market is valued at ~R131 billion by 2035.**

The total available market is the total untapped demand for a product or service in the ES market. The total available market size detailed in this

Market Intelligence Report (MIR) represents an estimate of the ES market, based on only three of the currently dominant ES market components – small-scale embedded generation (solar PV[8]), energy storage, and energy efficiency. The estimate does not take into account smaller technology market segments that are also part of this market sector, such as small-scale wind energy, waste-to-energy, solar thermal, and diesel generators.

2.5.1. Small-scale embedded generation – rooftop solar photovoltaic (PV) market size

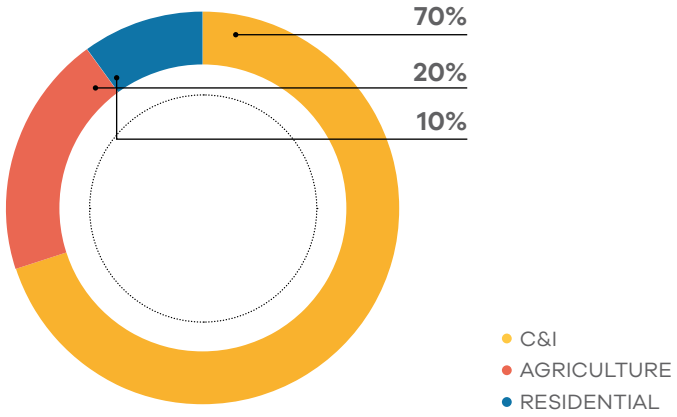
One of the major contributors to growth in the ES market has been the demand for rooftop solar PV. By the end of 2017, there was a total of 387 MW_p of installed solar PV rooftop systems throughout South Africa (CSIR, 2019). Estimations based on actual solar PV panel sales figures suggested that installed capacity in 2018 rose to ~600 MW_p (GreenCape analysis). In 2019, the market showed signs of growth, with the estimated total installed capacity rising to approximately 850 MW_p.

In 2020, the market continued to grow despite a short shock to revenues and loss of business development time as a result of the COVID-19 lockdown and extended load shedding. It is estimated that a total of 1.15 GWp of installed solar PV rooftop systems throughout South Africa with between 250 MW_p and 400 MW_p of rooftop solar PV have been installed in South Africa in the last 12 months.

The total annual available market could continue to grow at this rate to a saturation point of ~500 MW_p installed per year, reaching a total of 7.5 GW of installed capacity by 2035. According to GreenCape analysis, **at the cost of R10/W_p, this installed capacity growth represents a total available market of R5 billion a year, and a total available market of R75 billion by 2035.** The installation of an additional 500 MW_p translates to the potential creation of ~1 250 jobs per annum.

The commercial and industrial (Candi) sectors in South Africa continue to present the largest near-term opportunity for installations, with ~70% of the total verified systems installed in that sector. The reason for this is two-fold: Affordability and need. The Candi sector generally incurs higher electricity costs for being the highest energy users. The sector also has electricity use profiles that align well with solar PV generation times. Businesses in this sector also often operate from large premises with large roof spaces, which are attractive from an installation point of view. In 2020, the average size of an installation in the Candi sector is ~400 kW_p. The increase from 2019 is accounted for by the relative proportion of large rooftop projects delivered, and by an acceleration in licence approvals for >1MW systems.

Figure 12: Distribution of solar PV installations across end-user segments in South Africa (GreenCape analysis)



[8] Currently, the South African small-scale embedded generation (SSEG) market is dominated by rooftop solar PV, given the competitive price, technical maturity, and ease of implementation of this technology.

2.5.2. Energy storage market size

Developments such as battery storage options are emerging as the latest trends that will influence the ES market in the next five to ten years. Similar to the growth in the renewable energy market, growth in this space is driven by rising electricity costs, increased financial returns from storage investments, and growing awareness of the impact of carbon emissions. According to Wood Mackenzie 2020 analysis, despite a slowdown in price reductions, the global energy storage market is set to grow from around 4 GW of annual deployments in 2019 to more than 15 GW per annum in 2024.

These trends are reflected in the South African ES market, but the applications and related value streams of storage are only just beginning to be understood locally. Beyond a handful of private customers that have invested in battery technology to ensure energy security for their operations, the price is not yet right for behind-the-meter (BTM) application. However, energy storage is expected to become the keystone of the future SSEG market.

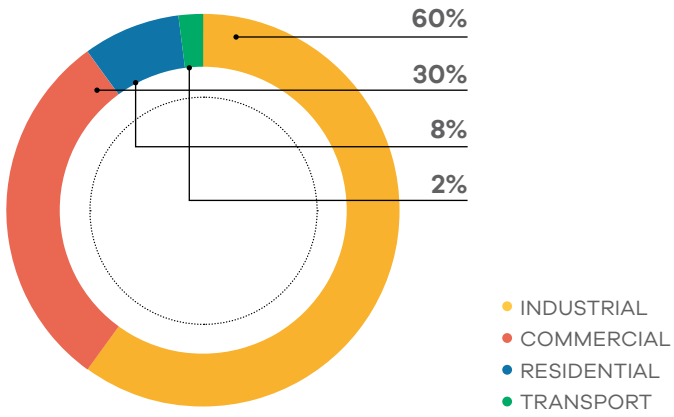
Assuming that 5% of the current installed rooftop solar PV market has installed BTM energy storage to combat load shedding (approximately four hours of back-up storage required) and the average cost of lithium-ion batteries as detailed in section 4, **the current market ranges between R1.2 billion and R2 billion.**

The potential market will depend on the growth of the solar PV market. Assuming that by **2035, 30% of the annually installed solar PV systems have installed behind-the-meter energy storage, the South African market would be approximately R31 billion, with 6.5 GWh installed energy capacity.**

2.5.3. Energy efficiency market size

Energy Services companies (ESCos) are those companies that offer innovative financial models for energy efficiency projects based on the achievable energy savings. In South Africa, the industrial and commercial sectors are most attractive to ESCos, as can be seen in Figure 13.

Figure 13: ESCos market for energy efficiency in South Africa (GreenCape analysis)



On average, energy efficiency projects in South Africa are relatively small. The average capital cost of a South African ESCo project is under R2 850 000. Commercial financing for these projects has improved in the past two years. Bundling of projects is still a common strategy, which creates a more attractive investment pipeline.

Although average project sizes in South Africa remain small, energy savings remain significant. This is reflected in the findings of the National Business Initiative (NBI) through its now discontinued Private Sector Energy Efficiency (PSEE) programme. This programme identified and facilitated the implementation of a sizeable set of energy-efficiency opportunities in the private commercial sector between 2013 and 2015, as shown in Table 6.

Table 6: Total energy-saving opportunities and capital leveraged for small and large businesses identified by the PSEE programme

Source: Adapted from NBI (2016)

Type	Identified	Implemented	Remaining opportunity	Percentage still to be realised
Number of sites	1 103	336	767	70
Number of opportunities	6 921	796	6 125	88
Annual energy savings	2 087 GWh	129 GWh	1 958 GWh	94
Lifetime energy savings	21 896 GWh	646 GWh	21 250 GWh	97
Lifetime carbon savings	449 $MTCO_2e$	17 $MTCO_2e$	432 $MTCO_2e$	96
Capital leveraged	R3.5 billion	R69.5 million	R3.4 billion	98
Average payback of opportunities	2.3 years	0.9 years	–	–
Annual energy usage	5 861 GWh	362 GWh	–	–

The capital leveraged in the PSEE programme is R69.5 million, which has resulted in 646 GWh of lifetime energy savings (R0.10/kWh). Given that the data in Table 6 represents a sample of energy end-users and the number of opportunities within the sample that have gone untapped, there is a significant opportunity for further energy efficiency interventions across a wider array of economic sectors and businesses. This suggests substantial market opportunities for Energy Services market players.

Compared to the annual electricity consumption in South Africa, the 2 087 GWh potential annual savings identified through the PSEE programme represents only a small fraction of the potential energy efficiency market. The International Energy Agency (IEA) (2019) calculated South Africa's annual energy use to be ~830 TWh in 2018, with electricity making up ~229 TWh of this total (Figure 14).

Figure 14: Energy consumption in South Africa by source (TWh)

Source: International Energy Agency (2019)

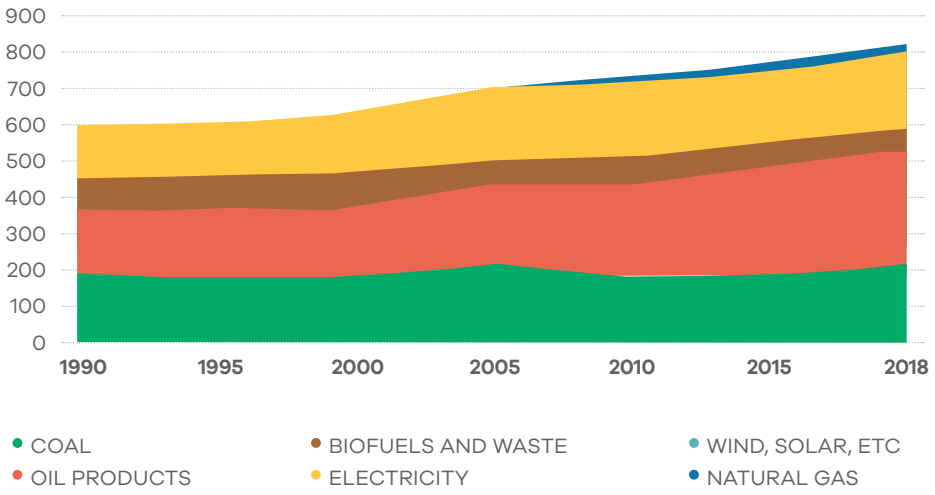
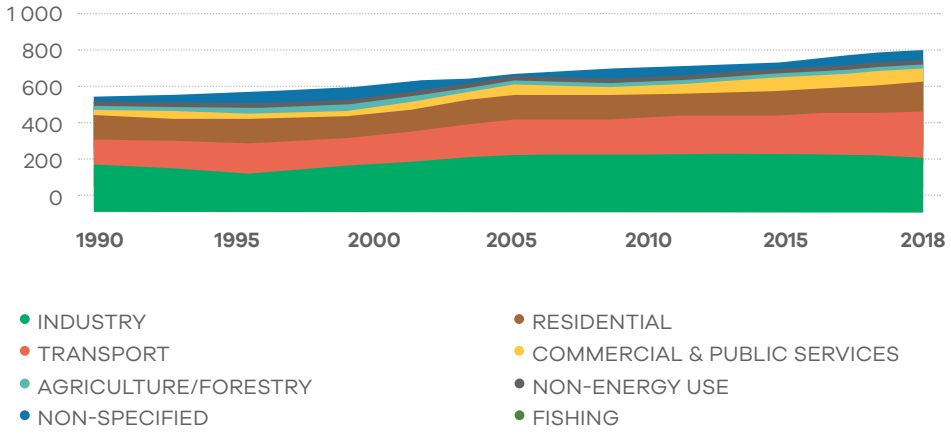
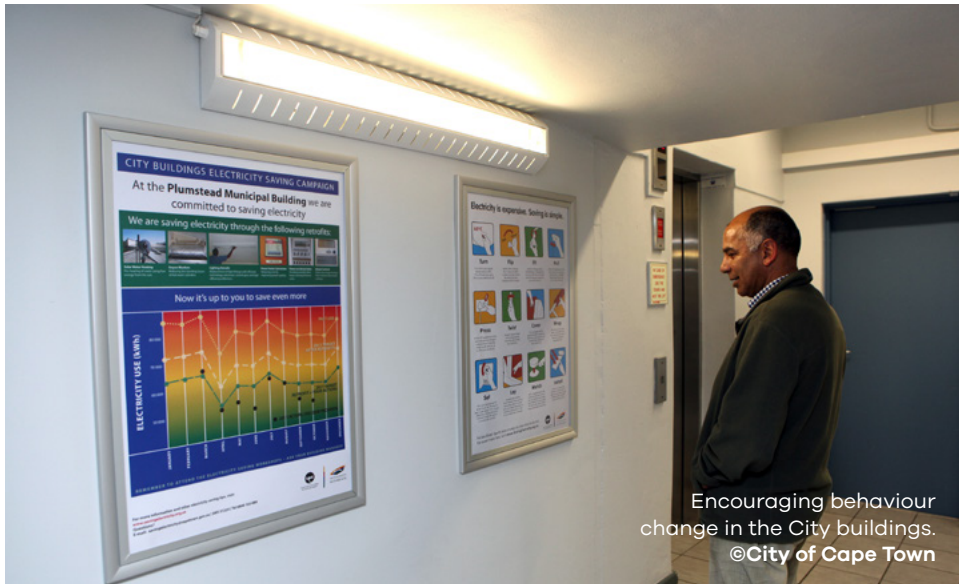


Figure 15: Energy consumption in South Africa by sector (TWh)

Source: International Energy Agency (2019)





Encouraging behaviour change in the City buildings. ©City of Cape Town

Conservatively assumed, annual energy savings of 15% of total electricity consumption are possible (the PSEE programme findings show 20% to 35%). In that case, potential energy efficiency savings could be as much as 34 TWh. **At a conservative rate of R0.10/kWh, the estimated annual total available market is R3.4 billion.** GreenCape's most recent market evaluation suggests the total available market size could reach ~ R25 billion by 2035.

Industry is the largest consumer of energy, with direct use of coal and coal-based electricity being the major energy sources, as shown in Figure 15 (IEA 2019). Now in its second phase, the South African Industrial Energy Efficiency (IEE) Project is a multi-stakeholder initiative. The IEE Project supports increased and sustained energy efficiency within industrial and selected commercial sectors by promoting the increased adoption of Energy Management Systems (EnMS), Energy Systems Optimisation (ESO), and the ISO 50001 series.

The IEE Project was launched in 2010 to assist industrial companies around the country to save energy and money, improve effectiveness, and demonstrate the positive impact of energy management on GHG emissions. The concept was developed by the United Nations Industrial Development Organization (UNIDO). The primary national implementer was the National Cleaner Production Centre South Africa (NCPC-SA), a programme funded by the Department of Trade, Industry and Competition (dti) and managed by the Council for Scientific and Industrial Research (CSIR).

To date 6.5 TWh of cumulative energy savings in participating companies have been achieved, which is equivalent to the electricity required to power 900 000 middle-income SA homes for 12 months, or five years of load shedding (at the 2019 level of 1.352 TWh).

It has also resulted in R5.3 billion cumulative cost avoidance in these companies.

POLICY, LEGISLATION, AND GOVERNANCE

Several acts, regulations, and policies guide the development of the electricity sector, with the main guiding document being the Integrated Resource Plan (IRP) 2019.

Energy distribution.
©Pxhere

3.1. Governance

National and local government collaboration with several relevant industry bodies guides the development of the Energy Services (ES) sector in South Africa.

3.1.1. National government

Several government departments and institutions guide the development of the ES sector:

- **The Department of Mineral Resources and Energy (DMRE)** is the custodian of all energy policies and energy security in South Africa.
- **The Department of Public Enterprises (DPE)** is responsible for the country's energy infrastructure, primarily through its responsibility for state-owned entities such as Eskom.
- **Eskom** is the state-owned energy utility. It owns most of the electricity generation, transmission, and distribution infrastructure. As such, it is an essential player in the electricity sector, especially as a delivery vehicle for numerous government programmes.
- **South African National Energy Development Institute (SANEDI)** is responsible for achieving the objectives of the National Energy Efficiency Strategy (NEES), the main strategy guiding the uptake of energy efficiency projects in South Africa. SANEDI's primary function is to direct, monitor and conduct applied-energy research, development, demonstration, and deployment. It also has to undertake specific measures to promote the uptake of green energy and energy efficiency in South Africa.
- **The National Energy Regulator of South Africa (NERSA)** regulates the electricity sector, with the Department of Mineral Resources and Energy as the custodian department. NERSA's main energy services related responsibilities are licensing and registrations; pricing and tariffs; promoting competition; compliance monitoring; and dispute resolution.

3.1.2. Local government

- **Local (municipal) government** is the arm of government closest to the end-users. Municipalities are responsible for a large portion of electricity distribution in the country.

3.1.3. Industry bodies

- **South African Biogas Industry Association (SABIA)** is a not-for-profit organisation that recognises the potential market for biogas and the need for representation of the industry. It facilitates network and information exchange between experts on advancing the field.
- **South African Energy Storage Association (SAESA)** is a not-for-profit organisation that aims to guide policy to allow for the accessibility of storage projects, as well as to advocate and advance the energy storage industry in SA.
- **South African Photovoltaic Industry Association (SAPVIA)** is a not-for-profit organisation that represents the solar PV industry in South Africa. It aims to ensure that solar PV is the generation technology of choice in South Africa and the rest of Sub-Saharan Africa, in support of the country's socio-economic development targets.
- **South African Wind Energy Association (SAWEA)** is a not-for-profit, member-driven association that aims to enable a commercial wind power industry in South Africa.

3.2. Legislation and regulation

Electricity Regulation Act 4 of 2006 as amended by the Electricity Regulation Amendment Act 28 of 2007 (ERA). These regulations guide the issuance of licences for generators and transmitters, wheelers, and distributors of electricity.

The amendment of Schedule 2 of the Electricity Regulation Act 2006, gazetted on26 March 2020, is a critical legislative document for SSEG in South Africa. It specifies the conditions for SSEG licence exemption and registration with NERSA.

Key requirements for different generator capacities are summarised on the next page:

- SSEG with a capacity of between 100kW and 1 MW requires registration with Nersa but does not need to be part of a ministerial determination, and does not require a generating licence.
- SSEG with a capacity greater than 1 MW but less than 10 MW needs to be licensed but does not need to be part of a ministerial determination.
- Generation plant with a capacity >10 MW needs to be licensed and be part of a ministerial determination and national procurement.

All generation connected to the grid needs to be registered with the relevant transmission/distribution grid operator.

Schedule 2 also specifies that SSEG power may be wheeled across the network, but only to 'related customers'. In such circumstances, a connection agreement must be in place with the distributor. NERSA has specified the process for registering SSEG systems (NERSA 2018).

It is currently working on the development of SSEG Regulatory Rules, which will likely clarify SSEG application processes and tariffs, amongst other areas. A breakdown of these requirements can be found in the table below.

Table 7: Licensing and registration for different SSEG system sizes

		<100kW	100kW-1MW	1MW-10MW	>10MW
NERSA	Registration	NO[10]	YES	YES	YES
	Licensing	NO	NO	YES	YES
Municipality/Eskom	Application for connection	YES	YES	YES	YES[11]

National Energy Act 34 of 2008: The National Energy Act was promulgated to ensure that diverse energy resources are available to the South African economy in sustainable quantities and at affordable prices in support of economic growth and poverty alleviation. The Act takes into account environmental management requirements and interactions among economic sectors. It provides for the development of the Integrated Energy Plan (IEP) and the formation of the South African National Energy Development Institute (SANEDI).

National Energy Efficiency Strategy (NEES) 2005, 2008, post-2015: The aim of the original NEES (2005) was 'to explore the potential for improved energy utilisation through reducing the nation's energy intensity

[9] For this to be true, there has to be an existing point of connection, the local distribution utility must keep a register of such installations, and the local distribution utility must prescribe the conditions for connection.

[10] If not accounted for in the Integrated Resource Plan (IRP), a deviation from the IRP may be required.

(thus reducing greenhouse gas emissions), and decoupling economic growth from energy demand' (Modise 2013) by achieving overall sectoral energy intensity reduction targets of 12% by 2015. In 2008 and 2011, the NEES was reviewed to discuss its scope and elements. The post-2015 National Energy Efficiency Strategy, which is yet to be finalised *CER(2017), is based on 25 policy recommendations within seven priority areas developed by the International Energy Agency (IEA 2014):

- cross-sectoral
- buildings
- appliances and equipment
- lighting
- transport
- industry
- energy utilities.

This updated strategy document will build on the original NEES. It is framed to complement the policies and strategies put forward by other national departments. The draft document was published for public comment in December 2016 but has not yet been finalised.

Energy mandatory reporting 2015: As part of the DMRE's Energy Efficient Monitoring System (EEMS) to track efficient consumption of energy within South Africa and the trends involved, it is mandatory for all energy users consuming more than 180 TJ per year to submit their energy consumption data to the DMRE. Companies using 400 TJ or more per year are required to submit a detailed energy management plan. The reporting requirement applies to all forms of energy.

The Carbon Tax Act, No 15 of 2019, was gazetted in May 2019 and came into effect on 01 June 2019. The carbon tax will be applied over two phases: Phase 1 will be from 01 June 2019 to 31 December 2022, and phase 2 will be from 2023 to 2030. In Phase 1, it will not have an impact on electricity prices. The rate of the carbon tax will be imposed at an amount of R120 per tonne of carbon dioxide equivalent (tCO2e) emitted. However, taking the tax-free thresholds into account, this rate will range closer to R6 and R48 per tCO2e. This rate will increase by CPI +2% per year until 31 December 2022. The Act has assumed a 'polluter pays principle' to the tax.

This relatively low tax rate and range of tax-free allowances in Phase 1 are designed to incentivise large emitters to transit to a low carbon profile before Phase 2. Once the results of the tax have been reviewed at the end of Phase 1, changes to rates and tax-free thresholds will be applied before the next phase begins. This would especially affect businesses with high fuel and electricity consumption. The impact of the carbon tax on the uptake of solar and other renewable forms of energy (which present a great case for carbon offsetting) is still to be determined and will be monitored.

3.3. Policy and white papers

White Paper on Energy Policy of 1998: This paper identifies the need for energy demand-side management and the promotion of energy efficiency in South Africa. Appropriate and supportive energy policies are required to attain the energy efficiency and conservation targets embodied in the Integrated Resource Plan (IRP) framework.

The white paper effectively supports the DMRE's mandate to ensure secure and sustainable provision of energy for socio-economic development by suggesting that it pursue energy efficiency programmes as one of the lowest cost options for reducing energy consumption.

Integrated Energy Plan (IEP) 2016: The IEP guides the country's broader energy needs. The IEP was developed in terms of the National Energy Act of 2008. The plan seeks to ensure diversity of energy supply as well as security by combining the objectives of the country's climate change, energy supply, and energy demand plans and aspirations. The IEP was released for public comment between November 2016 and March 2017, and an updated energy plan is yet to be published at the time of writing. The primary difference between the IEP and the Integrated Resource Plan (IRP) is that the IRP's focus is on electricity, its supply, and NERSA's ability to grant licences. At the same time, the IEP considers the whole energy sector and the implication of different prices.

Integrated Resource Plan (IRP) 2019: First promulgated in 2011, the IRP guides electricity provision in South Africa. Its custodian is the DMRE. The IRP, a living document that the DMRE is to update every two years, is developed in the context of the IEP. The IRP provides 1) an overall plan indicating the quantities of various electricity sources to meet the country's electricity demand in the next 20 years (the typical planning horizon); and 2) guidance for future energy infrastructure investments. Thus it largely determines the country's generation mix. After several iterations and a long wait, the IRP 2019 was gazetted in October 2019.

SEM retrofit installations.
©City of Cape Town

EMERGING OPPORTUNITIES, DRIVERS, AND BARRIERS

The evolving South African energy landscape creates opportunities for investors, financiers, project developers, component manufacturers, and suppliers in the embedded generation and energy efficiency markets.

A green revolution: Opportunities in the renewable energy sector.
©Pxhere

The following emerging opportunities have been identified through engagement with an array of Energy Services and green economy stakeholders.

Each opportunity is outlined in greater detail in the subsections below. A brief overview is provided in **Table 8**.

Table 8: Emerging Energy Services opportunities

Energy Services sector	Emerging opportunities in 2021
Small-scale embedded generation	• **Rooftop PV model diversification for the commercial and industrial (CandI) sectors:** A strong business case is driving increasing maturity, concentration and competition in the market. Developers are hence extending the types of offerings provided, such as O&M-only contract rebuys and system bundling. This provides attractive alternative access to the market for new entrants and smaller players. • **Solar Power Purchase Agreements (PPAs):** Although access to finance has improved with commercial banks having developed dedicated solar portfolios and finance mechanisms, corporate and capital-constrained customers are opting to transfer the performance and investment risk onto the service provider, whilstensuring a long-term fixed reduced tariff. There is significant opportunity in partnering with engineering, procurement, and construction companies (EPCs) to back the investment in meeting this demand. • **Solar PV for Energy Resellers:** In traditional resale, property development owners (residential estates or shopping malls, for example) can benefit from bulk electricity discounted from municipalities, and sell it to their tenants at the retail rate instead of the potentially less preferential individual unit tariffs. Similarly, the property developer can install a solar PV system, benefiting from a reduced power purchase agreement rate. The developer can then 'on-sell' the electricity generated by the PV system to tenants at a rate equivalent to the higher residential or commercial tariff, depending on the development. • **In-house capacity building:** Property development owners who have identified the significant potential for rooftop PV across their available portfolio are entering the market by developing in-house delivery capacity. This allows them to circumvent contractual arrangements with EPCs and reduce project costs. The growth potential of this opportunity is highly attractive for early-funding partners who can assist in backing such projects.
Energy storage	• **Behind-the-meter (BTM) battery storage back-up and UPS:** The need for energy independence and resilience in light of on-going load shedding is driving demand in back-up power and UPS applications, particularly in commercial, industrial, and agricultural applications where the opportunity costs of energy insecurity are high. This opportunity is still small due to the prohibitive cost of batteries, though it is expected to grow significantly as Li-ion prices continue to decrease over the next 5-10 years. For more information on promising storage applications in electric mobility and agriculture, refer to the 2020 Electric Vehicles MIR and Sustainable Agricultural MIR respectively.
Energy efficiency	• **Smart metering and demand-side management:** Development in smart metering technologies, and increasing awareness of the opportunity to both reduce commercial and residential electricity bills and improve revenue collection, are resulting in growing penetration over standard prepaid meters in municipalities. • **Aggregated interventions for commercial new builds and retrofits:** The end of the Private Sector Energy Efficiency (PSEE) programme in 2015, growth of the rooftop PV market, and tight margins against operational and contracting costs have led to a decline in small-scale energy-efficiency market participation, despite this being an attractive intervention for consumers. There has, however, been a resurgence in centralised solutions for medium to large commercial buildings, particularly in water heating, which allows the opportunity to aggregate benefits and project return.

4.1. Small-scale embedded generation

The following section details emerging opportunities in the small-scale embedded generation (SSEG) market, the drivers of these opportunities, and the relevant barriers.

4.1.1. Candi rooftop PV diversification

The strong business case for rooftop PV in the commercial and industrial (Candi) sector continues to drive high levels of competition. As a result, several large market leaders have emerged based on well-developed track records of high-quality service delivery for projects >150kWp. Due to relatively tight margins, it is expected that the market will continue to concentrate in this manner. A concurrent emerging trend is the development of various marketplace services to assist users in evaluating and comparing competitive tender bids.

This helps to avoid situations where the lowest price PPA is selected without an awareness of the potential trade-offs in design quality.

Additionally, this competitive and crowded landscape has led many small- and medium-sized enterprises (SMEs), EPCs, and ESCos to differentiate themselves by either focusing on <150kWp projects or by branching out into niche sections of the value chain.

These include:

- **Standardised contracting of projects in the portfolio**, as well as the use of commercially available off-the-shelf (COTS)[11] systems, which can help project developers reduce the transactional costs of each project. The off-taker, technology, and commercial risks can be spread across the portfolio. This unlocks improved market lending rates for the end consumer, and stimulate an untapped section of the market.
- **Bundling smaller rooftop PV projects together to reach a scale where they become attractive to investors.** This "bundling" can either take place before projects are built as a pipeline strategy, or be a refinancing driver post construction.
- **Partnering with or taking over the O&M contracts of EPCs who prefer to finance and focus on the earlier stages of the project.** This also creates an opportunity for foreign EPCs who want to establish a footprint in South Africa, but do not have a local office or labour force. These EPCs can partner with local EPCs post installation to continue doing the O&M in their name and carry their brand. Already, it has been observed that EPCs and ESCos are forming strategic joint venture agreements to best grow their businesses, both within the country and internationally.

  Considering that O&M contracts typically get renewed every two to five years (dependent on the project), this creates considerable opportunities for the next 5 to 10 years.

The opportunity for businesses and investors lies in partnering as finance hubs for EPCs who are emerging and gaining penetration on the large players, or by entering the market and targeting one of the niches.

[11] Commercially available off-the-shelf (COTS) systems are pre-packaged solutions, which are then adapted to satisfy the needs of the customer, rather than the commissioning of custom-made, or bespoke, solutions.

Table 9: Barriers and drivers of the Candi rooftop PV diversification opportunity

Drivers	Barriers
• **Smaller rooftop PV projects are bundled together** to reach a scale where they become attractive to larger investors	• Competitive tenders can lead to cost-cutting and **installation of poorly designed, sub-par systems.** Partially mitigated by PV green card, but poor quality is still a risk, particularly in smaller projects
• **Renewal of O&M contracts** after 2-5 years (project dependent)	• **Regulatory certainty** as the sector is still adapting to the most recent developments in municipal processes, system registration, and the granting of >1MW generation licences
• Creates **a market entry pathway for international project developers, investors,** and smaller players.	–
• **Access to finance** has been unlocked with commercial banks dedicating specific portfolios to supporting small-scale embedded generation projects	–

Table 10: Barriers and drivers of the Solar PPAs opportunity

Drivers	Barriers
• **Energy user does not need to raise upfront capital.** This became a larger factor with the COVID-19 lockdown and economic contraction leading to businesses being conservative with their balance sheets	• Offered at a **premium in comparison to a buy-own model** which can be supported by competitive and accessible loans from commercial banks
• Fixed tariff rates ensure **energy cost stability** over the future long term against rising Eskom tariffs	• Complexity in **negotiating PPA contracts** as these agreements are still relatively new. The energy user may not always be in the best position to counter effectively due to a lack in required legal, technical and/or financial capacity
• **Transfer of performance and maintenance risk** to the installer who is incentivised to employ technical expertise in ensuring optimum O&M	• **Customer confidence remains limited**, based on the maturity of the industry. Customers are still concerned about signing 20-year PPAs if they are unsure as to the longevity of the industry (i.e. will the company be around in five years)
• **The option of system buy-back** can sometimes be negotiated at a later stage, depending on the contract. This is useful for scenarios where the company may foresee its balance sheet being in a stronger position at a future date to take on the asset, but still wants to reap the benefit of reduced tariff in the present	–

4.1.2. Solar Power Purchase Agreements:

A Power Purchase Agreement (PPA) is a contract between a generator of electricity and buyer to purchase electricity (whether physically or notionally) at a pre-agreed price for a pre-agreed period. In this arrangement, the generator maintains ownership of the asset and ensures optimum performance and maintenance, recovering the cost at a premium in the provided tariff. In 2020, the COVID-19 economic lockdown increased prevalence of PPAs as businesses were forced to take a more conservative approach with their balance sheets. **It is estimated that PPAs now account for 30-40% of new Candi rooftop PV projects.** This will continue to increase as customer confidence grows.

4.1.3 PV for energy resellers

Residential, commercial, and industrial property development owners can function as energy resellers. The development pays a bulk electricity supply rate to the municipality, and 'on sells' the electricity to tenants at a higher rate (either residential or commercial, depending on the development)[12]. According to the NERSA Guidelines on Electricity Resale ("the Reseller Guidelines") that were published in 2016 in terms of the Electricity Regulation Act 4 of 2006, the reseller is only permitted to recover the difference between the reseller's tariff and the applicable "end-user" tariff.

With the Eskom electricity price continuing to increase (see section 4.3.1) and the price of renewable energy decreasing (see section 4.3.2), a point of grid parity[13] has been reached.

This has created a new opportunity for energy resellers to explore large-scale solar PV developments.

A similar model, as described above for traditional energy resale, can be used for the deployment of a communal rooftop solar PV system to service tenants within a development. The property developer installs a larger commercial-sized solar PV system benefiting from a reduced power purchase agreement rate (± R0.90), given the scale of the installation (see section 4.3.2). The property developer can then 'on-sell' the electricity generated by the PV system to tenants at a rate equivalent to either the local residential (± R2) or commercial (± R1.20) tariff, depending on the development. The difference between the reseller PPA rate and the tenant tariff presents an opportunity for property developers, as well as EPCs and investors.

South Africa's building and construction industry has grown exponentially in the last ten years, and continues to increase rapidly. Larger EPCs received on average two to three property tenders per month in the past year, which presents a significant opportunity for the on-sale of electricity to the property's tenants.

Table 11: Barriers and drivers of the solar PV for energy resellers opportunity

Drivers	Barriers
• **Rising electricity tariffs** have created a sizeable demand for viable alternative energy sources	• **Regulatory uncertainty.** The NERSA Guidelines on Electricity Resale ("the Reseller Guidelines") were published in 2016 in terms of the Electricity Regulation Act 4 of 2006. It empowers and obliges NERSA (as the authorised regulatory authority for the generation, distribution, and trading of electricity) to regulate the buying and selling of electricity as a commercial activity. Electricity re-sellers need to register with the National Regulator.
• **Energy security** is becoming increasingly important for property developers to offer their tenants. It is also becoming a key selling point for tenants.	• Any residential-level electricity on-sale agreement is subject to **home owners association approval**
• **Wheeling of energy** is an exciting driver for the uptake of energy services, specifically SSEG, in South Africa. Wheeling is the transportation of electrical energy from a generator to a separate electrical load, by making use of municipal or Eskom grid infrastructure and Power Purchase Agreements.	–
• **Access to finance** has been unlocked with commercial banks dedicating specific portfolios to supporting small-scale embedded generation projects	–

[12] The NERSA Guidelines on Electricity Resale ("the Reseller Guidelines") were published in 2016 in terms of the Electricity Regulation Act 4 of 2006. It empowers and obliges NERSA (as the authorised regulatory authority for the generation, distribution, and trading of electricity) to regulate the buying and selling of electricity as a commercial activity.

[13] Grid parity occurs when an alternative energy source can generate power at a levelised cost of electricity that is less than or equal to the price of power from the electricity grid.

4.1.4. In-house capacity building:

The commercial buildings market continues to present as one of the most promising growth segments for SSEG. At this point, many commercial property development owners have either explored or had an experience procuring a solar PV system. Thus the awareness of the strong business case for rooftop PV has led to some early movers developing their in-house capacity to deliver their projects. This is attractive for them as it cuts out the EPC, which in the conventional case functions as the middle man by reducing the profit margin. It does, however, introduce risks in learning-curve lessons, system performance, O&M, and regulations adherence/ fast-tracking.

The market opportunity lies in businesses and investors forming strategic partnerships with commercial property development owners to assist them via access to capital or technical expertise such that PV portfolios can be scaled at an optimum rate.

Table 12: Barriers and drivers of the in-house capacity building opportunity

Drivers	Barriers
• **Access to a large portfolio of properties** and available roof space means in-house developers have easy, first access to a large portion of the commercial market	• **Regulatory certainty** as the sector is still adapting to the most recent developments in municipal processes, system registration and the granting of >1MW generation licences
• By **circumventing PPAs** the complex negotiation processes of tariffs with EPCs is avoided, and costs are saved by shaving off the profit margin they would have taken	• **Bridging the gap in technical expertise** presents some risk to performance and returns. However, the necessary skills and experience are available in the job market due to the maturity of the sector
• **Access to finance** has been unlocked with commercial banks dedicating specific portfolios to supporting small-scale embedded generation projects	–
• **Increasing awareness of strong PV business case** on medium to large commercial properties	–

4.2. Battery energy storage

There are several technologies making inroads in the South African energy storage sector. Lithium-ion (Li-ion) and lead-acid battery technologies (see **Table 13**) are the most tried and tested. They remain the leaders in this market with the former emerging as a dominant choice due to its performance and proven operational stability. An 82% decrease in the cost of Li-ion batteries since 2012 and further indications for the continuing of this trend due to improvements in technology, manufacturing and scale show promise (See **Figure 16**).

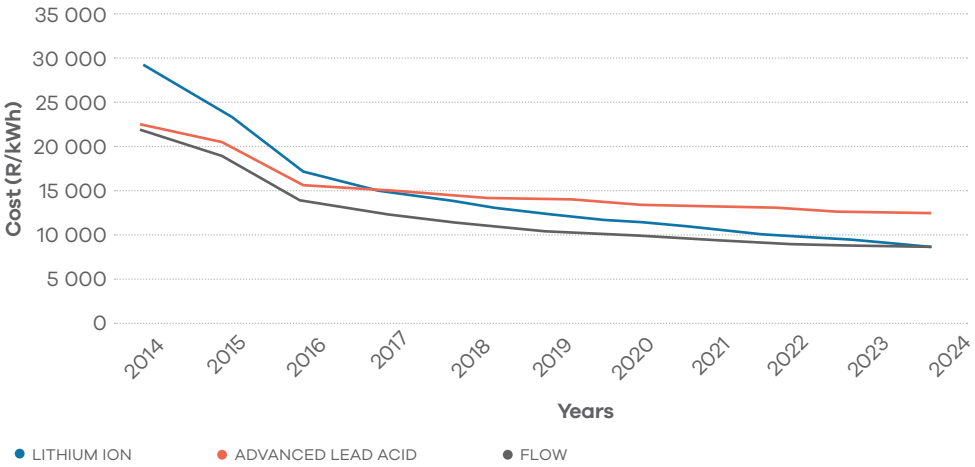
Battery energy storage.
©Solar MD

Table 13: Battery technology comparison (GreenCape analysis)

Technology	Benefits	Barriers	Cost range R/kWh
Lead-acid	Inexpensive, mature technology	Disposal, limited discharge cycles	R 200 – R 1 000 R/kWh
Lithium-Ion Phosphate	Low maintenance, high energy density	Higher cost	<15 kWh: R6 000 – R10 000 R/kWh <800 kWh: R5 000 – R9 000 R/kWh >800 kWh: R4 000 – R8 000 R/kWh

Figure 16: Behind-the-meter energy storage cost trajectory per technology 2014-24

Source: Adapted from IFC (2017a)



The growth of the market remains nevertheless constrained by prohibitive costs compared to diesel generators, typically at approximately three times the levelised cost per kWh. Storage applications in SSEG systems have thus been limited to scenarios where the customer is willing to pay a premium, driven by motivations such as sustainability and image marketing, e.g. the tourism and hospitality sector, lodges, and farms. Alternatively, installers are also still more likely to opt for PV-diesel, or PV-diesel-battery hybrid designs to provide greater flexibility and optimise on costs per kWh. Notably, as uptake increases and EPCs move to capitalise on a potential new market segment, there have been growing pains in bridging the gap of additional technical expertise to deal with the complexity of designs compared to a conventional grid-tied PV system or diesel back-up system. Communication of proper system use and monitoring is also a key success factor in ensuring maximum performance and return on investment.

It is predicted that **penetration will accelerate in the long term (5-10 years) when Li-ion prices have dropped past a tipping point against time-of-use tariffs. Numerous value stacking options** such as peak reduction and arbitrage will then **become economically viable:**

- Value stacking: The ability to leverage the same equipment, system, or process to deliver multiple benefits that maximise the financial impact.
- Peak reduction: The battery storage unit is charged at low power levels and discharged at times of high power levels. The aim is to reduce the maximum peak power consumption. The resulting power price is reduced, as are electricity costs.
- Peak arbitrage: The battery storage unit is charged during off-peak periods and discharged during peaks to take advantage of the difference in tariffs.

4.2.1. Back-up power and UPS

In the short term, the energy storage market is being driven by behind-the-meter (BTM) back-up power and uninterruptable power supply (UPS) applications and systems are typically sized for two to four hours of required load.

This is in response to the on-going experiences of load-shedding stages 2 to 6, which present risks to businesses in the commercial, industrial and agricultural sectors. To put this into perspective, this equated to 530 hours in 2019.

Energy users thus often cannot afford regularly scheduled and/or unexpected disruptions to business, production lines, and irrigation cycles, as this represents an exorbitant opportunity cost. Back-up storage potentially becomes viable when these risks are factored into the financial feasibility study.

Table 14: Barriers and drivers of the energy storage opportunity

Drivers	Barriers
• **Load shedding** has created the need for the provision of back-up power in the commercial, industrial and agricultural sectors to ensure security and resilience of the power supply against the cost of disruption	• **Diesel generators** can currently perform the same function at three times less cost per kWh
• **BTM battery prices** have declined considerably and consistently since 2016 (as depicted in **Figure 16**)	• **High upfront costs** still limit market growth; this can be countered by focused financing mechanisms, e.g. tariff structures, incentives or battery-specific lease agreements (PPAs)
• **Sustainability trend** presents an attractive marketing angle for customer-facing sectors such as hospitality and tourism	• **Rules and regulations** for behind-the-meter energy storage are still in a nascent stage
–	• **Value stacking options** are not yet economically viable, given the relative cost of storage to time-of-use tariffs

4.3. Energy efficiency

Energy service companies (ESCos) deliver energy efficiency as a service that is financed based on energy savings. Given the need to rapidly and significantly increase financing for energy efficiency, interest in this model continues to grow.

The South African market is currently dominated (more than 60%) by commercial and agriculture projects, with larger industrial-scale projects covering 30% of the market, as seen in **Figure 17**.

According to the Alliance for an Energy-Efficient Economy (AEEE) and Bureau of Energy Efficiency (BEE), the average project size in South Africa is relatively small. Given the project sizes, financing of these projects has been a major barrier for most small- to medium-sized ESCos. However, over the past two years commercial banks have gained experience in understanding the low-risk profile of energy efficiency (EE) projects and have extended their financing options to support both small and large projects.

Figure 17: Number of energy efficiency projects by sector in South Africa (GreenCape analysis)

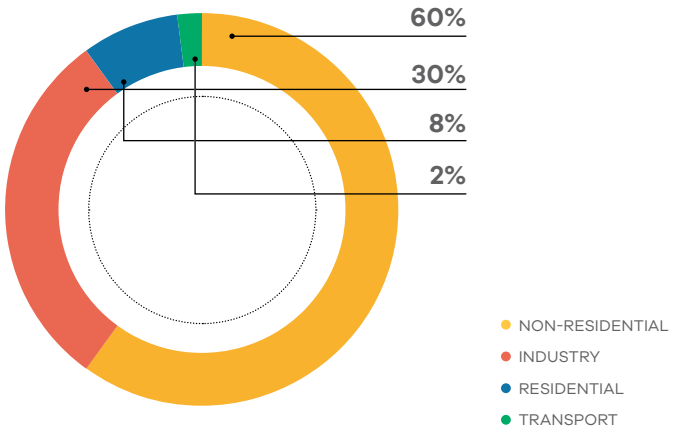
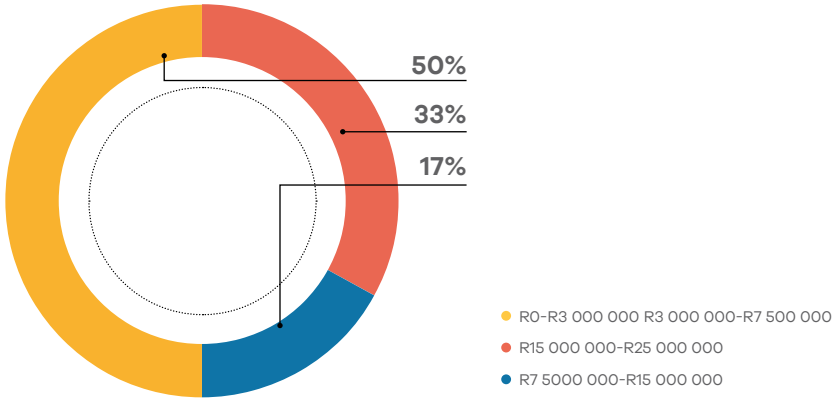


Figure 18 below details the average capital cost of energy efficiency projects in South Africa.

Figure 18: Average capital cost of energy efficiency projects in South Africa

Source: NBI (2016)



4.3.1. Smart metering and demand-side management

The ramping up of electricity costs has spurred the transition towards smart meters which empower energy users by providing real-time electronic monitoring and billing of consumption data. The fastest growing segment has been the residential sector, though willingness is not widespread due to privacy concerns. This is followed by commercial buildings (hotels, residential lodges, shopping complexes, offices), and industrial processing plants.

Greater demand-side awareness and transparency also encourages load reductions during peak hours and reduces strain on the grid. Whilst smart meters are still tagged with deterring upfront capital costs, it is expected that affordability will improve with further development in technology and wider penetration.

Another key driver is that they enable municipalities to improve grid reliability, billing collection, and credit control, and minimise theft by offering real-time alerts. However, municipal-wide implementation would require significant coordination and investment from the municipalities for O&M. The Smart Grid Vision 2030 initiative laid down by the SA National Energy Development Institute (SANEDI) as part of the South African Smart Grid Initiative (SASGI) is anticipated to enhance the demand for smart electricity meters in South African cities. The Smart Grid Readiness Test[14] initiated by SANEDI is assisting municipalities in assessing their readiness for investing in a smart grid network. The programme has resulted in large-scale rollouts of smart meters across the City of Tshwane, Nelson Mandela Bay and Johannesburg.

There is a promising medium- to long-term opportunity for ESCos in the market who are leading the transition to smart meters.

[14] SASGI website

Table 15: Barriers and drivers of the smart metering and demand-side management opportunity

Drivers	Barriers
• **Ease-of-use** of smart meter integrated systems which allow consumption monitoring and bill reduction on the savings sharing model	• A large portion of the population still shows an **unwillingness to transit from standard prepaid meters** and may have concerns regarding privacy
• **Rising electricity tariffs and complex time of use (TOU) tariffs** are driving energy users towards solutions that increase the transparency of their utility bill	• **Recession** and COVID-19 economic downturn has decreased appetite of the residential and commercial market to engage in EE investments
• Allows commercial and industrial users to reduce and manage their **carbon tax** contributors	–
• **Standardised regulations for smart meters** have been published (NRS 049) providing regulatory certainty	–
• **Municipalities are supportive of current private sector-led transition** due to the greater level of grid reliability and revenue collection possible, without the need to commit significant investment	–

4.3.2. Aggregated interventions for commercial new builds and retrofits

Since the end of the Private Sector Energy Efficiency programme (PSEE) in 2015 and rise of the rooftop PV market, the main barrier for ESCos focused on energy efficiency has been educating their target market in the opportunity. In addition, difficulty in securing consistent projects of a reasonable size (>R 3 million) to absorb operational costs such as contracting and project risks have led to tight margins.

Energy-efficient lighting projects are a common example of immediate value that might not get off the ground without sufficient scale.

As a result, the opportunities in this market have moved towards longer-term ''energy-as-a-service'' – performance contracting offerings of large centralised projects which aggregate savings across many loads.

This coincides with developments in the national market for resource-efficient green buildings, which has since grown exponentially since 2010 and is expected to be valued at R13.6 billion by 2020 (IFC 2017b). To date, more than 400 buildings have been certified by the Green Building Council in South Africa across its various categories, saving ~600 million kWh of energy per year (GBCSA 2019). New buildings only make up ~5% of total buildings in South Africa, and retrofitting of existing buildings is expected to be the largest sector within the green building industry from 2021 onwards.

Most notably, the new draft Energy Efficiency Standards (SANS10400-XA 2nd edition) which were published for public comment specify that a limit of 50% of electricity may be used for water heating. This is driving an opportunity for the provision of centralised retrofit solutions such as heat pumps and solar water heaters across the existing commercial buildings market.

Table 16: Barriers and drivers of the aggregated commercial opportunity

Drivers	Barriers
• **Legislative and regulatory changes for green buildings** (SANS10400-XA), specifically a 50% limit on electricity used for water heating, are driving the market for retrofitting centralised EE interventions	• **Raising market awareness** of the available opportunity and building partnerships with commercial property development owners
• Aggregated loads of commercial buildings **improve economies of scale**, strengthens profit margins and business longevity	• **Recession and COVID-19 economic downturn** has decreased appetite of the residential and commercial market to engage in EE investments
• **Energy-as-a-service performance contracting model** reduces the need for the user to invest upfront capital or maintain centralised solution	–

Floating solar PV installation on a dam at Marlenique Estate. **©New Southern Energy**

FUNDING AND INCENTIVES

A range of general and sector-specific funding solutions and incentives is available to investors, manufacturers, and service companies in the green economy. It covers Development Finance Institutions (DFIs), local public and private sector financiers and investors, and a considerable range of tax incentives.

The cost of renewable energy technology continues to decline, with many useful business case solutions, including solar PV panels as roofing in carports.
©Pxhere

South Africa ranks as one of the top 15 nations in the world in terms of driving the green growth agenda (ahead of Australia, Singapore, and Finland). This drive is on the back of a range of funding solutions and tax incentives available to green technology manufacturers and service companies, as well as those who use or procure such goods and services.

The South African Climate Finance Landscape looks at detailed project-level data, understanding in detail the source, disbursement, instrument and use. The insights can support public and private role-players with information to shape sectoral strategies and selected policies and improve coherence and coordination between public and private level spending in the sectors. The South African Climate Finance Landscape has tracked R62.2 billion in annual climate finance invested in SA. Find out more here.

5.1. General database web page

The GreenCape Finance Desk hosts a web page with a number of Green Finance resources that cover funding and incentives available to companies operating in the green economy. A few of the available database are highlighted below.

The Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please visit https://www.greencape.co.za/content/sector/green-finance

ACCESS TO THE SOUTH AFRICAN CLIMATE FINANCE LANDSCAPE

5.1.1. Green Finance Database

In conjunction with the Western Government Department of Economic Development and Tourism, GreenCape maintains a database of funding sources and incentives that may be relevant to green economy investors. The database contains information on more than 150 funding opportunities, including an overview of the opportunity and relevant contact details and links. It is ideal for any entity seeking a broad range of funding solutions and financial incentives, with South African institutions being the main source of opportunities. The database is available to view and download online[15].

5.1.2. Government funding and incentives database

An updated document focused on South African government funding and incentives is available to view and download online[16]. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

[15] https://www.green-cape.co.za/content/focusarea/green-finance-databases

[16] https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf

5.1.3. Finfind database

Finfind[17] is an innovative online finance solution that brings together SMME finance providers and finance seekers. With a focus on finance readiness, Finfind has more than 200 lenders and over 350 loan products available to SMEs. The database is ideal for South African SMMEs who are seeking funding and/or business advisory services, and those who want to improve their understanding of finance.

Wesgro has partnered with Finfind to assist local companies seeking finance for their business. See more here: https://wesgro.finfind.co.za/quiz/disclaimer/wesgro

5.1.4. AlliedCrowds database

AlliedCrowds[18] is the first complete aggregator and directory of alternative finance providers in the developing world. Sign-up is free and allows users to access a global database where one can filter for sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant), and type of funding (crowdfunding, angel investing, venture capital, impact investing). In addition:

- Themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organisation (WGEO) are available.
- Reports, including a number specifically about African funding sources, can also be downloaded for free.
- Businesses / organisations can also contact Allied Crowds to create a customised funding database. This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

Click the buttons below to access the relevant content

GREENCAPE'S GREEN FINANCE WEB-PAGE

GREEN FINANCE DATABASE

GOVERNMENT FUNDING AND INCENTIVE BOOKLET

FINFIND WEBSITE

ALLIED CROWDS WEBSITE

[17] https://www.finfindeasy.co.za/

[18] https://alliedcrowds.com/

THE WESTERN CAPE: AFRICA'S GREEN ECONOMY HUB

The Western Cape is a world-class investment destination.

Solar PV installation in the Western Cape Province.
©GreenCape

The province provides businesses and investors with prime locations, modern infrastructure, a skilled workforce, low operational costs and an abundance of natural resources. It is also a sought-after place to live, with unrivalled natural beauty, vibrant culture, excellent schools and universities, and an outstanding quality of life.

In 2017, Cape Town was ranked among the top 21 global investment destinations by Foreign Direct Investment (fDi) Intelligence, a division of the Financial Times.

A great place for green business

There are compelling reasons why the Western Cape Province is viewed by many as Africa's green economy hub. Coupled with a strong and rapidly growing market for green technology and services in South Africa and beyond, the Western Cape offers:

- Africa's renewable energy and cleantech hub, with a critical mass of leading companies present.
- Local presence of major professional services and financiers.
- Significant market opportunities for businesses and investors in agriculture, energy services, utility scale solar and wind, waste, water, bioeconomy and resource efficiency.
- A supportive government that has made ease of doing business and the green economy key priorities.
- Five universities with comprehensive R&D capabilities and dedicated green economy skills programmes.
- A range of investment incentives in the Atlantis Special Economic Zone (SEZ) for Green Technologies.

Supporting businesses and investors

The province also offers dedicated support for businesses and investors focusing on greentech and services, including:

Western Cape Department of Economic Development & Tourism: Driving the green economy policy landscape in the Province.
InvestSA One Stop Shop: Offers convenient investor support on permits, licensing and registrations - all under one roof.

City of Cape Town Enterprise and Investment: Creates an enabling environment to attract investment that generates economic growth and job creation in Cape Town
GreenCape: Provides dedicated support and market intelligence to green economy sectors.
Wesgro: The official investment and trade promotion agency for the Western Cape.
SAREBI: A business incubator providing nonfinancial support to green entrepreneurs.
SARETEC: Offers specialised industry-related and accredited training for the wind and solar industries.

Market opportunities in the province and South Africa

Some of the major market opportunity areas in the province and South Africa in the next five years are outlined in the graphic on the next page (see individual MIRs and the GreenCape website for more information).

R&D capabilities and skills

The region's five universities – University of Cape Town, Stellenbosch University, University of the Western Cape, the Cape Peninsula University of Technology and the George campus of the Nelson Mandela Metropolitan University – underpin all of this with comprehensive research and development (R&D) capabilities and dedicated green economy skills programmes.

ATLANTIS SPECIAL ECONOMIC ZONE FOR GREEN TECHNOLOGIES

The Atlantis SEZ is a zone dedicated to the manufacturing and provision of services in the green technology space - technologies that reduce or reverse the impact of people on the planet. Wind turbines, solar panels, insulation, biofuels, electric vehicles, materials recycling and green building materials are all examples of green technologies that will be welcomed to the zone.

The zone welcomes manufacturers, service providers, suppliers and other players in the value chains of different green technologies. The SEZ is situated in the Atlantis industrial area north of Cape Town, south of Wesfleur, east of Dassenberg Road, and west of the Witsand community.

CLICK TO VIEW THE ATLANTIS SEZ WEBSITE

Why invest in the Atlantis SEZ?

There are strong and growing South African and African markets for greentech. The South African greentech manufacturing market is worth at least R30bn; with a growing greentech market in the neighbouring countries. South Africa has opportunities in energy, waste, agriculture, transport and other sectors and is a great entry point for the whole of Africa, in particular the SADC region.

Atlantis is a great location and development ready. 94 hectares of zoned development-ready land is available for leasing to investors. Bulk infrastructure is in place and Atlantis has new public transport and shipping links, whilst boasting fibre connectivity too. Atlantis is also close to major ports, roads, universities and greentech markets.

Investors have access to extensive investment support through the One Stop Shop for investor support and the rest of the investor support ecosystem, which includes InvestSA, GreenCape, the City of Cape Town, and Wesgro. Together the ecosystem provides information and advocacy; market intelligence; facilitated access to permits and licenses, planning and development approval; and skills training.

Investors and tenants are accessing attractive incentives in the form of tax relief and allowances, employment tax incentives, fast-tracked development approvals, fee exemptions and subsidies.

There is an attractive, wide-ranging skills base to recruit from with 5 universities and many more colleges in the province, and a large range of unskilled, semi-skilled, technical and professional candidates.

FOR MORE INFO, CLICK TO EMAIL THE ATLANTIS SEZ BUSINESS DEVELOPMENT EXECUTIVE

atlantis
special economic zone
cape town

GREENCAPE'S SUPPORT TO BUSINESSES AND INVESTORS

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.
Our vision is a thriving prosperous Africa, mobilised by the green economy

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. Our vision is a thriving prosperous Africa, mobilised by the green economy

Working in developing countries, GreenCape catalyses the replication and large-scale uptake of green economy solutions to enable each country and its citizens to prosper. We work with businesses, investors, academia and government to help unlock the investment and employment potential of greentech and services, and to support a transition to a resilient green economy.

We assist businesses by removing barriers to their establishment and growth and provide our members with:

- free, credible and impartial market information and insights
- access to networks of key players in government, industry, finance and academia
- an advocacy platform to help create an enabling policy and regulatory environment for green business

We assist local, provincial and national government to build a resilient green economy by providing:

- support on the development of standards, regulations, tools and policies
- expert technical knowledge on key sectors in the green economy
- access to networks of key players across business, academia, and internationally

Since inception in 2010, GreenCape has grown to a multi-disciplinary team of over 40 staff members, representing backgrounds in finance, engineering, environmental science and economics.

Our market intelligence reports form part of a working body of information generated by sector desks and projects within GreenCape's three main programmes – energy, circular economy and resources.

Benefits of becoming a GreenCape member

We currently have over 2 500 members, and offer free membership. Becoming a member of GreenCape will give you access to the latest information regarding developments in the various sectors; access to tools, reports, and project information; and offer you the opportunity – through our networking events – to meet and interact with various stakeholders in the green economy.

CLICK HERE TO BECOME A GREENCAPE MEMBER

We have facilitated and supported ~R41bn of investments in renewable energy projects and manufacturing. From these investments, more than19 000 jobs have been created.

Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under-used resources:

309 200 fossil GHG emissions saved (equivalent to the electrical usage of 39 800 households in SA);

Over R120 million generated in financial benefits (additional revenue, cost savings and private investments);

69 permanent jobs in member companies, as well as 25 temporary positions, and 218 economy-wide jobs in supply chains have been created.

REFERENCES

As cities continue to grow, so does the global demand for energy. Renewable energy resources present the key to a just and equitable energy future.
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Alliance for an Energy Efficient Economy (AEEE) and Bureau of Energy Efficiency (BEE) 2019. The International Energy Services Conclave. 2019 – Energy Efficiency for Business Competitiveness in New Delhi. Available from: < https://www.iea.org/topics/energyefficiency/escos/> Accessed 01 November 2017.

CER. 2017. Post 2015 National Energy Efficiency Strategy Progress. Available from: <https://cer.org.za/wp-content/uploads/2017/01/National-Energy-Efficiency-Strategy.pdf> Accessed 07 December 2020.

CSIR. 2019. Jobs spin-offs in focus as South Africa's rooftop solar installed base grows beyond 400 MW. Available from: < Research Estimates and Discussion> Accessed 21 October 2019.

Department of Energy. 2018. South African Energy Sector Report. Available from: <http://www.energy.gov.za/files/media/explained/2018-South-African-Energy-Sector-Report.pdf> Accessed 01 November 2019.

Department of Energy. 2019. The South African Energy Sector Report 2019. [ONLINE] Available at: http://www.energy.gov.za/files/media/explained/2019-South-African-Energy-Sector-Report.pdf. [Accessed 4 February 2020].

Department of Tourism. 2017. The Green Tourism Incentive Programme. Available from: <https://goo.gl/XkWBkK> Accessed 01 November 2017.

Energy Market Trends. 2019. Energy as a Service Market by Services Type End-User And Region – Global Forecast to 2024 Available from: https://www.prnewswire.com/news-releases/the-global-energy-as-a-service-market-is-projected-to-grow-at-a-cagr-of-10-8-from-2019-to-2024--300864712.html Accessed 12 October 2019.

Eskom. 2017. Historical average price increase. Available from: <https://goo.gl/eaAC9W> Accessed 08 November 2017.

Eskom. 2018. Tariffs and charges (Megaflex tariff). Available from: < http://www.eskom.co.za/CustomerCare/TariffsAndCharges/Pages/Tariffs_And_Charges.aspx> Accessed 14 March 2018.

Global Innovation Lab for Climate Finance (The Lab). 2018. Pay As You Save for Clean Transport – Instrument Analysis. Available from: <https://www.climatefinancelab.org/wp-content/uploads/2018/02/Pay-As-You-Save-for-Clean-Transport_Instrument-Overview.pdf> Accessed 12 October 2018.

Green Building Council of South Africa (GBCSA). 2019. Green Building in South Africa: Guide to Costs and Trends. Available from: <https://gbcsa.org.za/wp-content/uploads/2019/08/2019GreenBuildingBooklet-Final-1.pdf> Accessed 14 January 2020.

International Energy Agency (IEA). 2014. Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa, World Energy Outlook special report. Available from: <https://goo.gl/LxBaP0> Accessed 07 December 2017.

International Energy Agency (IEA). 2019. South Africa: Statistics Data Browser 2017. Available from: <https://www.iea.org/statistics/?country=ZAFandisISO=true> Accessed 30 October 2019.

International Finance Corporation (IFC). 2017a. Energy storage trends and opportunities in emerging markets. Available from: <https://goo.gl/PbVbDu> Accessed 07 December 2017.

International Finance Corporation. 2017b. Green buildings market intelligence: South Africa company profile. Available from: <https://goo.gl/ciscic> Accessed 04 December 2017.

International Renewable Energy Agency (IRENA). 2019. Renewable Power Generation Costs in 2018. International Renewable Energy Agency, Abu Dhabi. Available from: <https://www.irena.org/publications/2019/May/Renewable-power-generation-costs-in-2018> Accessed 25 October 2019.

MarketsandMarkets. 2019. Energy as a Service Market by Services Type (Energy Supply Services, Operational and Maintenance Services, and Energy Efficiency and Optimization Services) End-User (Commercial and Industrial), and Region – Global Forecast to 2024 Available from: < https://www.marketsandmarkets.com/Market-Reports/energy-as-a-service-market-23172723.html#:~:text=%5B163%20Pages%20Report%5D%20The%20global,at%20a%20CAGR%20of%2010.8%25.f

Modise, M. 2013. Overview on the National Energy Efficiency Strategy (NEES) Post 2015. Presentation given at the Integrated Energy Plan Public Workshop. Available from: <http://www.energy.gov.za/files/IEP/jhb_workshop/Overview-on-the-National-Energy-Efficiency-Strategy-Post2015-26Sep2013.pdf> Accessed 19 December 2017. > Accessed 19 October 2020.

National Business Initiative (NBI). 2016. The Private Sector Energy Efficiency Programme: two years of focused energy-efficiency interventions in the private sector 2013-2015. Available from: <https://goo.gl/Qxozid> Accessed 06 November 2017.

National Cleaner Production Centre South Africa (NCPC-SA). 2017. Annual Highlights 2016/17. Available from: <https://goo.gl/HtnkQR> Accessed 02 November 2017.

National Treasury. 2016a. Package of measures to deal with climate change: The carbon tax and energy efficiency tax incentive. Johannesburg: s.n.

National Treasury. 2016b. Minimum threshold for local production and content for solar photovoltaic systems and components. Pretoria: National Treasury.

National Treasury. 2018. Carbon Tax Bill. Pretoria. <http://www.treasury.gov.za/comm_media/press/2018/2018112101%20Carbon%20Tax%20Bill%202018-B46-2018.pdf> Accessed 14 November 2020.

Navigant Research. 2017. ESCo Market Overview. Available from: <https://www.navigantresearch.com/research/esco-market-overview> Accessed 03 November 2017.PV GreenCard. 2018. The PV GreenCard. Available from: <https://www.pvgreencard.co.za/> Accessed 16 November 2018.

SALGA. 2018. Telephonic conversation.

SALGA. 2020. Status of small scale embedded generation (SSEG) In South African Municipalities. Available from: <https://www.sseg.org.za/wp-content/uploads/2019/03/Status-of-Small-Scale-Embedded-Generation-in-Municipalities. pdf> Accessed 30 October 2020.

SANEDI. 2016. Energy storage and South Africa. Available from: <http://www.sapvia.co.za/wp-content/uploads/2016/11/Energy-Storage-SAPVIA-Nov2016.pdf> Accessed 27 November 2017.

SAPVIA. 2018. Role of SAPVIA. Available from: <http://www.sapvia.co.za/role-of-sapvia/> Accessed 16 November 2018.

SAWEA. 2018. Vision and Purpose. Available from: <https://sawea.org.za/about/> Accessed 16 November 2018.

South Africa. 1962. Income Tax Act, No. 58 of 1962, Section 12. Pretoria: Government Printer. Available online: < http://sars.mylexisnexis.co.za/> Accessed 12 March 2018.

Statistics South Africa. 2017. CPI History. Available from: <http://www.statssa.gov.za/publications/P0141/CPIHistory.pdf?> Accessed 08 November 2017.

Wood Mackenzie. 2020. Energy storage outlook report. [ONLINE] Available at: https://www.woodmac.com/store/outlook/power-and-renewables-outlook/energy-storage/. [Accessed 4 February 2020].

Wright and Calitz. 2020. Setting up for the 2020s: Addressing South Africa's electricity crises and getting ready for the next decade. Available from: https://researchspace.csir.co.za/dspace/handle/10204/11282 Accessed 08 November 2020.

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The writing of this MIR was made possible with the generous support of the Western Cape Government of South Africa's Department of Economic Development and Tourism.

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