



# Utility-scale renewable energy

—

2019

# Market Intelligence Report

—





### 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

We thank Jack Radmore and Ian Scrimgeour for the time and effort that went into compiling this market intelligence report.

### Disclaimer

While every attempt has been made to ensure that the information published in this report is accurate, no responsibility is accepted for any loss or damage to any person or entity relying on any of the information contained in this report.

Copyright © GreenCape 2019

This document may be downloaded at no charge from [www.greencape.co.za](http://www.greencape.co.za). All rights reserved.

Subscribe to receive e-mail alerts or GreenCape news, events, and publications by registering as a member on our website: [www.greencape.co.za](http://www.greencape.co.za)



18 Roeland Street, Cape Town, 8001, South Africa

Authors: Jack Radmore and Ian Scrimgeour  
Editorial and review: Bruce Raw, Mike Mulcahy, Salomé Bronkhorst,  
and Nicholas Fordyce  
Images: GreenCape, Jeffrey Barbee, Abengoa Solar,  
and Nicholas Fordyce  
Layout and design: Tamlin Lockhart Art Direction

# Contents

Executive summary	1
What's new?	3
1. Introduction and purpose	4
2. Sector overview	6
2.1. Context	6
2.2. 2018 Integrated Resource Plan (IRP 2018)	9
2.3. The REIPPPP	14
2.4. Key players	18
2.5. REIPPPP market size	18
2.5.1. Economic value of renewable energy facilities	18
2.5.2. Investments made to date	21
2.5.3. Allocations of generation capacity	22
2.5.4. Future pipeline based on IRP 2018 allocations	22
2.6. Economic development through the REIPPPP	23
3. Policies and regulation	26
3.1. Guiding policies	26
3.2. Government departments involved in the energy and electricity sector	28
3.3. Energy regulation	28
4. Opportunities and barriers	30
4.1. Emerging opportunities	31
4.1.1. Bid Window 5 of the REIPPPP	31
4.1.2. Manufacturing potential	32
4.1.3. Municipalities exploring the option to procure from IPPs	34
4.1.4. Refinancing of REIPPPP Bid Windows 1-4	36
4.2. Market uncertainties	39
4.2.1. Ensuring continuity and transparency	39
4.2.2. Maintaining the country's existing manufacturing base	39
4.2.3. Reforming the country's electricity sector	39
5. Funding and incentives	42
5.1. General database web page	42
5.1.1. Green finance database	42
5.1.2. Government funding and incentive database	42
5.1.3. Finfind database	42
5.1.4. AlliedCrowds database	42
6. The Western Cape: Africa's greentech hub	44
7. GreenCape's support to businesses and investors	48
8. References	52

# List of acronyms and abbreviations

AUW	African Utility Week
BW	Bid window
CAGR	Compound annual growth rate
CCA	Customs controlled area
COD	Commercial operation date
CPUT	Cape Peninsula University of Technology
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated solar power
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DoE	Department of Energy
dti	Department of Trade and Industry
EAF	Energy availability factor
ED	Economic development
EKF	Danmarks Eksportkredit (Denmark Export Credit Agency)
EPC	Engineering, procurement and construction
ERA	Electricity Regulation Act, No 4 of 2006
ETI	Employment tax incentive
GWp	Gigawatt peak
ICN	International Cleantech Network
IDC	Industrial Development Corporation
IDZ	Industrial Development Zone
IEA	International Energy Agency
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IPPO	Independent Power Producers Office
IRP	Integrated Resource Plan
kWh	Kilowatt-hour
LNG	Liquefied natural gas
MCSA	Minerals Council South Africa
MWp	Megawatt peak
NDP	National Development Plan
OEM	Original equipment manufacturer
O&M	Operation and maintenance
PCE	Portfolio Committee on Energy
PPA	Power purchase agreement
PV	Photovoltaic
RE	Renewable energy
RECP	Renewable Energy Cooperation Programme
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RMB	Rand Merchant Bank
SAPVIA	South African Photovoltaic Industry Association
SARETEC	South African Renewable Energy Technology Centre
SAWEA	South African Wind Energy Association
SED	Socio-economic development
SEZ	Special Economic Zone
SIPs	Strategic infrastructure projects
SSEG	Small-scale embedded generation
VRE	Variable Renewable Energy

# List of figures

<b>Figure 1:</b> Timeline of RE in the South African context	5
<b>Figure 2:</b> Key utility RE movements in SA to date	7
<b>Figure 3:</b> Policy adjusted IRP draft 2018	10
<b>Figure 4:</b> Governance structure of IPP office	16
<b>Figure 5:</b> IPP office procurement process	16
<b>Figure 6:</b> Tariff decline and MW awarded in 4 Bid Windows	17
<b>Figure 7:</b> Typical company types involved at different stages of project life	18
<b>Figure 8:</b> Countries from where private investments were made in the REIPPPP	21
<b>Figure 9:</b> Policies guiding South Africa's economic growth trajectory	26
<b>Figure 10:</b> Eco-system of policies relating to the REIPPPP	27
<b>Figure 11:</b> Eskom week on week EAF for 2016, 2017 and 2018	32
<b>Figure 12:</b> Average Tariff (R/kWh) decline of Solar PV and Wind in the REIPPPP	36
<b>Figure 13:</b> GreenCape's focus areas	49

# List of tables

<b>Table 1:</b> Additional drivers affecting the private market	9
<b>Table 2:</b> Capacities for least cost plan by year 2030	13
<b>Table 3:</b> Capacities for least-cost plan by 2030 with annual build limits on RE	13
<b>Table 4:</b> Market movements in the REIPPPP	14
<b>Table 5:</b> IRP 2010, IRP 2018, determinations to date in MW	15
<b>Table 6:</b> Status of remaining REIPPPP projects	17
<b>Table 7:</b> Tariffs offered by solar PV, wind and CSP projects over bid windows [R/kWh]	21
<b>Table 8:</b> Actual procured generation capacities per REIPPPP bid window	22
<b>Table 9:</b> Future pipeline based on IRP 2018 allocations	22
<b>Table 10:</b> Economic development through the REIPPPP BW 1-4	24
<b>Table 11:</b> Procurement outstanding based on IRP adjustments	30
<b>Table 12:</b> Local solar PV manufacturing	33
<b>Table 13:</b> Key players in wind tower manufacturing/construction located in SA	34
<b>Table 14:</b> Average Debt funding as percentage of Total Funds	37
<b>Table 15:</b> Split in debt and equity REIPPPP BW 1-4	38
<b>Table 16:</b> Commercial Operation Date BW1-3	38
<b>Table 17:</b> Lead financiers BW1-4	38
<b>Table 18:</b> Lead equity investors BW1-4	39

## Exchange rate used:

1 USD = R14.29 (December 2018)

# Executive summary

**The South African energy mix is primarily made up of coal assets because of limited technology options in the past, and due to South Africa's abundant supply of the commodity. The South Africa Minerals Council's National Coal Strategy for South Africa ranks the country seventh in the world, with 253 million tonnes extracted in 2016 (MCSA 2018). Coal power currently represents over 90% of the total electricity mix, with the remainder covered by nuclear, hydro and most recently, renewable energy.**

South Africa (SA) still has a single utility electricity model where a single entity (Eskom) owns and operates generation, transmission and a share of distribution infrastructure. This model is designed to aid developing energy markets that require significant long-term (10-15 years) infrastructure investments and demand balancing. However, the applicability of this single utility model is changing rapidly in a global context with the introduction of new technologies, which are cheaper, modular, capable of being decentralised and more environmentally friendly. SA is in the early stage of this transition on the back of a large-scale renewable energy (RE) rollout.

South Africa's RE market has exploded over the last eight years after the inauguration of the Independent Power Producers Office (IPPO) in 2010. The IPPO, with the support of the Department of Energy, has procured 6 376 MW of energy to date<sup>1</sup>. This has been managed through six bid rounds in the large Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) bid windows, and through two bid rounds in the small REIPPPP. Of the projects procured, 3 772 MW (Draft IRP 2018) are operational, while 20 projects from the small programme are waiting on Power Purchase Agreement (PPA) signatures. The National Department of Energy (DoE) has determined a total of 14 725 MW of RE, which allows for **another 8.3 GW of procurement to still occur.**

The REIPPPP has been lauded globally for its clear mandate, growth path and independence in its procurement approach. This is clearly illustrated through a tariff decline of more than 150% over five years, with the levelled cost of electricity for wind and solar in the most recent

expedited rounds coming in at less than R0.62/kWh. Each bid window has also seen a major oversubscription in tender submissions from numerous local and international developers and investors.

To date, the programme has attracted more than R200 billion in investment, of which R48.7 billion is foreign equity and financing activities.

**The latest Integrated Resource Plan (IRP) 2018 allocations indicate 8 100 MW for wind, 5 670 MW Solar Photovoltaic (PV) and 2 400 MW of small-scale embedded generation (SSEG) to be procured by 2030, which has the potential of attracting in excess of R200 billion in the next 12 years.** Using an indicative R/MW overnight capital cost per technology, the approximate market value per technology based on IRP 2018 allocations is R88 billion (for solar PV), R142 billion (for wind) and R30 billion (for SSEG).

The timing of procurement will have a major impact on manufacturing and pricing in the market. A consistent annual allocation will attract international developers, manufacturers and increase competitiveness, which in turn will decrease the tariffs bid. Indications are that **prices as low as R0.46/kWh and R0.56/kWh for solar and wind can be expected by 2030.**

With a growing energy market and an increase in the number of IPPs, **a secondary market for refinancing and equity buyouts has emerged.** Institutional investors seeking 20-year stable returns and larger IPPs looking to develop their asset management businesses are able to reassess project risk after 2/3 years of operations and exit clauses have expired.

<sup>1</sup> IPPO presentation to the Parliamentary Portfolio Committee on Energy (PCE) on 6 March 2018.



There are further opportunities related to decreasing battery prices and growth in Variable Renewable Energy (VRE) as a percentage of the total energy mix. There is **an opportunity for utility-scale (load balancing and frequency control), small-scale, and off-grid solutions; however, it remains a relatively small market opportunity for manufacturing. If battery storage replaces the allocation of gas in the IRP, there is a market of 8.1 GW between 2025 and 2030.**

Although the local market remains small, local manufacturing to provide battery storage for both grid services and utility-scale storage may represent a viable opportunity – if manufacturers access other markets from a South African base. A view on African decentralised power supply and electric vehicles will need to support a manufacturing base in South Africa.

Lastly, the introduction of wheeling frameworks within municipalities and potential for energy trading is improving the viability of utility-scale RE projects for private and municipal off-take. Limitations do however exist in accessing generation licences for projects larger than 1 MW, whilst public entities (municipalities) require the Energy Minister’s determination to purchase power from private generators.

The DoE has set the foundation for South Africa to become a global leader in transitioning to RE, and a technology and innovation hub for the continent. The next five years are critical to demonstrate intention, ensure stability and garner international and local support in a rapidly transitioning energy environment.



# What's new?

Since the publication of the 2017 Utility-scale Renewable Energy Market Intelligence Report, there have been a number of important developments in the sector and in the national government's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP). In 2018:

- a new Energy Minister was appointed;
- after a long delay, 27 independent power producer projects were signed under Bid Windows 3.5 and 4 of the REIPPPP;
- the draft 2018 Integrated Resource Plan was released; and
- the country started to experience load shedding again, because of coal and nuclear power plant maintenance requirements.

This MIR replaces the 2017 report. In addition to updates on the state of the REIPPPP, it highlights:

- the opportunities for investors arising from Bid Window 5 and the influence of the draft 2018 IRP on Bid Window 5 opportunities;
- the developments around municipalities seeking the option to procure from independent power producers; and
- the opportunity to refinance projects from Bid Windows 1-4.

Notable developments to take note of, include the following:

- Nuclear energy has intentionally been left out of the energy mix up to 2030.
- Small-scale embedded generation has been included in energy planning, with 2 400 MW up to 2030.
- There is a drive for mid-merit power and peaking plants as part of the energy mix.
- Diminishing utility-scale battery prices and value stacking (frequency and voltage control) are supporting their inclusion on a national planning level.

# 1

## Introduction and purpose

**This report provides potential investors and businesses in the utility-scale RE sector with a greater understanding of market opportunities in South Africa.**

*Renewables 2018*, a report by the International Energy Agency (IEA), finds that globally the share of renewables in meeting global energy demand is expected to grow by one-fifth in the next five years to reach 12.4% in 2023.

Renewables will represent the fastest growth in the electricity sector, providing almost 30% of power demand in 2023, up from 24% in 2017. During this period, renewables are forecast to meet more than 70% of global electricity generation growth, led by solar PV and followed by wind, hydropower, and bioenergy.

A key driver behind this global shift has been government policy support and procurement programmes, which most recently include countries such as Mexico, Egypt, Morocco, Zambia, Ethiopia, Saudi Arabia and Rwanda, with prices dropping as low as R0.33/kWh (\$0.024/kWh) under competitive processes (Magyari 2017). For the first time, renewable capacity additions of 178 gigawatts (GW) accounted for more than two-thirds of global net electricity capacity growth. Solar PV capacity expanded the most (97 GW). Meanwhile, onshore wind additions declined for the second year in a row, and hydropower growth continued to decelerate. Led by commercial and industrial projects, followed by residential applications, the expansion of distributed generation, spurs almost half of global PV capacity growth in the period 2018 to 2023.

The South African renewable energy market is following a similar trend. Solar PV and wind are

Global renewable energy consumption increased by more than 5% in 2017 – three times faster than total final energy consumption. In the power sector, renewables accounted for half of annual global electricity generation growth, led by wind, solar PV, and hydropower (Renewables 2018).

dominating the market, backed by a growing small-scale embedded generation market (mostly solar for commercial and industrial businesses).

As shown in **Figure 1**, the introduction of RE in the South African context dates back to 2003 with the delivery of the White Paper on RE policy. However, only in 2010 with the release of the **Integrated Resource Plan (IRP) 2010-2030** did the RE framework really start to take shape. The purpose of the IRP 2010 was to determine the preferred energy mix over the next 20 years. It included determinations for RE amounting to 14 725 MW, coal-fired plants of 6 250 MW, and gas-fired power plants of 3 726 MW.

Given the large amount of power to be acquired from the private sector, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was established to fulfil three specific duties: professional advisory services, procurement management, monitoring, evaluation, and contract management.



**Figure 1: Timeline of RE in the South African context**

Following a call for more regulatory and policy certainty, the Draft IRP 2018 has been released with the aim to determine the preferred energy mix up until 2030. It includes determinations for additional RE amounting to 13 770 MW, coal-fired plants of 1 000 MW, and gas-fired power plants of 8 100 MW.

This report provides potential investors in the utility-scale RE space with a greater understanding of market opportunities in South Africa, taking into account the size of the opportunities and the level of risk involved. The report is compiled for foreign direct and local investors (persons or organisations) that are looking to invest directly in the utility-scale RE green economy through project development, asset management, equity, debt, equipment manufacture or support services.

**In what follows:**

**Section 2** gives an overview of the market, and describes market size and key players.

**Section 3** details the general legislative and regulatory framework governing RE.

**Section 4** highlights emerging opportunities and barriers in the market.

**Section 5** focuses on funding and incentives.

**Section 6** gives an overview of the Western Cape as Africa's growing greentech hub.

**Section 7** focuses on the free services that GreenCape provides to its members.

*Note: GreenCape's Energy Services Market Intelligence Report explores the energy services market, including the embedded generation RE market (generation of less than 1 MW), and energy efficiency. This market has been excluded from this report.*

For enquiries or to access our services, contact our Renewable Energy Sector Desk at [re@green-cape.co.za](mailto:re@green-cape.co.za).



# 2

## Sector overview

**Accounting for nearly 7% of installed capacity, the South African RE sector is showing rapid growth and significant potential. Every month new projects reach commercial operation, with over 3 GWp of projects connected and operational to date.**

### 2.1. Context

South Africa's nominal capacity is dominated by coal-fired generation stations with a net output of 37.8 GWp, which represents more than 90% of the country's total installed capacity of over 45 GWp. Nuclear generation capacity comprises 4% of generation capacity, and comes from the only nuclear generation facility on the African continent, Koeberg power station. RE is a new sector in SA, with the first commercial utility projects coming online in 2013.

At the time of writing, 3.8 GW of RE is commercially operating (IPPO 2017), of which the three main technologies are concentrated solar power (CSP), solar photo voltaic (PV), and wind.

The significant growth of SA's RE industry in recent years is the result of several factors:

- Proactive government policy in procuring RE capacity;
- Increases in electricity tariffs charged by the national utility, Eskom;
- Wind and solar energy competing on a levelled cost of electricity basis with coal and nuclear;
- Establishment of Renewable Energy Independent Power Producers Procurement Programme (REIPPPP);
- Offtake guarantees by government, backed by the treasury.

Figure 2 and Table 1 below illustrate some of the key utility RE movements in SA to date, with additional drivers affecting the market.



## Key

- Key events
- Determinations
- Signing events
- Minister appointments

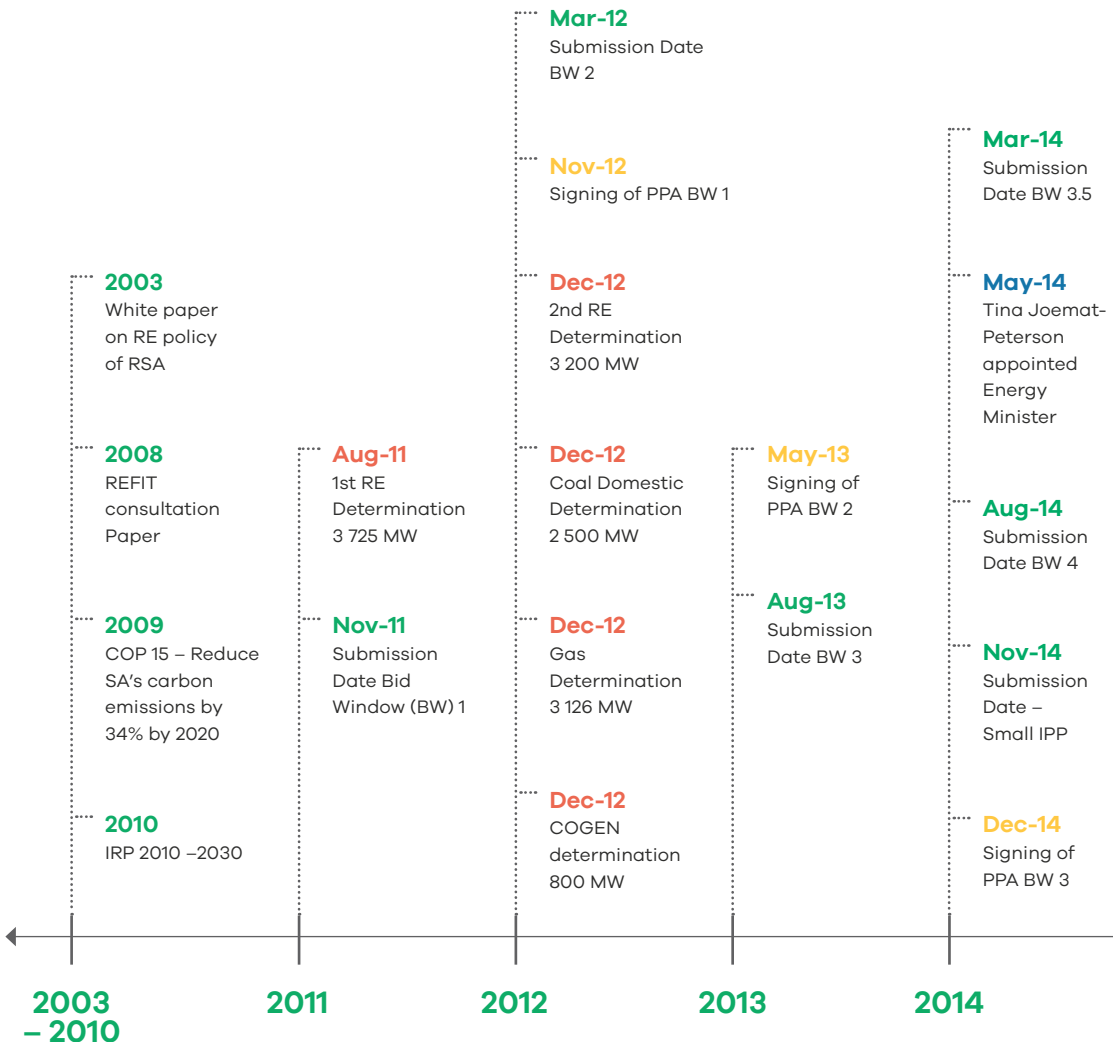
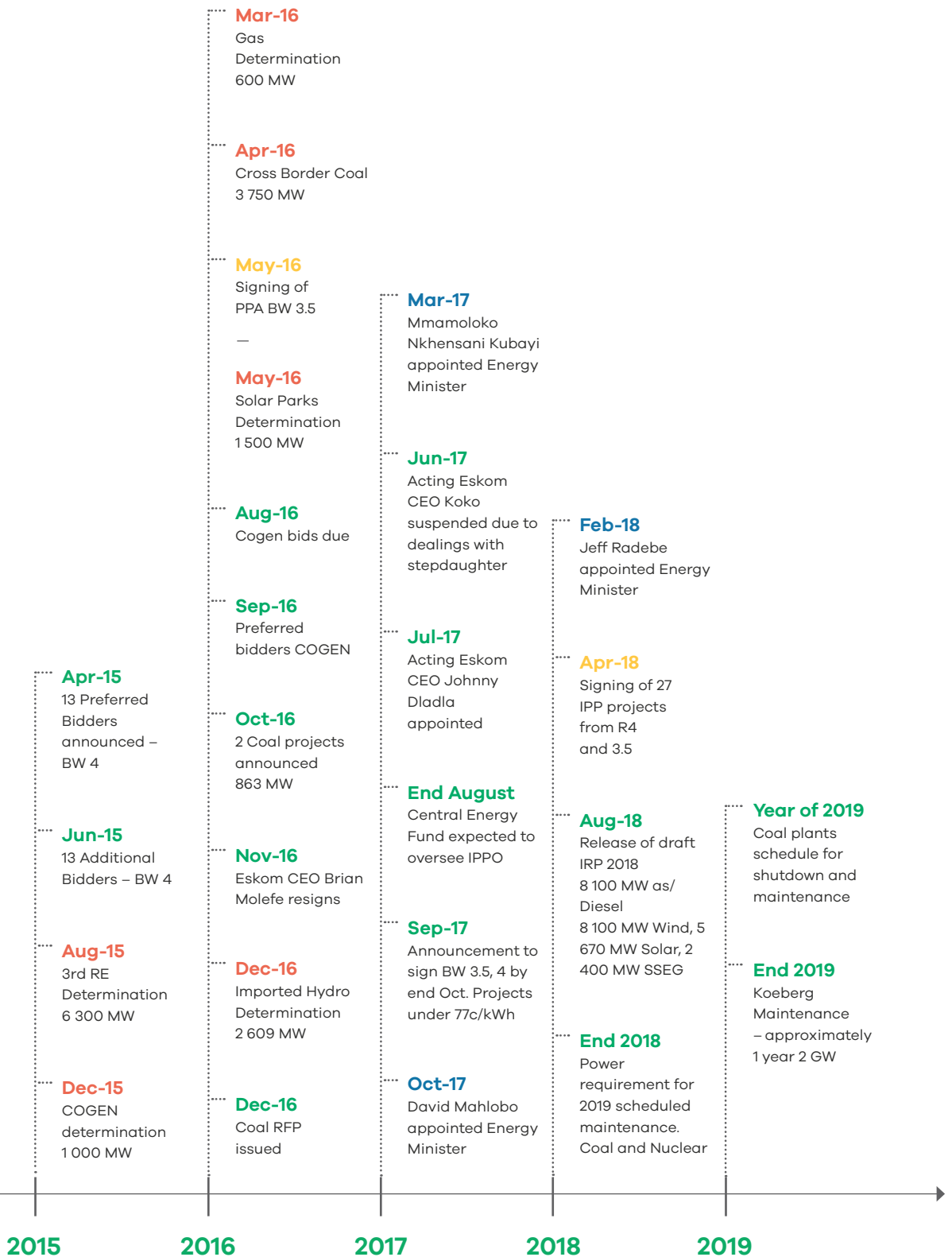


Figure 2: Key utility RE movements in SA to date



**Table 1: Additional drivers affecting the private market**

Date	Movement
October 2016	Adoption of Smart Meter Specifications – NRS049-2
December 2016	CSIR Energy Centre Report highlights the actual tariffs from REIPPPP and Coal IPP showing how cheap RE builds have been. Solar – R0.62/kWh; Wind – R0.62/kWh; Coal – R1.03/kWh
January 2017	Reason for not signing IPPs announced by the Minister of Energy – decreased growth below 2%, resulting in lower demand for electricity.
April 2017	Western Cape High Court Judgement nullifies government’s nuclear agreements for failing to consult public and undertake due processes. Minister of Energy decides to review all determinations after nuclear judgement. This is one of the main reasons for no response on municipal section 34 requests. <sup>2</sup>
July 2017	City of Cape Town files court application to purchase from IPPs
Sep/Oct 2017	Public consultations for Atlantis Special Economic Zone (SEZ) for Green Technologies
Dec 2018	Launch of Atlantis SEZ for Green Technologies, with national Department of Trade and Industry (the dti) encouraging greentech investment through incentives.

## 2.2. 2018 Integrated Resource Plan (IRP 2018)

The IRP, developed by the national DoE, serves as primary plan for new-build power generation. When originally drafted in 2010, it was intended to be updated every two years. Since 2010, there have been several draft revisions but as yet no updated IRP has been officially adopted. The IRP generally considers several scenarios, with the policy adjusted IRP being the primary plan.

The latest revision, IRP 2018, has gone through a public comment process and a final version is expected to be published early in 2019. This draft marks a significant shift towards renewable

energy, with the bulk of new generation coming from PV, liquefied natural gas (LNG) and wind. The policy adjusted scenario is shown in **Figure 3** below.

It is worth noting that the new coal capacity in the plan was not in the least cost modelling, but was added based on projects procured through the coal-to-power IPP process. While this would create a concerning break in RE projects if implemented in its proposed form, it also shows a commitment to the IPP programme and gives credibility to the value of government’s commitments.

<sup>2</sup> A Section 34 request entails a request for the Minister of Energy to make a determination against the IRP for the procurement of energy generation as detailed under section 34(1) of the Electricity Regulation Act, 2006 (Act No 4 of 2006).



	Coal	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas/ Diesel	Other (cogen, biomass, landfill)	Distributed Generation
Current	37149	1860	2100	2912	1474	1980	300	3830	499	
2019	2155					244	300			Allocation to the extent of the short term capacity and energy gap
2020	1433				114	300				
2021	1433				300	818				
2022	711			513	400	1000	1600			
2023	750				1000	1600				500
2024		1860				1600		1000		500
2025					1000	1600				500
2026						1600				500
2027	750					1600		2000		500
2028					1000	1600				500
2029				1575	1000	1600				500
2030			2500		1000	1600				500
Total Installed Capacity by 2030 (MW)	44381	3720	4600	5000	8288	17742	600	6830	499	4000

Source: Adapted from DoE (2018)

- Installed capacity
- Committed/Already contracted
- New capacity
- Extension of Koeberg plant life
- Distributed generation capacity for own use

**Figure 3: Policy adjusted IRP draft 2018**

The draft also makes a strong statement towards encouraging local manufacturing. By forcing annual build limits on PV and wind, i.e. the maximum limit of a specified technology that can be built in a given year, the plan brings

procurement closer to 2024. The impact of adding build limits to the least cost scenario can be seen in [Table 3](#). The annual build limits bring forward PV procurement from 2027 in [Table 2](#) (no build limits) to 2024, [Table 3](#).











**Table 2: Capacities for least cost plan by year 2030**

Year	PV (MW)	Wind (MW)	Gas (CCGT/ CC-GE/ OCGT) (MW)	Landfill Gas (MW)
2020				
2021				
2022				
2023				
2024				
2025			2 380	
2026			750	250
2027	2 290		1 480	
2028	1 640	2 500	2 200	
2029	2 180	2 800	2 200	
2030	1 710	3 700	1 930	
<b>Total</b>	<b>7 820</b>	<b>9 000</b>	<b>10 940</b>	<b>250</b>

**Table 3: Capacities for least-cost plan by 2030 with annual build limits on RE**

Year	PV (MW)	Wind (MW)	Gas (CCGT/ CC-GE/ OCGT) (MW)	Landfill Gas (MW)
2020				
2021				
2022				
2023				
2024	1 000			
2025	1 000	1 600		
2026	1 000	1 600	2 380	
2027	1 000	1 600	1 650	
2028	1 000	1 600	1 950	
2029	1 000	1 600	3 000	250
2030	1 000	1 600	1 800	
<b>Total</b>	<b>7 000</b>	<b>9 600</b>	<b>10 780</b>	<b>250</b>

## 2.3. The REIPPPP

The South African utility-scale RE model, which has evolved since 1998, can be divided into four phases (derived primarily through policy and competition). Key policy movements are summarised in [Table 4](#) below.

**Table 4: Market movements in the REIPPPP**

	Initiation	Market Development	Transition	Consolidation
Pivotal Movements	RE policy uncertainty	Programme development	Bid Window 1-2 [nascent market – high returns]	Bid Window 3-4 [competitive market]
Timeline	1998 – 2008	2009 – 2010	2011 – 2013	2014 – Present
Government	1998 White paper on Energy	2009 – Renewable Energy feed-in-tariff (REFIT) phase 2 launched by NERSA	2011 – DOE abandon REFIT for competitive tender process	Nuclear debate
	2003 White paper on RE	2009 – COP 15 commitments	2011 – 1st Determination: 3 725 MW	Delay in Bid Window 4 (BW4) announcement
	2007/08 Load shedding	IRP 2010 – 2030	Aug 2011 – Issue of REIPPPP RFP	Job losses as a result
	2008 – REFIT draft guidelines issued by NERSA	2010 – Establishment of IPP office	Nov 2011 – Bid submission period	April 2018 – Sign BW4
	2008 – Eskom Solar hot water rebate programme		Dec 2011 – Preferred bidder Announcement	August 2018 – Updated IRP
	2008 – Energy Act enacted		11 Dec 2011 – COP 17 in Durban	Nov 2018 - Suggestion of BW5 announcement
	2008 – Commissioning of Darling Wind Farm		2012 – 2nd determination – 3 200 MW	
			Nov 2012 – Signing of PPA BW1	
			May 2013 – Signing of PPA BW2	

The REIPPPP came about after a number of policy movements and programme refinements. These include the IRP 2010-30, the establishment of the IPP office and cancellation of the REFIT programme.

The introduction of RE into national energy planning extends as far back as the 1998 White Paper on the Energy Policy of South Africa. The policy committed to encouraging private sector participation, competition and open, non-discriminatory access to the transmission system. The sector was further supported in 2003 with the

White Paper on RE, by which the government set a target of 10 000 GWh RE consumption by 2013, and in 2009 when NERSA approved the policy and tariffs for a REFIT programme.

Nevertheless, the 2011 promulgation of the IRP issued by the Department of Energy (DoE) had the greatest impact on the RE sector. Government set a target of 17.8 GW of new power generation capacity (Table 5) to be delivered through RE technologies, and abandoned the REFIT programme for a competitive RE tender approach.

**Table 5: IRP 2010, IRP 2018, determinations to date in MW**

	IRP 2010 – 2030 Policy Adjusted	2018 updated plan
Solar	8 400	8 288
Wind	8 400	17 742
CSP	1 000	600
SSEG		4 000
<b>RE goal 2030</b>	<b>17 800</b>	<b>30 630</b>
<b>Determinations to date</b>		
1st Determination	3 725	
2nd Determination	3 200	
3rd Determination	6 300	
Solar Parks Determination	1 500	
<b>Determined to date</b>	<b>14 725</b>	

The major concern with the establishment of a ~R560 billion<sup>3</sup> programme was to ensure fair competition and independence, free from undue influence. With all previous generation, transmission and equitable share of distribution managed by Eskom, the programme had to have a very clear separation of powers.

Central to SA's RE programme was the establishment of the Independent Power Producers Procurement Programme (IPPPP) by the DoE (illustrated in Figure 4 below), National

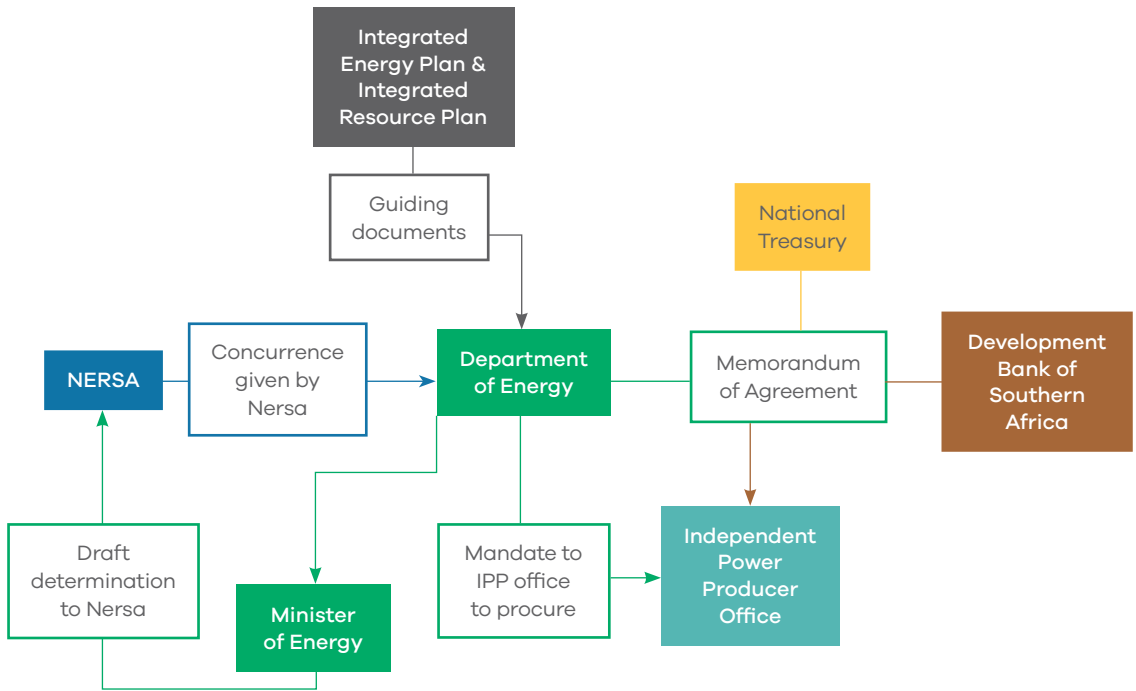
Treasury (NT) and the Development Bank of Southern Africa (DBSA) in 2010. A memorandum of agreement (MoA) was concluded between the parties, and the DBSA was directed to support the establishment of the Independent Power Producer (IPP) office. In 2016, the MoA was extended for a further three years.

The IPP office is housed in the DBSA, which oversees staff, operations and procurement of consultants' goods and services. Initial funding was provided as a loan recoverable at financial

<sup>3</sup> Weighted capital cost of 6 422 MW (R31 438 804/MW)\*17.8 GW

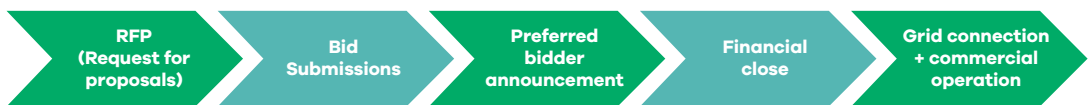
close. The office is an agent of the DoE and is mandated to procure whilst National Treasury, through the Government Technical Advisory Centre, manages the IPP office account. National Treasury also provides a guarantee to back the obligations of Eskom in terms of the Power Purchase Agreements (PPAs) with the IPPs.

The IPP office operates at arms-length from government and is self-funded through a 1% project fee paid by IPPs. The office is not a juristic person under the MoA, which ensures its independence from government departments.



**Figure 4: Governance structure of IPPO**

The formation of the IPP Office’s procurement process, [Figure 5](#), has been lauded as one of the key elements to driving success.

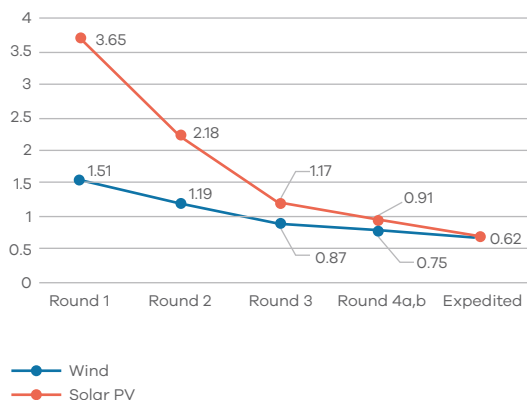


**Figure 5: IPPO procurement process**

To date, the IPP office has facilitated 6 376 MW over six Bid Windows and 112 projects under the REIPPPP. The success of this independent mechanism has resulted in a rapid drop in RE prices, and the inclusion of a number of international developers, manufacturers and EPCs.

There has been four rounds of projects in the large REIPPPP with a price drop of more than 80% in Solar PV over the last six years, which is a testament to the programme’s success and independence.

Average Tariff (R/kWh) decline



MW awarded per Bid Window

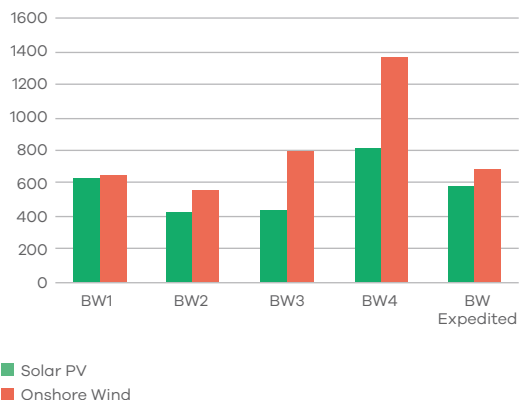


Figure 6: Tariff decline and MW awarded in 4 Bid Windows

Figure 6 illustrates the average tariff decline in the wind and solar PV sector over the four bid windows plus expedited round that have been initiated, together with the megawatts awarded

for each bid window. To date, 6 376 MW<sup>4</sup> has been procured with the status of the remaining projects shown in Table 6 below.

Table 6: Status of remaining REIPPPP projects (MW)

Programmes	Large IPP			Small Scale IPP		
	Procured	Operational	Determined	Procured	Operational	Determined
Wind	3 352	1 980	6 360	9	0	400
Solar PV	2 287	1 474	6 225	80		
Concentrated solar power	600	400	1 200	0		
Landfill gas	8	22	540	0		
Small hydro	19			0		
Biomass	52			10		

Section 34(1)(a) of the Electricity Regulation Act, No 4 of 2006 (ERA) allows the Minister of Energy, in consultation with the NERSA, to make Ministerial Determinations for new generation capacity if they believe that it is required to secure the continued uninterrupted supply of electricity. The Ministerial Determinations may also outline the type of energy sources from which electricity must be generated.

<sup>4</sup> Independent Power Producers Office (IPPO) presentation to the Parliamentary Portfolio Committee on Energy (PCE) on 6 March 2018.



## 2.4. Key players

Market opportunities in the REIPPPP are best categorised according to the project development phases that the programme follows: development, construction, operations and

maintenance. Accordingly, the key players or company types involved in this market are described in [Figure 7](#), with an indication of the project development stage in which they are typically involved.

<b>IPP:</b>	<p>Independent power producer. It is responsible for project inception and development, land acquisition, finance sourcing and bid submission. May sometimes be a project sponsor or may submit a bid with the backing of such an entity.</p> <p>Project stages involved: Project development, project construction, project operation and maintenance.</p>
<b>OEM:</b>	<p>Original equipment manufacturer (OEM). Suppliers of key technology, e.g. the manufacturer of the selected turbine in a wind farm. This company will play a major role in dictating the technology partners that will constitute a project and may also play the role of O&amp;M (see below).</p> <p>Project stages involved: Project construction, project operation and maintenance.</p>
<b>O&amp;M:</b>	<p>Operation and maintenance (O&amp;M) company. It is usually the main equipment supplier or a technical entity well-versed in the specific technology.</p> <p>Project stages involved: Project construction, project operation and maintenance.</p>
<b>EPC:</b>	<p>Engineering, procurement and construction. Typically, this player is responsible for managing the various sub-contracts in the construction phase of a project and may also be involved in the design and development phase of the project.</p> <p>Project stages involved: Project development, construction and O&amp;M.</p>

**Figure 7: Typical company types involved at different stages of project life**

## 2.5. REIPPPP market size

The REIPPPP has attracted investment from prominent global RE project developers and Tier 1 component manufacturers. It has done so because of the growth potential, localisation requirements, the programme's transparency and strong government support. Global leaders such as Abengoa, Mainstream Renewable Power, Jinko, and Canadian Solar, as well as South African developers such as Pele Green Energy, Aurora Power Solutions and Biotherm Energy, have entered the market.

The REIPPPP has attracted more than R200 billion in investments into the South African economy, of which R48.8 billion have been from foreign direct investment (FDI). Some of the main contributing countries are Germany, France, Italy, Spain, and the USA.

### 2.5.1. Economic value of renewable energy facilities

The Council for Scientific and Industrial Research (CSIR) study (CSIR 2015) demonstrates that between January and June 2015, REIPPPP projects with some 800 MWp and 1 GWp of wind and solar PV respectively, 'generated up to R4 billion more in financial benefits than their cost'. As projects from more recent rounds of the programme come online, the installed capacity and financial benefits realised will continue to increase as these projects offer much lower tariffs and costs (IPPO March 2017) than their predecessors (see [Table 7](#)).





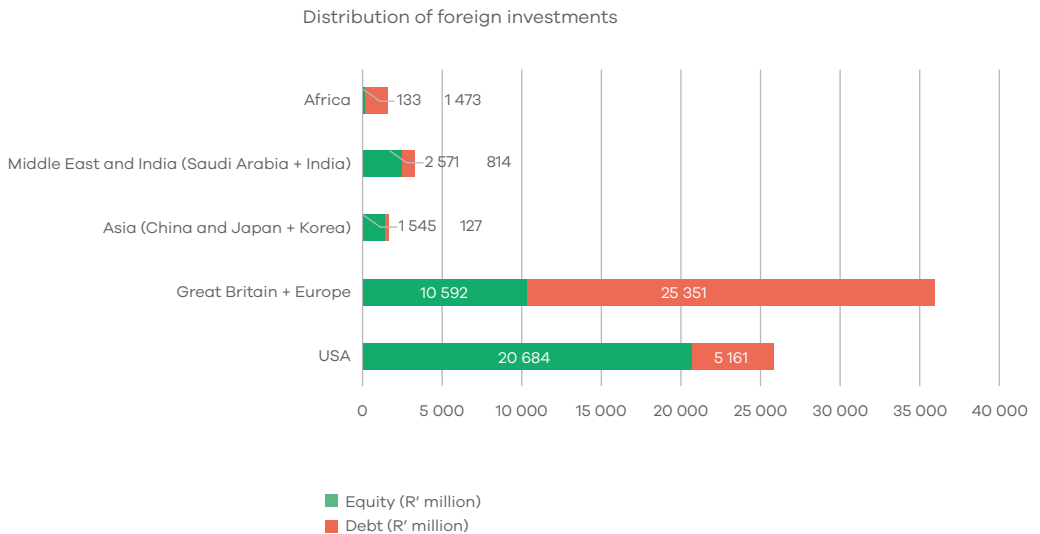
**Table 7: Tariffs offered by solar PV, wind and CSP projects over bid windows [R/kWh]**

Programmes	Large IPP						Small-scale IPP	
	Round 1	Round 2	Round 3	Round 3.5	Round 4 a,b	Expedited	S1	S2
Wind	1.51	1.19	0.87		0.75	0.62	1.15	
Solar PV	3.65	2.18	1.17		0.91	0.62	1.22	1.01
Concentrated solar power	3.55	3.32	1.93	1.8				
Landfill gas			1.11					
Small hydro		1.36			1.24			
Biomass			1.65		1.61		1.65	

**2.5.2. Investments made to date**

Total investments made in the programme (debt and equity) over the past four bidding windows, excluding the expedited round, totalled over R200 billion as of March 2017 (IPP Office). This is split between domestic (75.6%, R151 billion) and foreign

(24.4%, R48.8 billion) investments. The programme has been successful not only in attracting significant investments but also in attracting them from a wide variety of investment sources (see Figure 8.)



**Figure 8: Countries from where private investments were made in the REIPPPP**

### 2.5.3. Allocations of generation capacity

Table 8 presents final capacities per round, including the small IPP programme. As the table shows, wind and solar PV are the dominant technologies in terms of actual capacity

procured, with later rounds of the programme having to adjust their allocated technology because of favourable bid prices as well as high (over-) subscription rates.

**Table 8: Actual procured generation capacities per REIPPPP bid window**

Programmes	Large IPP					Small Scale IPP	
	Round 1	Round 2	Round 3	Round 3.5	Round 4 a,b	S1	S2
Wind	639	555	785	0	1 363	5	5
Solar PV	625	414	435	0	813	30	50
Concentrated solar power	150	50	200	200	0	0	0
Landfill gas	0	0	13	0	0	0	0
Small hydro	0	14	0	0	5	0	0
Biomass	0	0	17	0	25	10	0

A recent update from the IPP Office during the announcement of REIPPPP Rounds 3.5 and 4a,b, stated that 59% of the utility scale IPP projects were operational, but none of the small IPP projects were. The IPP office also indicated that 44% of the total RE determination had been procured at the time of the announcement.

### 2.5.4. Future pipeline based on IRP 2018 allocations

Using an indicative R/MW overnight capital cost per technology, an approximate market value per technology based on IRP 2018 allocations is depicted in Table 9 below.

**Table 9: Future pipeline based on IRP 2018 allocations**

Technology	Indicative ZAR (million)/MW cost	IRP 2018 new capacity (MW)	Potential market value
Solar PV	R15.6 million	6 000	R93 billion
Wind	R17.5 million	14 400	R252 billion
SSEG	R12.5 million	4 000	R50 billion



## 2.6. Economic development through the REIPPPP

Energy security and investment aside, the REIPPPP contributes directly to South Africa's broader national development agenda. This is both by design and through the willingness of industry players who recognise the South African socio-economic context in which they are developing projects.

The REIPPPP's economic development (ED) component accounts for 30% of each tender proposal, while the tariff accounts for 70%. As the REIPPPP progresses, the tariffs are becoming increasingly competitive, with the range and impact on the overall tender becoming less significant. It is therefore becoming more important to improve the economic development objectives below to be more competitive.

- **Job creation:** focusing on South African citizens, black South African citizens and those local to projects;

- **Local content:** capturing as much of the local project spend as possible;
- **Ownership:** advancing ownership by black South Africans and local communities;
- **Management control:** increasing the presence of black South Africans in management of the economy;
- **Preferential procurement:** empowering black-, women- and youth-owned, and small enterprises;
- **Enterprise development:** developing small businesses in local communities and stimulating the local economy;
- **Socio-economic development:** addressing some of the socio-economic needs of communities local to projects.

Over the five bid rounds there has been little change between the minimum and target development objectives, with percentages visible in the ED scorecard shown below. The only major change has been the local content requirements in bid windows 2, 3, 3.5 and 4 shown in [Table 10](#).



**Table 10: Economic development through the REIPPPP BW 1 - 4**

Bid Windows	BW 1		BW 2		BW 3,3,5 and 4	
	Min	Target	Min	Target	Min	Target
<b>Job Creation</b>						
SA citizens	50%	80%	50%	80%	50%	80%
SA citizens who are black	30%	50%	30%	50%	30%	50%
Skilled black SA citizens	18%	30%	18%	30%	18%	30%
SA citizens from local communities	12%	20%	12%	20%	12%	20%
<b>Local Content</b>						
Onshore Wind, CSP with storage, Small Hydro, Landfill Gas, Biomass, Biogas	25%	45%	25%	60%	40%	65%
Solar PV and CSP	35%	50%	35%	60%	45%	65%
<b>Ownership</b>						
Shareholding by black people and/or black enterprises in the <b>seller</b>	12%	30%	12%	30%	12%	30%
Shareholding <b>by local communities</b> in the <b>seller</b>	3%	5%	3%	5%	3%	5%
Shareholding by black people and/or black enterprises in the <b>construction</b> contractor	8%	20%	8%	20%	8%	20%
Shareholding by black people and/or black enterprises in the <b>operations</b> contractor	8%	20%	8%	20%	8%	20%
<b>Management Control</b>						
Black top Management	0%	40%	0%	40%	0%	40%
<b>Preferential Procurement</b>						
BBBEE Procurement spend	-	60%	-	60%	-	60%
SME and QME (QSE and EME) Procurement	-	10%	-	10%	-	10%
Women-owned vendor procurement	-	5%	-	5%	-	5%
<b>Enterprise development</b>						
Enterprise development contributions	-	0.6%	-	0.6%	-	0.6%
Adjusted enterprise development contributions	-	0.6%	-	0.6%	-	0.6%
<b>Socio-economic Development</b>						
Socio-economic development contributions	1.0%	1.5%	1.0%	1.5%	1.0%	1.5%
Adjusted socio-economic development contributions	1.0%	1.5%	1.0%	1.5%	1.0%	1.5%

The ED objectives are expected to change in future bid rounds as a result of local communities within a 50 km radius of the project site receiving delayed income<sup>5</sup> and local content rules being open to exploitation.

In future rounds it is expected that there will be a number of improvements, including:

- redefining a local community or clarity on the definition of 'a local community';
- ensuring that local communities receive early, efficient and equitable benefits;
- a focus on technology-specific items for localisation – laminating of panels, construction of towers, blades, etc. have to be done locally;
- more stringent burdens of proof, for instance, CFOs will require signed certificates from auditors.

To date there are 62 community trusts implementing numerous economic development activities across SA. Many of these projects are supporting communities in rural locations, where community resourcing is scarce. As with many local development initiatives, the upskilling and integration of new technology, and partnerships between international and local teams require patience and consistency. These success stories are communicated by the various industry associations concerned, including the South

African Photovoltaic Industry Association (SAPVIA) and the South African Wind Energy Association (SAWEA).

Among many others, highlights include over 31 207 job years created in construction and operation and maintenance (IPPO 2017), whilst numerous large investments have been made in manufacturing and assembly. Qualifying communities will receive R29 billion in income over the project's 20-year lifespan as a result of the minimum ownership requirement of 2.5%.

To truly demonstrate the impact and future benefits of the programme, it is necessary to look at programmes on the ground. One such example is the South African Renewable Energy Technology Centre (SARETEC) at the Cape Peninsula University of Technology (CPUT) campus in Bellville, Cape Town. As well as short courses on solar PV systems and biomass technologies, SARETEC now offers internationally accredited courses for:

- Wind turbine services technicians;
- Solar photovoltaic service technicians.

The institution was specifically founded to cater for the REIPPPP's skills requirements, particularly in the long-term operation and maintenance phases of projects.



<sup>5</sup> Local community trusts comprising 2.5%-5% of the project are funded through free carry by the remaining shareholders and/or development finance institutions through a loan. Given that the community does not inject any capital themselves, dividends are only repaid once the loans are repaid. This can delay dividends to the community for 15 years.



# 3

## Policies and regulation

This section focuses on policies and regulation that guide and affect procurement in the renewable energy sector

### 3.1. Guiding policies

South Africa's economic growth is guided by several key policies, as shown in [Figure 9](#) (national Department of Economic Development, 2011). Of these, the policies highlighted relate directly to procurement within the RE sector

via the economic development component of the REIPPPP. The design of the REIPPPP takes into account all these policies, making it a highly strategic infrastructure and development programme.

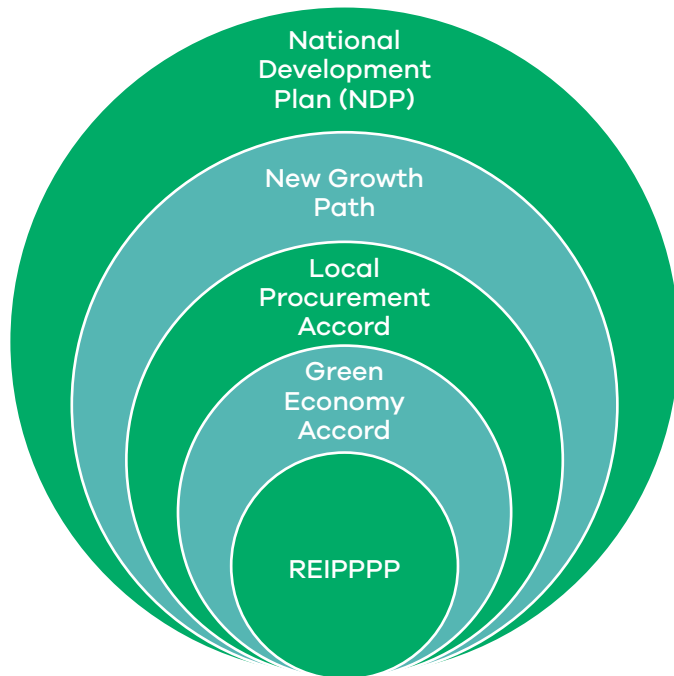
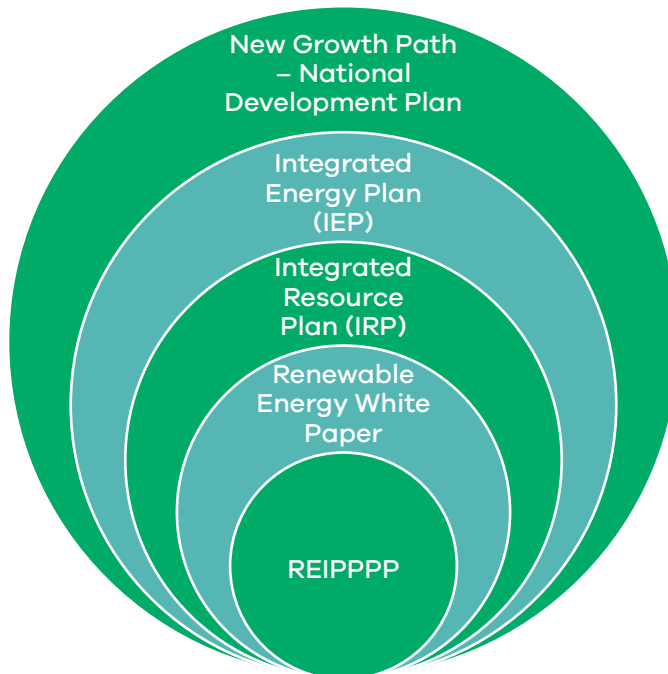


Figure 9: Policies guiding South Africa's economic growth trajectory

<b>National Development Plan (NDP)</b>	Supports procurement of at least 20 GW of RE by 2030 in its outline of the country's development path.
<b>New Growth Path</b>	Sets targets creating jobs and identifies priority areas, with infrastructure development named as key to the success of this vision.
<b>Local Procurement Accord</b>	As the economy grows and the country industrialises, this accord sets an aspirational target of 75% of all products used in the country to be manufactured locally. This is particularly evident in the REIPPPP's local content rules.
<b>Green Economy Accord</b>	Incorporated within the New Growth Path, this accord between government, labour and business seeks to shift the country's economy towards sustainable development, green job creation and industrial development.

Other supporting programmes include the dti's special economic zone (SEZ) programme, which seeks to establish a dedicated economic zone in each province that attracts specific economic activities. The Atlantis SEZ for Green Technologies in the Western Cape offers compelling support and incentives to manufacturers of green technologies, especially those supplying the REIPPPP.

Specific to the procurement of new generation capacity, SA is guided by the IRP 2010-2030 (most recently, the IRP 2018), which stems from the broader national energy plan, embodied within the Integrated Energy Plan (IEP). These plans are presented in [Figure 10](#).



**Figure 10: Eco-system of policies relating to the REIPPPP**

<b>NDP</b>	Supports procurement of at least 20 GW of RE by 2030 in its outline of the country's development path.
<b>IEP</b>	Outlines the general energy plan for the country. The IEP looks into energy security, access to energy, reducing cost of energy supply, energy efficiency, localisation and sustainability in all energy matters.
<b>IRP</b>	Specifically outlines the planning, sourcing and quantities of electricity generation sources contributing to the country's generation mix.
<b>RE White Paper</b>	Determines that a significant and equitable level of national resources should be invested in RE, while also setting targets for RE generation capacity.

## 3.2. Government departments involved in the energy and electricity sector

Different government departments are involved in various capacities in executing the policies listed in [Section 3.1](#). The most prominent departments are listed below, with a brief summary of their interaction with the REIPPPP:

<b>National Treasury</b>	Ensuring value for money, affordability of electricity supply, and providing sovereign guarantees for the signed PPAs.
<b>Department of Environmental Affairs (DEA)</b>	Ensuring environmental custodianship and assessment of environmental impact studies, as well as ensuring appropriate land use.
<b>Department of Trade and Industry (dti)</b>	Responsible for ensuring industrialisation through the REIPPPP's economic development component, especially local content; as well as black economic empowerment and development of small businesses.
<b>Department of Public Enterprises</b>	Shareholder in Eskom, the sole power off-taker.

## 3.3. Energy regulation

Energy regulation in South Africa is governed by the Electricity Regulation Act, No 4 of 2006 (ERA). This act establishes the national regulatory framework, and outlines the role of the national energy regulator (NERSA). In terms of large-scale renewable energy, the most relevant aspect of the Act is the impact of its current interpretation on public purchase of energy.

Current interpretations of the Act require that any generation facility selling to a public entity requires a determination (permission) from the minister of energy. This is currently a limitation on building generation plants outside of the REIPPPP and selling energy directly to cities; however, a number of changes are expected, given the current 1 MW exemption (facilities under 1 MW do not require a generation licence) and the 200 MW annual allocation for SSEG in the IRP.



# 4

## Opportunities and barriers

Changes in the country's electricity sector continue to present a variety of opportunities for the RE market.

The dramatic drop in solar PV and wind prices has had a significant impact on South Africa's future energy mix. Based on the updated IRP 2018, government still expects to procure 24 GW of RE generation by 2030 (see Table 11).

**Table 11: Procurement outstanding based on IRP adjustments**

IRP Adjustments	RE goal 2030	Procured to Date	Determined to Date	To be Procured
IRP 2010 – 2030 Policy Adjusted	17 800	6 376	14 725	11 424
Draft 2016 IRP Base Case 2030	19 647			19 647
Draft 2016 IRP Carbon Budget 2030	33 347			33 347
IRP 2018 Update	30 630			24 254

Technology improvements, improved risk appetite and the global RE drive could result in SA seeing solar PV and wind prices as low as R0.46/kWh and R0.56/kWh by 2030 (Wright et al. 2017). There is potential for:

- **local government procurement of electricity** from IPPs;
- **manufacturing opportunities** from local content requirements; and
- **opportunities for greentech manufacturers** in the proposed Atlantis GreenTech SEZ.

This section discusses the opportunities presented by the REIPPPP and challenges to the

**The price of solar PV and wind could fall to R0.46/kWh and R0.56/kWh, respectively, by 2030.**

RE sector's growth. It also details additional and continuing opportunities, outlining the nature of the challenges and how they may be overcome by custodians within government and the private sector.

## 4.1. Emerging opportunities

### 4.1.1. Bid Window 5 of the REIPPPP

Post the release of the IRP 2018 for public comment, the Minister of Energy released a statement stating that bid window 5 (BW5) of REIPPPP would be announced immediately after the final gazetted version of the IRP 2018 was released. However, with elections in May and troubles at Eskom, the timelines remain unclear.

That said, if **the DOE aims to ensure continuity in the market, the most optimistic result will be that the BW5 submission and RFP occur in 2019 with 2019/20 for commissioning from 2023 onwards.** This looks like the most plausible outcome as Eskom's Medium Term System Adequacy Outlook indicates that there is a potential electricity supply shortfall starting in 2019. [Figure 11](#) below shows how much is needed depending on demand and power station performance assumptions. Based on the apparent shortfall<sup>6</sup> we expect that round 5 the REIPPPP programme will be launched in 2019/20.

## The influence of IRP 2018 on Bid Window 5 opportunities

The major driver for BW 5 opportunities is the IRP 2018. It has some major changes in comparison to the policy-adjusted IRP of 2010, which resulted from:

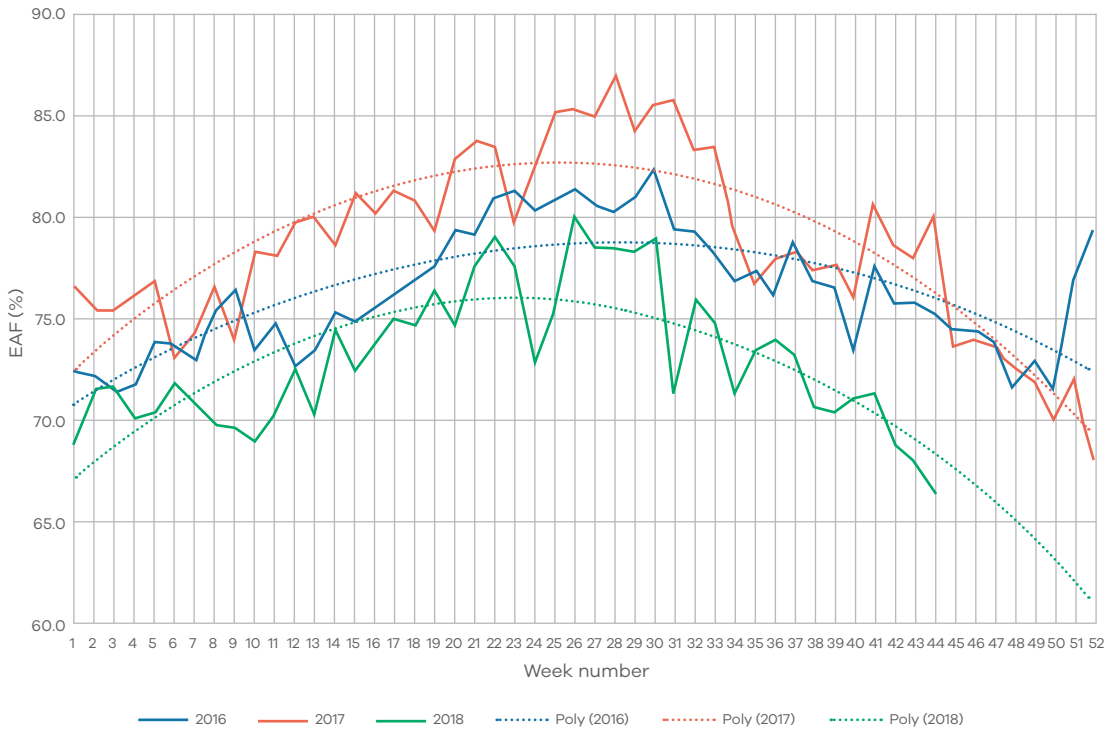
- drop in Eskom plant performance availability (assumed to be 86% but 77% for 16/17);
- demand 30% lower than 2010 expectation;
- technology cost decline – wind, solar.

These market changes have led to a reduction of nuclear and coal, and the exclusion of CSP plants up until 2030, and an increase in the contribution of RE to the energy mix. RE can potentially fulfil 21% of energy production of 321 TWh by 2030, with gas also playing a significant role in the next decade.

Financial close for BW 4, 4b and 3.5 took place at the end of July 2018, with 2 476 MW committed contracted capacity for 2019–2022 for PV, wind and CSP. After that, there is speculation of a potential procurement gap resulting from lower electricity demand as a consequence of low growth and increased efficiencies from businesses.

The IRP 2018 seems to accommodate numerous interests in the coal and RE sector by not using the Least Cost Model, which would delay wind and solar procurement to 2027 and exclude coal entirely. The merits for the proposed plan will come under scrutiny, given the major investment made into renewables to date, the need for consistency, and potential job losses in the coal sector.

<sup>6</sup> The week-on-week energy availability factor (EAF) of South Africa's generation fleet continues to plunge to its lowest level in years, from 67,88% in week 43 of 2018 to 66,37% in week 44 of 2018.



**Figure 11: Eskom week-on-week EAF (Eskom 2018) for 2016, 2017 and 2018**

If procurement is to follow the updated IRP 2018, there is a potential market investment opportunity of 1000 MW of solar PV and 1600 MW of onshore wind per annum. Based on BW4's total project cost per megawatt, the equivalent ZAR value investment is approximately R20.7 million\*1000 MW + R21.129 million\*1600 (Eberhard & Naude 2017) – with a future market of R55 billion/year (~2600 MW of wind and solar/annum) thereafter.

The forecasted procurement capacity provides an excellent opportunity for international panel, tower and turbine manufacturers to construct local manufacturing plants. A market of 1000

MW/annum for solar PV provides sufficient comfort for 5 manufacturers to develop facilities of +-200MW each. However, it is expected that industry players will be tentative on making decisions, given the previous market delays. Alternatively, a manufacturer can grow incrementally with the market through securing the local market (SSEG) and a potential export market to bridge any procurement gaps. With this market structure a manufacturer can benefit from a first lead advantage and hurdle any manufacturers that have become despondent through previous delays.

#### 4.1.2. Manufacturing potential

There is an opportunity in the REIPPPP for solar PV, wind tower and battery OEMs who are supplying into the REIPPPP already. They can sharpen their competitive advantage by aligning closely with the country's industrialisation agenda (see local content discussion under Section 3) and with the dti's SEZ programme, which in the Western Cape has translated into the Atlantis SEZ for Green Technologies.

**Bid Window 5 offers potential opportunities of 1000 MW solar PV and 1600 MW onshore wind, valued at R54 billion, with a future market of R50 billion per year.**

Localisation studies have been commissioned by the dti for solar PV, wind energy and concentrated solar power (CSP) technologies. The purpose of these studies is to define which and how many components can be manufactured or assembled locally. The Department of Trade and Industry (dti), for example, indicates in its wind energy industry localisation roadmap (dti 2017) that the localisation of wind energy technology could result in setting up:

- between one and five wind tower manufacturing facilities;
- one blade manufacturing facility; and
- one facility to assemble nacelles and hubs.

Two wind tower manufacturing facilities have already been set up in South Africa, one of which is located in Atlantis, Western Cape.

The Western Cape alone has in the past three years realised around R500 million in investments in component manufacturing. This total excludes spend on local services such as logistics, and civil and electrical works for projects based within the province and nationally.

### Local PV panel manufacturing

The local content requirement of BW4 and BW5 aims to enforce local lamination and assembly in the solar PV manufacturing value chain. However, panel providers require a minimum market of 1000 MW per year to justify a local production

In line with the REIPPPP’s developmental contribution, the Atlantis GreenTech SEZ and the Eastern Cape’s East London and Coega IDZs have attracted significant investments in wind tower facilities and component manufacturing. The CoCT has also welcomed a considerable number of developers, panel manufacturers and inverter companies who are setting up offices in the city.

facility. The updated IRP 2018 indicates that there is a market of approximately 8 GW of solar PV by 2030, with 814 MW already committed.

Table 12 below shows a number of solar PV assembly/manufacturers located in South Africa, which have been set up primarily as a result of the REIPPPP. To compensate for the delays in the REIPPPP, companies have followed different business paths to manage the risk.

**There is a market for 8 GW of solar PV by 2030, with 814 MW already committed.**

**Table 12: Local solar PV manufacturing**

Company	Status
Jinko Solar	100 MW/year facility – decreased capacity due to delay in REIPPPP
Sun Power	160 MW/year facility – currently dormant
ART Solar	75 MW/year facility – decreased capacity due to delay in REIPPPP
ILB Helios	300 MW/year facility – recently upgraded to tier 1 manufacturer in partnership with Seraphim



Two tower manufacturers have been set up in South Africa over the past eight years as a result of the REIPPPP; however, with increased competition and improvements in technology, concrete towers have become a viable option for new plants in BW4 and BW4b. Large developers and EPCs such as Enel, Building Energy, Innwind and Nordex/Acciona are using concrete towers for their projects. Table 13 below shows some of the key players in the local market.

The updated IRP 2018 provides a market of approximately 14.4 GW of onshore wind by 2030 with +1.3 GW commencing construction over a three-year period.

**There is a market for onshore wind generation of ~14.4 GW by 2030 with ~1.3 GW commencing construction over the next three years.**

**Table 13: Key players in wind tower manufacturing/construction located in SA**

Company	Status
DCD wind towers	Capacity of 200 towers per year. Currently dormant due to delay in REIPPPP.
GRI towers	Capacity of 150 towers per year. Not running at full capacity due to slowdown in REIPPPP.
Concrete towers	At least 5/12 projects of BW 4 making use of concrete towers. Competitive pricing and improved design driving the movement.

**Local battery manufacturing**

Navigant Research forecasts that global revenue in advanced batteries for utility-scale applications will grow from \$221.8 million in 2014 to \$17.8 billion in 2023 at a compound annual growth rate (CAGR) of 62.8%.

In SA, the battery value proposition is dependent on the service offering / value stacking – frequency and voltage control, peak shaving, deferral of grid infrastructure. The allocation of gas and storage in the updated IRP 2018 can theoretically be replaced with battery storage if it becomes viable, and can offer the same service as envisioned for gas. This represents a market of ~5GW between 2022 and 2030.

Although the local market remains small, local manufacturing to provide battery storage for both grid services and utility-scale storage may represent a viable opportunity – if manufacturers access other markets from a South African base.

**4.1.3. Municipalities exploring the option to procure from IPPs**

Metropolitan municipalities are driving the shift away from the ‘single buyer’ model for IPPs and are promoting direct purchases, wheeling, and energy trading. These developments provide investors and project developers with alternative offtake agreements and improved potential returns, and create new business cases.

Metropolitan municipalities around the country are challenging the ‘single-buyer’ model currently dominated by Eskom, in order to be allowed to purchase electricity directly from IPPs. 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.

**If battery storage replaces the allocation of gas in the IRP, there is a market of 5 GW between 2025-2030.**



According to Eskom’s latest integrated report, between 40% and 45% of the electricity it generated in 2016/17 was routed through to municipalities. With municipalities pushing to reduce this amount by as much as 10% in order to increase independence, this could represent a feasible market for utility-scale RE projects if we see a move away from the “single-buyer” model.

Beyond direct sales from IPPs to municipalities, electricity wheeling and energy trading provide opportunities for local generators to increase their access to off-take agreements, new business cases, and greater returns. Electricity wheeling will allow IPPs to wheel their energy to any willing buyer connected to the national grid at a point where wheeling is available. Electricity wheeling is currently allowed by Eskom and by three municipalities in the Western Cape. Drakenstein, City of Cape Town and Stellenbosch have policies in place and a tariff approved by the National Energy Regulator of South Africa (NERSA). Other municipalities around the country have allowed single pilot wheeling projects but they are yet to implement policies for replication.

The release of regulations allowing private sector energy trading has also opened the market to

**Direct sales from IPPs to municipalities, electricity wheeling and energy trading provide opportunities for local generators to increase their access to off-take agreements, new business cases and greater returns.**

private sector power purchase agreements and on-sales to private consumers using the national and local distribution networks.

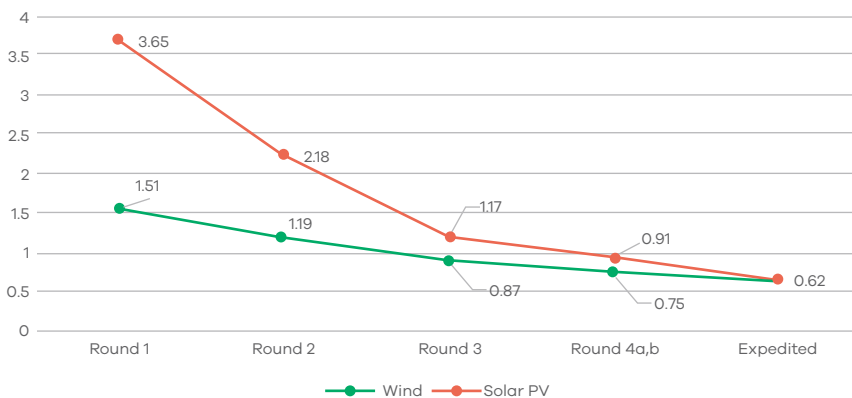
#### 4.1.4. Refinancing of REIPPPP Bid Windows 1-4

As a result of the early adoption risk of RE technology in SA, a market for refinancing existing plants and purchasing equity has emerged. This has the potential to unlock substantial value, with indications of a 100-300 basis point margin for debt in early REIPPPP projects, increasing leverage (75% to 85%), and potentially 5% to 10% margins for equity.

The key drivers of this new market are a different risk profile for Eskom, and RE asset management and post Commercial Operation Date (COD) risk.

**Lower Eskom risk profile and drop in tariffs:** The REIPPPP has gone through a number of risk mitigation stages in the course of eight years, from off-take risk (Eskom), to sovereign guarantee (treasury), technology, and construction risk. Possibly the most demonstrable indicator of the change in risk associated with the REIPPPP is the drastic drop in tariffs over the programme’s lifespan (shown in Figure 12).

**The refinance of existing RE plants and purchase of equity, can unlock significant value for investors. There are a number of projects that will become available for sale of equity and refinancing of debt over the next two / three years.**



**Figure 12: Average Tariff (R/kWh) decline of Solar PV and Wind in the REIPPPP**

Major contributors to the drop in tariffs have been:

- falling global technology prices;
- growing competition, from 53 bidders in BW1 to over 100 in the Expedited Round;
- improved efficiencies in site selection; and
- lower financing costs, related to both equity and debt.

**Competition for financing and equity provision has never been more competitive.** With a track record of plant operation, Eskom has demonstrated that it can meet its payment obligations. Also, international financiers and equity providers are introducing new foreign funding models and, in some cases, expecting lower return.

There are, however, a number of constraints for change in ownership and refinancing, which are explicitly detailed in the Implementation Agreement, point 8 and 16, in the request for qualification and proposals for new generation. Investors should note that:

- **No change in ownership is allowed without written consent by the DOE and within a three-year lock-in period after COD.** Black Equity can also not be diluted through a change in ownership. The percentage of Black Equity has to be the same as proposed at bid, and submitted in Schedule 2 to the RFP.

- **There are no refinancing of debt cases from which to work;** however, commercial debt arrangers generally have a cancellation clause upon exiting a finance agreement within a specific period (3 years). The DOE has indicated that there would be a potential need to share in the benefits of refinancing on a 50:50 basis.

### Refinancing options

Refinancing options include:

- **Increasing leverage through mezzanine or senior debt (75% to 85%)** – cash out for equity players – see [Table 14](#) below for average Debt:Equity ratios for the respective rounds (Eberhard & Naude 2017).
- **Improving on financing terms** – decrease debt rates and relax covenants on developers/EPC/O&M providers (improved tariffs and less restriction on developer/EPC).
- **Post construction (lower equity returns expectations)** – early equity returns (prior to construction) are generally higher due to numerous development and construction risks. Post construction, early operations attract equity with lower risk appetite and lower returns expectations (pension, insurance and mutual funds).

**Table 14: Average Debt funding as percentage of Total Funds**

Average debt funding as percentage of total funds					
Technology	BW 1	BW 2	BW 3	BW 3.5	BW 4
Wind	74.5%	75.4%	75.0%		70.7%
Solar	73.5%	72.6%	77.5%		75.4%
CSP	70.0%	70.5%	75.0%	71.7%	

Based on the IPP update of March 2017, R201.8 billion (including early revenue and VAT facility) is committed for BW1-4, including small projects BW1 and 2. [Table 15](#) below shows the split in debt and equity.

**Table 15: Split in debt and equity REIPPPP BW 1-4**

Values in Billions	Total	Equity	Debt
<b>Total committed investments</b>	<b>201.8</b>	<b>34.2%</b>	<b>65.8%</b>
Foreign Investors and financiers	48.8	35.77	12.98
Local	153.1	33.20	119.80

Provided the lock-in period of three years after COD, a number of projects will become available for sale of equity and refinancing of debt over the

next 2/3 years. [Table 16](#) below shows the years in which projects from BW1-3 reached COD, and the size (in MW) of projects (NERSA 2017).

**Table 16: Commercial Operation Date BW1-3**

Commercial Operation Date					
	2013	2014	2015	2016	2017
CSP			1	2	1
Hydro			1	1	
Landfill				1	
Solar PV	1	24	1	5	2
Wind		7	5	5	1
<b>Grand Total</b>	<b>1</b>	<b>31</b>	<b>8</b>	<b>14</b>	<b>4</b>

Given the competitive nature of the market and value on offer, a number of expert financial services are offering refinancing services for

capital seeking to enter the market. An outline of the lead financiers and equity investors is provided in [Table 17](#) and [Table 18](#) below.

**Table 17: Lead financiers BW1-4**

Main project financiers					
	BW 1	BW 2	BW 3	BW 3.5	BW 4
Nedbank	9	5	7	1	7
Standard Bank	11	5	1	1	5
ABSA	3	4	6	1	7
IDC	10	5	5	0	0
DBSA	9	2	5	1	2
RMB	5	4	2	1	2
Future Growth	7	1	0	0	0
Investec	0	3	1	1	0
IFC	2	1	0	1	0

**Table 18: Lead equity investors BW1-4**

Equity in projects	Projects (1-4)
Old Mutual	17
IDC	9
Enel	11
Mainstream	6
Mulilo	6
Thebe	6
Biotherm	7
Scatec Solar	6
Blue Falcon	6
Pele Green Energy	7

## 4.2. Market uncertainties

Delays in the rollout of the REIPPPP and statements made by Eskom and Coal unions about the future of RE have created doubt in the market. This has, to some extent, been addressed by statements in support of the programme by the Presidency, the Treasury, the DoE, and signing of BW4; however, the timing of future energy procurement as per the 2018 IRP still creates substantial uncertainty.

There is a critical need for action by government on three levels:

- **ensuring continuity and continued transparency** in the rollout of the programme;
- efforts to **support the manufacturing base and attract new investment** confidence;
- prioritising the **reform of the country's electricity sector** to reflect South Africa's sustainable resources and market offerings.

### 4.2.1. Ensuring continuity and transparency

The success of the REIPPPP programme has largely hinged on the market size and longevity that the programme afforded investors, as well as the lauded transparency in the programme's execution. Substantial efforts are required to maintain these conditions, especially in light of recent programme delays. At the time of writing, BW5 had yet to be announced, with a potential delay of six years until future procurement.

Furthermore, markets in other parts of the world are on the rise, which means local markets are

facing greater competition for investments. For current players in the market, continued delays mean financial losses and idle manufacturing facilities, as well as losses in market confidence.

As a result of the uncertainty the sector has in the past year seen a number of international businesses closures, suspended investment decisions, and manufacturers running on skeleton staff.

### 4.2.2. Maintaining the country's existing manufacturing base

Recognising the REIPPPP's success in attracting these investments, it is important to ensure successful implementation of projects such as the dti's SEZ programme, as well as effective execution of the local content and enterprise development components of the REIPPPP, to maintain the local manufacturing base. Again, a long-term market view — through certainty and clarity on the rollout of the proposed 13.86 GW of wind and solar capacity allocated to RE generation — is crucial to sustaining investor confidence. Beyond the uncertainty experienced by manufacturers lies the risk of projects failing to meet their local content commitments as a result of constrained manufacturing capacity and programme execution. This, in turn, will increase the REIPPPP's reputational risk.

### 4.2.3. Reforming the country's electricity sector

Global trends in electricity sector development indicate that it is typical for traditional



monopolies to resist any sector reform or liberalisation that reduces their market advantage. This is not new or unique to the South African situation. However, in line with the development agenda and the RE sector's contribution, as well as increasingly competitive technology pricing, it is imperative that government acts to facilitate a transition to an electricity sector that is fit for the future.

It has been clearly shown that the national utility's position as the electricity generator and sole transmitter is a source of conflict. This is demonstrated by Eskom's ambiguous commitments on RE procurement in recent months, despite significant improvements in the price competitiveness of solar PV and wind energy.

Such tensions point to an imminent change in the electricity sector. In the new scheme of things, IPPs will play an increasingly important role, with Eskom's traditional dominance being successfully challenged by new market entrants. This transformation goes beyond the RE programme and includes the simultaneous coal and gas IPP programmes that are now underway.

The same shifts are taking place in the embedded generation space, with private end users and municipalities alike seeking increased

levels of autonomy from traditional electricity supply options. Market opportunities in this space are discussed in a separate GreenCape MIR covering the Energy Services market, which comprise energy efficiency and embedded generation.

Directly linked to a shift in the South African electricity sector is the transition of coal-based jobs. The loss of jobs remains a major issue steering the 2018 IRP, with 12.6 GW of coal to be decommissioned by 2030 and 34.4 GW by 2050. CSIR analysis shows that 60 000 jobs in the gas and 110 000 jobs in the PV and wind sector will be created by 2030. However, only a net surplus of 30 000 jobs will be created by 2030 as a result of the decommissioning of 12.6 GW of coal plants.

This can be viewed either as a major obstacle or a unique opportunity to embark on a just transition from coal mining jobs to jobs in RE and Gas. These jobs, however, might not be in the same geographies or employ the same individuals. A great deal of work is already underway to support this transition and provide opportunities to re-skill and re-train, but this will have to be ramped up. This represents an opportunity for training providers and for intergovernmental cooperation, for SA to learn how to manage these transitions and drive resilient job creation.



© Abengoa Solar



CE 2014  
O.F. 51463

Max. Plate Size  
16,000x3,500≥5mm

SWL  
18,000K

ELECTRO PERMANENT MAGNETIC  
PLATE HANDLING SYSTEM

# 5

## Funding and Incentives

**A range of general and sector-funding solutions and incentives is available to investors, manufacturers and service companies in the green economy.**

It covers international sources, such as Development Finance Institutions (DFI), local funding pools including the public and private sector, and a considerable range of tax incentives.

### 5.1. General database web page

The GreenCape Finance Desk hosts a web page<sup>7</sup> with a number of Green Finance resources that cover funding and incentives available to companies in the green economy. A few of the available database are highlighted below.

#### 5.1.1. Green Finance Database

In conjunction with the South African National Energy Development Institute (SANEDI), GreenCape maintains a database of funding sources and primarily dti-driven incentives that may be relevant to green economy investors. The database contains information on more than 100 funding opportunities, including an overview of the opportunity and its 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<sup>8</sup>.

#### 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<sup>9</sup>.

#### 5.1.3. Finfind database

Finfind<sup>10</sup> is an innovative online finance solution that brings together SME 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.

#### 5.1.4. AlliedCrowds database

AlliedCrowds<sup>11</sup> 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.
- You can also contact Allied Crowds to create a customised funding database for you.

This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

<sup>7</sup> <https://www.greencape.co.za/content/focusarea/green-finance-databases>

<sup>8</sup> <https://www.greencape.co.za/assets/Uploads/GreenCape-Finance-Database-v6.xlsx>

<sup>9</sup> <https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf>

<sup>10</sup> [www.finfindeasy.co.za](http://www.finfindeasy.co.za)

<sup>11</sup> <https://alliedcrowds.com/>





# 6

## The Western Cape: Africa's green economy hub

**The Western Cape is a world-class investment destination.**

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 (RE) 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:

**InvestSA One Stop Shop:** Offers convenient investor support on permits, licensing and registrations - all under one roof.

**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 non-financial 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.

# Major market opportunities: Western Cape and South Africa

## Agriculture

### Precision agriculture

Tools, data analysis, local manufacturing & financing.

### Solar energy for agriculture

Minimum market of R120 million (WC) and R420 million (SA) for solar PV in agri & agri-processing.

### Controlled environment agriculture

R600 million potential market (WC), 15% annual growth (WC).

## Energy services (SA-wide)

### Solar PV systems & components

600MWp installed capacity; R1.7bn additional investment in 2018 (R7.7bn to date)

### Local manufacturing & assembly

Solar PV systems and components – systems require compliance with local content regulations

### Energy storage

Keystone of future energy services market; ~R5bn market for demand side management and back-up power by 2035

## Utility scale renewable energy (SA-wide)

### Independent power production

6.3GWp independent power procured, 13.7GWp additional capacity by 2030, based on updated IRP (5.67GWp solar, 8.1GWp wind).

### Rest of Africa

Greater uptake of RE & decentralized systems. Off-take guarantees and local currency debt innovation needed.

### Local manufacturing

Refined local content requirements, with specific components obligated to be locally manufactured e.g. wind towers, tower internals, panel laminating, PV mounting structures

## Waste

### Municipal PPP

Public-private partnership projects of R1.3bn (WC)

### Organic waste treatment

Landfill ban require treatment technologies to process 1 m/t p.a. of organic waste (WC)

### Alternative waste treatment

Cape Town has highest landfill cost in SA & good business case for AWT. R1bn+ invested by solution providers since 2016 (SA)

## Water

### Industrial and Commercial

Water intense food & bev sectors expected gross capital formation of ~R14bn by 2021

### New developments

Green building certifications increased 25-fold since 2010 (SA)

### Municipal

Significant opportunities in metro markets incl. new R5.8bn (417 MLD) Cape Town augmentation programme (WC)

## Bioeconomy & resource efficiency

### Food value retention

At least R600m retained through improved cold chain management & waste reduction (SA)

### Solar thermal

Already installed: R33m (WC), R135m (SA); ~R3.7bn potential market in agri-processing

### Biogas

For electricity, heating & transport; R100m of installations expected by 2023



# 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.

## Why invest in the 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 SADC market.

**Atlantis is a great location and development ready.** 93 hectares of zoned City of Cape Town

land is available for leasing to investors. Bulk infrastructure is in place and Atlantis has new public transport and shipping links and fibre connectivity. 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 information, contact the SEZ's Investment Promotion Facilitator, Jarrod Lyons: [jarrod@greencape.co.za](mailto:jarrod@greencape.co.za)**



# 7

## 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.**

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.

**We have facilitated and supported R17bn of investments in renewable energy projects and manufacturing. From these investments, more than 10 000 jobs have been created. Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under- used resources, we have to date diverted nearly 63,000 tonnes of waste from landfill.**

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, waste and resources.

Figure 13 below shows the different focus areas within each of our programmes.

### ***Benefits of becoming a GreenCape member***

We currently have over 1100 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.



① **Renewable Energy**

Utility-scale projects, localisation of component manufacturing, incentives & financing options, wheeling & energy trading.

② **Energy Services**

Energy efficiency & embedded generation, electric vehicles, alternative basic electrification, incentives & financing options.

③ **Alternative Waste Treatment**

Municipal decision-making & policy & legislative tools on alternative waste treatment options; small-scale biogas, recycling & reuse (dry recyclables, construction & demolition waste).

④ **Western Cape Industrial Symbiosis Programme (WISP)**

The team matches businesses to share unused resources, cut costs & create value. They also support entrepreneurs to identify & realise new business opportunities in the waste industry.

⑤ **Water**

Water provision & economic development; greentech opportunities for water use efficiency, treatment & reuse, business water resilience.

⑥ **Sustainable Agriculture**

Precision-, conservation- and controlled environment- agriculture; valorisation of wastes to high value bio- products, including bio-energy.

Figure 13: GreenCape’s focus areas

**Support through the International Cleantech Network**

GreenCape’s membership of the International Cleantech Network (ICN) gives our members access to international business opportunities in countries where other cleantech clusters are based (mainly Europe and North America).

To become a member or to get your ICN passport, please contact GreenCape or visit our website: [www.greencape.co.za](http://www.greencape.co.za)











# 8

## References

- Bladergroen, B.J. 2017. Li-Ion Battery Development in South Africa (2011 – 2017). SA Energy Storage Conference 2017, University of the Western Cape.
- Department of Energy. 2013. Integrated Resource Plan for Electricity 2010- 2030. Update Report 2013. November 2013.
- Department of Energy. 2018. Draft Integrated Resource Plan (Draft IRP 2018). August 2018.
- Eberhard, A. & Naude, R. 2017. The South African Renewable Energy IPP Procurement Programme. Review, Lessons Learned & Proposals to Reduce Transaction Costs. Graduate School of Business, University of Cape Town.
- Department of Trade and Industry (dti). 2017. The wind energy industry localization roadmap in support of large-scale roll out in South Africa. Integrated final report, January 2017. Prepared by Urban-Econ Development Economists and EScience Associates.
- Eskom. 2018. Week-on-week energy availability factor (EAF) for 2016, 2017 and 2018 to date. Concerns mount over Eskom's medium-term system adequacy outlook, 23 September 2018. EE Publishers. From <http://www.ee.co.za/article/concerns-mount-over-eskoms-medium-term-system-adequacy-outlook.html> [Accessed on 8 December 2018]
- Independent Power Producers Office (IPPO). 2017. Independent Power Producers Procurement Programme, an Overview. March 2017.
- International Energy Agency (IEA). Renewables 2018. Available at <https://www.iea.org/renewables2018/> [Accessed on 8 December 2018]
- Magyari, S. 2017. 30 lowest solar PPSs worldwide. SolarPlaza, January 2017. Available at <https://www.solarplaza.com/channels/top-10s/11647/global-pv-prices-show-continuous-decline/>.
- Minerals Council South Africa. 2018. National Coal Strategy for South Africa 2018. Chamber of Mines Coal Leadership Forum.
- NERSA. 2017. Monitoring renewable energy performance of power plants. Issue 10, September 2017.
- Wright, J.G., Bischof-Niemz, T. Calitz, J., Mushwana, C. Van Heerden, R. & Senatla, M. 2017. Formal comments on the Integrated Resource Plan (IRP). Update Assumptions, Base Case and Observations 2016. CSIR Energy Centre. April 2017.

