



REIPPPP focus on wind

As at 31 December 2020

Purpose and outline of this report

The purpose of this report is to provide a high level "at a glance" overview of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) with the focus on the contribution from wind projects in particular.

The REIPPPP is located within the overall South African policy framework and notably in the:

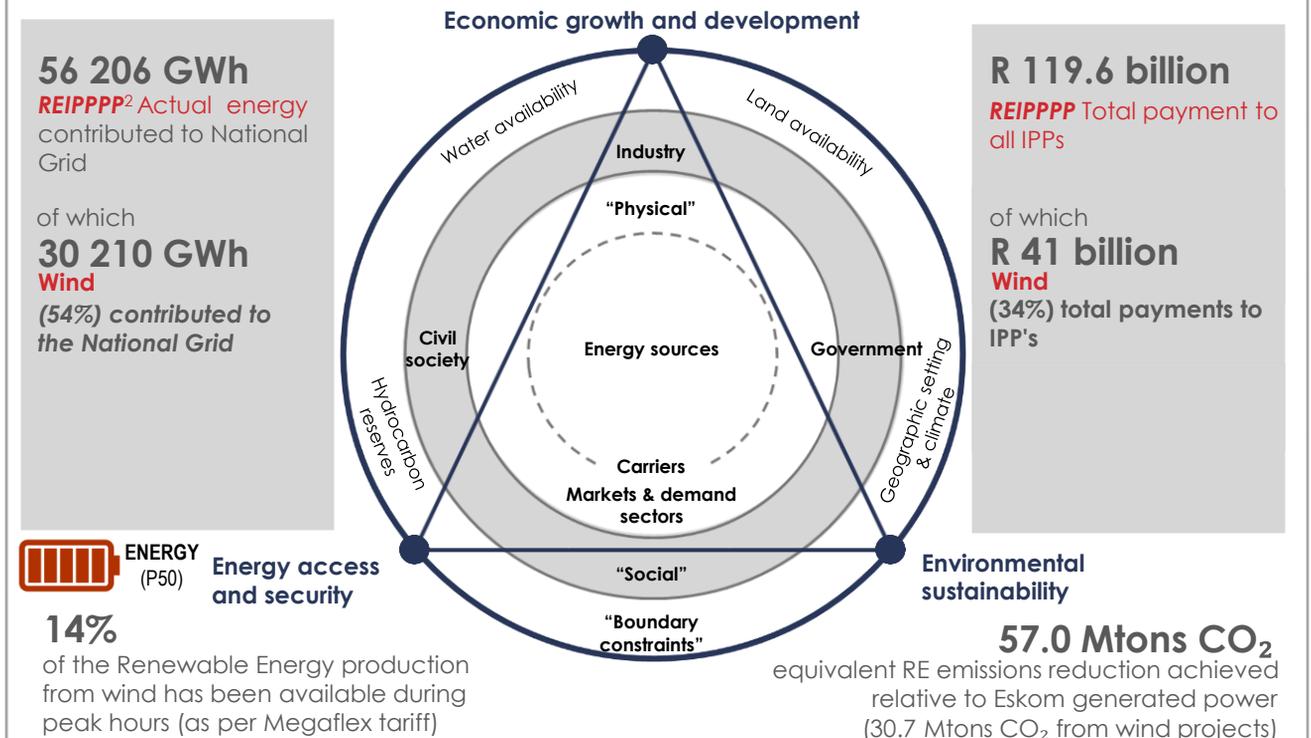
- Respective White Papers on Energy Policy (1998) and Renewable Energy (2003);
- The Electricity Regulation Act (2006) and National Environmental Management Act (1998);
- The South African National Development Plan (NDP);
- The Integrated Energy Plan (IEP); and
- The Integrated Resource Plan (IRP)⁴ for Electricity.

Renewable Energy (RE) capacity for the programme is pursued from the different RE technologies identified in the IRP, including onshore wind, solar photovoltaic (PV), concentrating solar power (CSP), biomass, biogas, landfill gas and small hydroelectric power plants. By the end of December 2020, the REIPPPP had successfully implemented seven bid windows² from which it procured 6 422 megawatt (MW) from 112 independent power producers (IPPs). Of these, 36 are wind IPPs to contribute 3 366 MW³ to the electricity grid.

South Africa is perhaps best known for its solar resource, but the Wind Atlas for South Africa (WASA) has also confirmed the country's exceptional wind resources. IPPs participating in the REIPPPP have been harvesting this clean energy resource very successfully, making a significant contribution to the country's energy needs, economic development and environmental sustainability in the process (refer to the energy triangle, for wind IPPs under the REIPPPP, below).

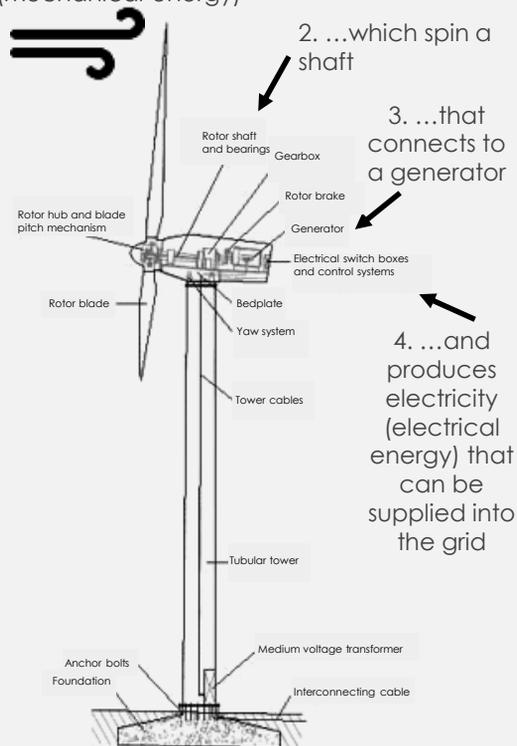
This publication celebrates the electrical energy and economic development contribution wind IPPs have made and continue to make in South Africa's pursuit of a cleaner, cost effective electricity mix.

Key REIPPPP Energy Triangle¹ Facts: Wind Technology (for period 11/2013 – 12/2020)



Note 1. Source: World Economic Forum – Global Energy Architecture Performance Index Report (2013). **Note 2.** BW1, BW2, BW3, BW3.5, BW4 and smalls BW1 (1S2) and BW2 (2S2). **Note 3.** Includes 2 smalls projects with a capacity of 9 MW. **Note 4.** The IRP 2019 was promulgated in October 2019 and replaced the IRP 2010 as the country's official electricity infrastructure plan.

1. Wind turns the blades
(mechanical energy)



2. ...which spin a shaft

3. ...that connects to a generator

4. ...and produces electricity (electrical energy) that can be supplied into the grid

Wind technology basics

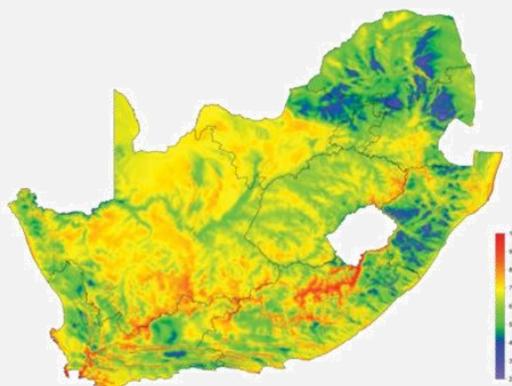
A wind turbine is a rotary device that extracts energy from the wind. The wind turns the blades (mechanical energy), which spin a shaft that connects to a generator and produces electricity (electrical energy). The mechanical energy can be used directly by machinery or the energy can be converted to electricity.

Wind resource potential in South Africa

Wind power was anticipated, by both the IRP and independent researchers, as the technology most likely to contribute significantly to the South African energy mix, because of technology maturity and established global capacity. South Africa furthermore offers exceptional wind resource potential throughout most of the country, but particularly along our extended 3 000 km coastline.

The country's wind resource has been comprehensively mapped in a **publicly available Wind Atlas** to support planning and wind power development.

Wind Atlas of South Africa (WASA), large scale high resolution wind resource map



Mean wind speed (ms⁻¹) @ 100m WASP modelled, 250 m resolution



www.
wasaproject.info or
wasa.csir.co.za

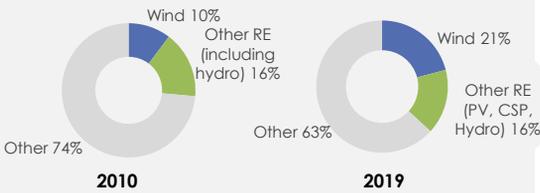
The first phase of the project (focusing on Western Cape, parts of the Eastern Cape and Northern Cape Provinces) was initiated in June 2009 and concluded in April 2014, delivering a large-scale, high-resolution, measurement-based, verified numerical Wind Atlas for South Africa that is publicly available, free of charge, for planning and development of wind farms and off-grid electrification. The level of accuracy and granularity of the data have proven invaluable for wind power development, confirming that traditional climatology and global models underestimated resource potential in the country by as much as 5%.

During the second phase, WASA 2, five additional wind measurement stations were installed in the remaining parts of the Eastern Cape, and was extended to include KwaZulu Natal and the Free State Provinces. WASA 2 commenced in March 2013 and concluded in 2018.

Four (4) additional measurement stations were erected in beginning of September 2018 in the Northern Cape Province under WASA 3. The measurements results of WASA 1-3, which covered an estimated 75% of South Africa's land cover was used to extrapolate the prevailing wind conditions for the rest of South Africa.

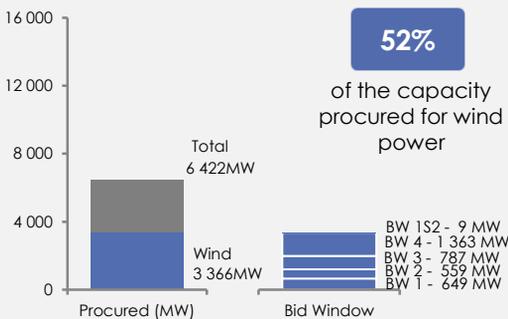
IRP 2030 electricity mix

Technology capacity share 2010 vs 2019 (%)



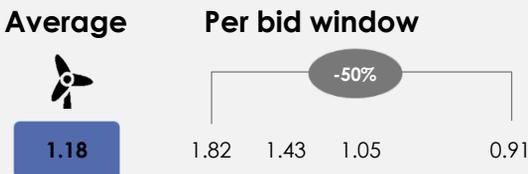
Capacity procured³

Wind as share of total procured



Average wind energy tariffs⁴

R/kWh



Wind power in South Africa's electricity plan to 2030

In terms of South Africa's Integrated Resource Plan 2010, wind was expected to contribute 10% (9 200 MW¹) towards the country's electrical power capacity by 2030. The IRP 2019 was promulgated in October 2019 and replaced the IRP 2010 as the country's official electricity infrastructure plan. In the IRP 2019, the share of wind in 2030 has increased to 21% (17 742 MW²).

The Minister of Mineral Resources and Energy has to date determined 6 800 MW of solar and wind power to be procured from IPPs (under the IRP 2019), of which 4 800 MW of wind power needs to be procured between 2022 and 2024.

To date, 3 366 MW of wind power has been procured under determinations made under the IRP 2010. This represents 52% of the RE technology mix capacity procured to date.

Offering an increasingly cost competitive energy alternative

In line with international experience, the price of renewable energy is increasingly cost competitive with conventional power sources.

The REIPPPP has effectively captured this global downward trend with prices decreasing in every bid window (BW).

Energy procured by the REIPPPP is progressively more cost effective, with wind as one of the cheapest forms of generating electricity. The real price for wind power has dropped by 50% to R0.91/kWh (in April 2020 terms).

Note 1. Wind power to be constructed between 2010 and 2030, which includes 8 400 MW new build, 700 MW committed build and 100 MW from Eskom's Sere wind farm. **Note 2.** Including committed / already contracted capacity (2019 – 2022) as well as new capacity (2022 to 2030). **Note 3.** Procured capacity includes contribution from smalls projects – 2 projects with a capacity of 9MW. **Note 4.** Fully indexed price, inflation adjusted (2020).

Procured¹ vs operational

Wind capacity (MW)



3 366

Megawatts

from **36**

IPP projects



Carbon emission reductions

Projected using P50 (Mton CO₂)

Projected (P50)

12.1

Mton CO₂ / annum



59%

Wind contribution to total

Carbon emission reductions ITD

of which

57.0

Mton CO₂

30.7 Mtons CO₂

from wind power



Wind power procured

By the end of December 2020, 3 366 MW¹ of wind power, from 36 wind projects, had successfully been procured under South Africa's REIPPPP.

The South African portfolio includes some of the largest wind power plants in the world, with the average project size for the 36 wind IPPs being 93.5 MW. The collective wind capacity will deliver an annual projected energy output of 11 886 GWh³. This is enough to power 3.6 million households² annually.

By the end of December 2020, 26 wind IPPs had started commercial operation, contributing 2 395 MW capacity to the national power system (71% of total wind power procured).

Contributing to cleaner energy

The electrical power generated by renewable energy sources contributes to the national objectives for a cleaner energy mix. The 112 IPP projects that have already been procured are expected to reduce the CO₂ emissions annually by 20.5 Mtons (using P50³ figures). Of this, the 36 wind IPPs, that have been procured to date, are projected to contribute a reduction of 12.1 Mtons CO₂ (59%).

Over the past 12 month period alone (ending December 2020), the operational wind projects have reduced CO₂ emissions by 6.4 Mtons (already 53% of the total 12.1 Mtons annual P50 projection for wind IPPs).

Realised (12 month period)



53%

6.4 Mtons CO₂

Since the first REIPP started commercial operations at the end of 2013, 56 206 GWh have been generated, reducing carbon emissions by 57.0 Mtons. Of this, wind projects have contributed 30 210 GWh and reduced carbon emissions by 30.7 Mtons.

Note 1. Procured capacity includes 9 MW procured by smalls projects in smalls BW1 (1S2). **Note 2.** Based on an annual usage for an average South African home of 3 319 kWh. **Note 3.** Projected annual energy contribution – P50 refers to probabilities for annual energy production which are expressed as P values. A P50 figure is the level of generation that is forecasted to be exceeded in 50% of years over a 10 year (or sometimes 20 year) period.

REIPPPP energy generation

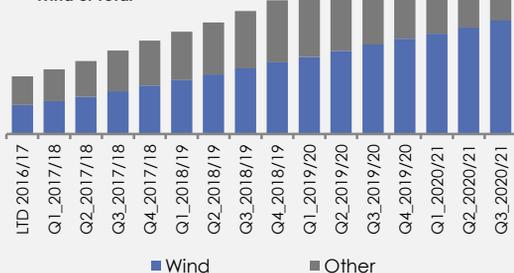
Energy ITD (GWh)



Gradual commissioning of 26 wind projects

54%

Wind of Total



Energy Generation ITD

56 206 GWh

of which

30 210 GWh

from wind power



Energy supplied

The first REIPP (a solar PV project) reached COD, supplying electrical power to the grid, in November 2013. Since inception, 56 206 GWh of energy has been generated by renewable energy sources from the 76 projects that are operational.

The first wind REIPP became operational on 1 February 2014, and since then wind power has contributed 30 210 GWh of energy, which is more than half of all renewable energy produced until the end of December 2020. Of this energy, 1 807 GWh was generated during this reporting quarter (October to December 2020).

The energy generated over the past 12 months (January 2020 to December 2020), from the 26 projects that have reached COD, was 6 317 GWh.

This 6 317 GWh represents 78% of the annual projected energy production by all the operational Wind IPPs (P50¹ for the 26 operational IPPs is 8 144 GWh). Twenty-two (22) of the 26 projects have been operational for more than 1 year.

Individually, two (2) of these 22 wind projects (9%) have exceeded their P50¹ projections, while 64% of the IPPs (14 projects) achieved greater than 90% of their P50¹ projections. Eight (8) projects fall short of achieving greater than 90% of their P50¹ projections.

Energy supplied to the grid

Energy generated (GWh)



Projected generation for active Wind projects (P50)

11 853 GWh/a

Total Realised Past 12 month period 6 317 GWh

Q

1 807 GWh

Operational Projects 8 144 GWh/a

Achievement of P50¹ projections

No. of projects



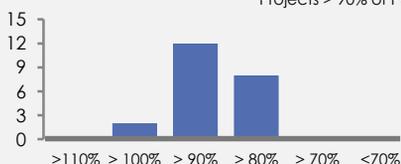
Projects in COD > 1 year

64%

Projects > 90% of P50



22



Note 1. Projected annual energy contribution.

Committed investments

Bid window 1 to 4, 1S2 & 2S2 (Rand billion)



209.7

Rand billion

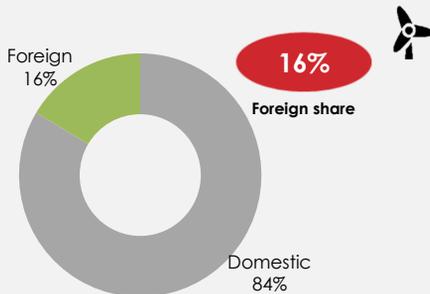
Committed (**total project costs¹**) for IPP development in BW 1, 2, 3, 3.5, 4, 1S2 & 2S2

of which

R80.6 billion from wind power

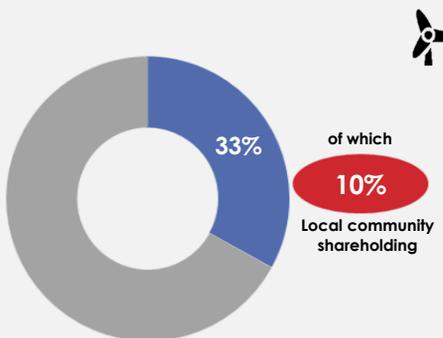
Foreign equity and financing share

Bid window 1 to 4, 1S2 & 2S2 (percentage)



Shareholding by black South Africans

Active projects³



Investment attracted for wind power

Wind IPPs have attracted significant investment, in the development of these projects, into the country. The total investment (total project costs¹), of all projects under construction and projects in the process of reaching financial closure⁴, is R209.7 billion of which R80.6 billion is from onshore wind IPPs.

The expected project value² for these 36 wind projects procured to date is R59.8 billion and at end December 2020, R45.6 billion (76%) had actually been spent by 34 active wind projects (in BW 1 to 4).

Wind IPPs have attracted R13.2 billion in foreign investment (debt and equity) in the seven bid windows (BW1 – BW4, 1S2 and 2S2), of which R12.1 billion is foreign equity. Foreign investment has therefore represented 16% of total investment in wind projects under the REIPPPP to date. Several factors may contribute to local dominance, such as low currency exposure (international lenders may be reluctant to lend to projects that earn revenue in Rands). However, whether firms borrow locally or internationally, IPPs still provide all the funds for the construction and operation of the power plans, bears all the risks of the project, and only start recovering its investment when the power plant starts generating power based on the actual performance of the plant. Lower than anticipated performance will lead to lower than anticipated returns and ability to serve the debt raised (locally or internationally).

Equitable shareholding in wind IPPs

South African (local) equity shareholding across BW1 to BW4, 1S2 and 2S2 equates to 48% (R11.1 billion) of total equity (R23.2 billion). Black South Africans own, on average, a 33% share of wind projects that have reached financial close.

Shareholding by black South Africans has been secured across the value chain.

Black people in local communities also hold ownership in the IPP projects operating in or nearby their vicinities. On average, black people in local communities own 10% of IPPs at financial close.

Note 1. Total Project Costs means the total capital expenditure to be incurred up to the commercial operations date in the design, construction, development, installation and/or commissioning of a project, which is equal to the total debt and equity related to a project as reported at commercial close. **Note 2.** Project Value means the total project cost that involves the capital costs and costs of services procured for the construction of a project, but excludes finance charges, land costs, mobilisation fees to the operations contractor and the costs payable to the distributor, national transmission company and/or a contractor for the distribution or transmission connection works. **Note 3.** Active projects are projects currently in construction (or in operation) i.e. BW1, BW2, (16 of 17 projects) BW3, BW3.5 (no wind projects) and BW4. **Note 4.** BW3 (one project), and 1S2 and 2S2 have not yet reached financial close.

REIPPPP operational capacity



Capacity (MW)



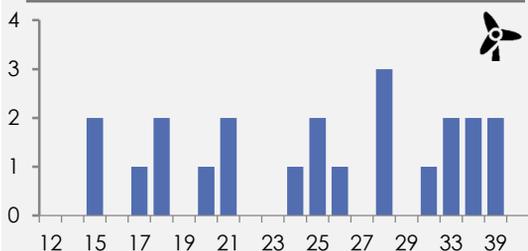
Wind power delivering capacity quickly

By the end of December 2020, 27 projects with a capacity of 2 528 MW were scheduled to have reached commercial operations. The actual achievement has been 26 projects delivering 2 395 MW³ (95% of the scheduled plan and a shortfall of 132 MW).



Distribution of lead times

Construction (in months) for completed projects

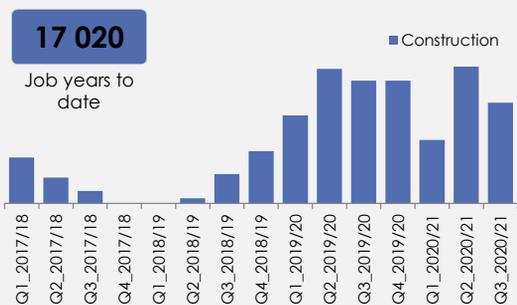


A few IPPs that have started operations have done so below the contracted capacity. As a result there was a 14.7 MW shortfall between contracted and delivered capacity for active¹ projects at the end of December 2020.

The average lead time for the 26 projects to reach commercial operations was 805 days (2.2 years). Lead times across the portfolio varied from 15 to 39 months.

Construction Employment

Actual (Job years) (active projects¹)

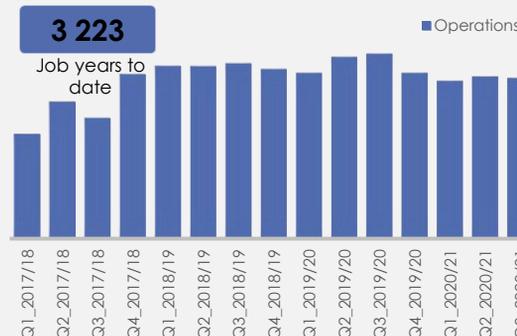


Employment creation

During the construction of REIPPs, numerous employment opportunities are being created. Active RE projects (projects that have commenced construction and/or entered operations¹) delivered 45 601 job years² for SA citizens while in construction, of which 17 020 (37%) of these employment opportunities were for the construction of wind IPPs. This is 50% more than planned, since the active wind IPPs have committed to create 11 358 job year opportunities for SA citizens during the construction phase.

Operations Employment

Actual (Job years) (active projects¹)



The construction phase offers a high number of opportunities over shorter durations, while the operations phase requires fewer people, but over an extended operating period.

The 26 wind IPPs that have successfully reached commercial operations to date have reported 3 223 job years for SA citizens. This is 16% of the job years for SA citizens planned (20 180) over the operational life (20 years) by projects that have reached COD to date, with these 26 projects only being in operation an average of 52 months (approximately 4.3 years). Over the operational life of the full wind portfolio (BW 1 to BW4, 1S2 and 2S2), 32 140 job years are expected to be created for SA citizens.

Note 1. Actuals tracked against Active projects – referring to all projects that have commenced construction and/or entered operations i.e. currently BW1, BW2, (16 of 17 projects) BW3, BW3.5 (no wind projects) and BW4. **Note 2.** The equivalent of a full time employment opportunity for one person for one year. **Note 3.** The 26 projects planned to deliver 2 409.8 MW, but only achieved 2 395 MW.

Local content spend¹

(Rand billion)

43%

local content planned
by wind IPPs

planned



R25.5
Rand billion

actual

(at December 2020)

R 21.6 billion

47%

of total project value for
wind IPPs realised to date

Preferential procurement



Total **B-BBEE spend** by wind IPPs during construction and operations until end December 2020:

R 25.7 billion

91%

of total procurement spend
by wind IPPs achieved



Total procurement from **QMEs & EMEs** by wind IPPs during construction and operations until end December 2020:

R 8.1 billion

28%

of total procurement spend
by wind IPPs achieved



Total procurement from **women owned vendors** by wind IPPs during construction and operations until end December 2020:

R 2.4 billion

8%

of total procurement spend
by wind IPPs

Enterprise development



R 4.8 billion
committed



R164.8 million

Actual ED spend by
wind IPPs until end
December 2020

of which
R4.4 billion

committed to local communities

Socio-economic development



R 14.1 billion
committed



R544.6 million

Actual SED spend by
wind IPPs until end
December 2020

of which
R13.0 billion

committed to local communities

Local content

Local content commitments by the 36 wind IPPs amount to R25.5 billion or 43% of total project value (R59.8 billion for procured wind projects). Actual local content spend reported for the 26 wind IPPs that have started (and/or concluded) construction amounts to R21.6 billion against a corresponding project value (as realised to date) of R45.6 billion. This means 47% of the project value for wind projects has been locally procured, exceeding the 43% commitment from IPPs, with 10 wind IPPs that still need to commence construction.

Preferential procurement

The actual share of procurement spend by the 34 active wind IPPs, from B-BBEE suppliers (R25.7 billion for construction and operations) is currently reported as 91%, which is significantly higher than the target of 60% and commitment of 76% made by the 36 procured wind IPPs.

Total procurement spend by active wind IPPs from Qualifying Small Enterprises (QME) & Exempted Micro Enterprises (EME) has amounted to 8.1 billion (construction and operations) to date, which is 28% of total procurement spend to date (while the required target is 10% and the commitment by procured wind IPPs is 8%).

Procurement by active wind IPPs from women-owned vendors of 8% of total procurement spend has been achieved against a 5% target and 4% commitment by procured wind IPPs.

Enterprise development

Enterprise development contributions² committed by the 36 procured wind IPPs amount to R4.8 billion. Of the total commitment, R4.4 billion is specifically allocated for local communities where the wind IPPs operate. A total contribution of R164.8 million has already been made for enterprise development by the 26 operational wind IPP projects.

Socio-economic development

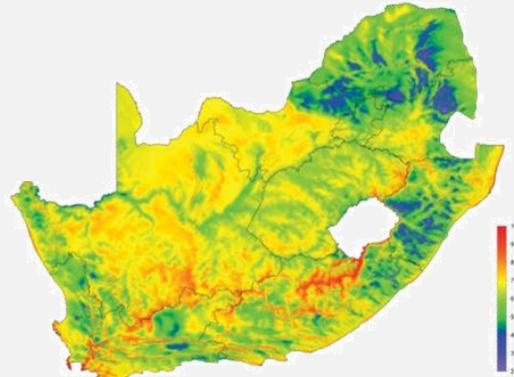
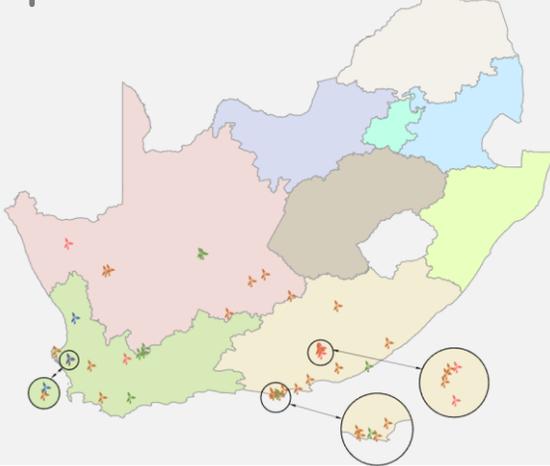
A total contribution of R14.1 billion has been committed to SED initiatives by the 36 procured wind projects. Of the total commitment, R13.0 billion is specifically allocated for local communities where the wind IPPs operate. SED contributions² made by the 26 operational wind IPPs amount to R544.6 million to date.

Note 1. Local content is expressed as % of total project value. **Note 2.** Socio-economic development and Enterprise Development obligations become effective only when operations commence and revenue is generated.

Geographic distribution



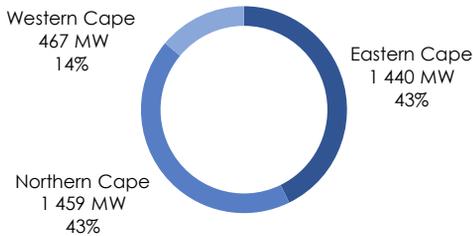
Wind Atlas of South Africa (WASA), Large Scale High Resolution Wind Resource map



Wind IPPs are largely located along the coastal regions of the Eastern Cape and Western Cape provinces, based on the strong wind flows along these shores. Surprisingly, a large share of wind IPPs are also located in the Northern Cape. Northern Cape and Eastern Cape together make up 86% of the capacity with 1 459 MW and 1 440 MW located respectively in each province. The Eastern Cape has the highest number of wind projects at 16, while the Northern Cape has 12 projects and the Western Cape has 8.

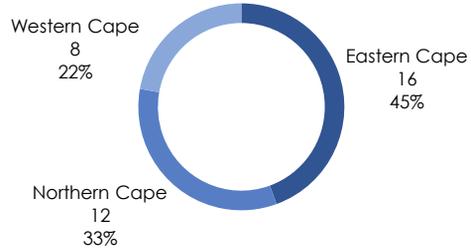
Share of wind capacity

Provincial distribution of capacity (MW)



Share of wind projects

Provincial distribution of projects (#)



Province	Provincial totals		Technology share	
			OW	Other RE
Eastern Cape	Number of projects	17	16	1
	Capacity procured (MW) ¹	1 509	1 440	70
	Capacity online (MW) ²	1 205	1 136	70
Northern Cape	Number of projects	59	12	47
	Capacity procured (MW) ¹	3 621	1 459	2 162
	Capacity online (MW) ²	2 676	801	1 875
Western Cape	Number of projects	14	8	6
	Capacity procured (MW) ¹	606	467	139
	Capacity online (MW) ²	592	458	134
Other Provinces	Number of projects	22	0	22
	Capacity procured (MW) ¹	685	0	685
	Capacity online (MW) ²	475	0	475

Note 1. BW1 – 4 and smalls BW 1 and BW2. One BW3 project and the smalls projects have not yet signed. **Note 2.** Excluding projects in early operations.

OW – Onshore Wind, Other RE includes PV – Photovoltaic, BM – Biomass, LG – Landfill Gas, SH – Small Hydro, CS – Concentrated Solar

Glossary of icons

These icons are used in the document to represent the following concepts:

ENERGY (P50)



Energy (kWh, MWh or GWh) production / generation projected with a 50% probability that it will be achievable for the established capacity

CAPACITY



Generation capacity (kW, MW or GW) i.e. the rated output capability of the power plants



Investment



Job creation

Renewable energy source | technology type:

SOLAR



Solar CSP
(Concentrated Solar Power)



Solar PV
(photovoltaic)

WIND



Wind generation

HYDRO



Small hydro

BIO



Biomass

WASTE



Landfill gas /
waste to energy

Colour convention used [RGB]

Colours used to denote technologies



Solar PV [220 | 89 | 36]



CSP [245 | 149 | 1]



Wind [82 | 109 | 176]



Landfill, hydro, biomass, biogas
(when treated as a group e.g. IRP)
[209 | 40 | 46]



Hydro [151 | 167 | 208]



Landfill [152 | 154 | 172]



Biogas [180 | 179 | 146]



Biomass [155 | 187 | 89]

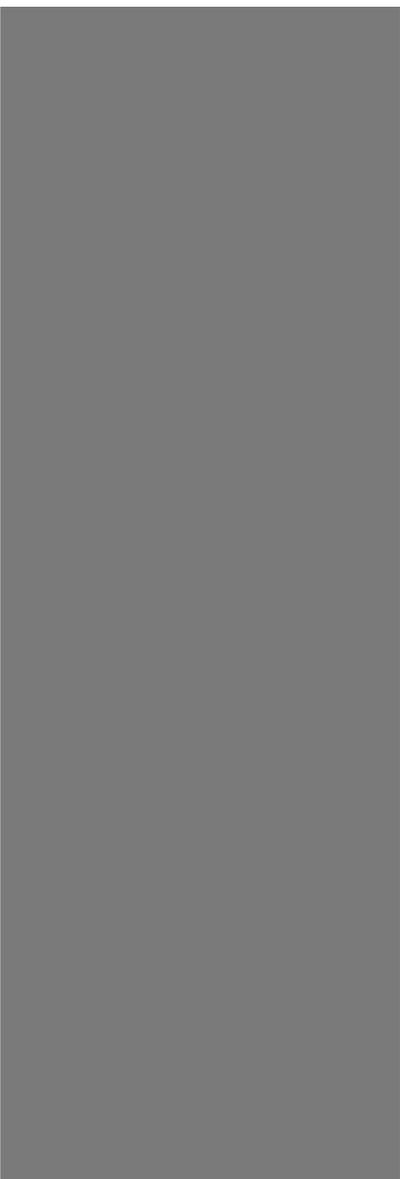
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