



REIPPPP focus on wind

As at 31 December 2021



**mineral resources
& energy**
Department
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

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IPP Programme - 10 years of Empowering Change

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:

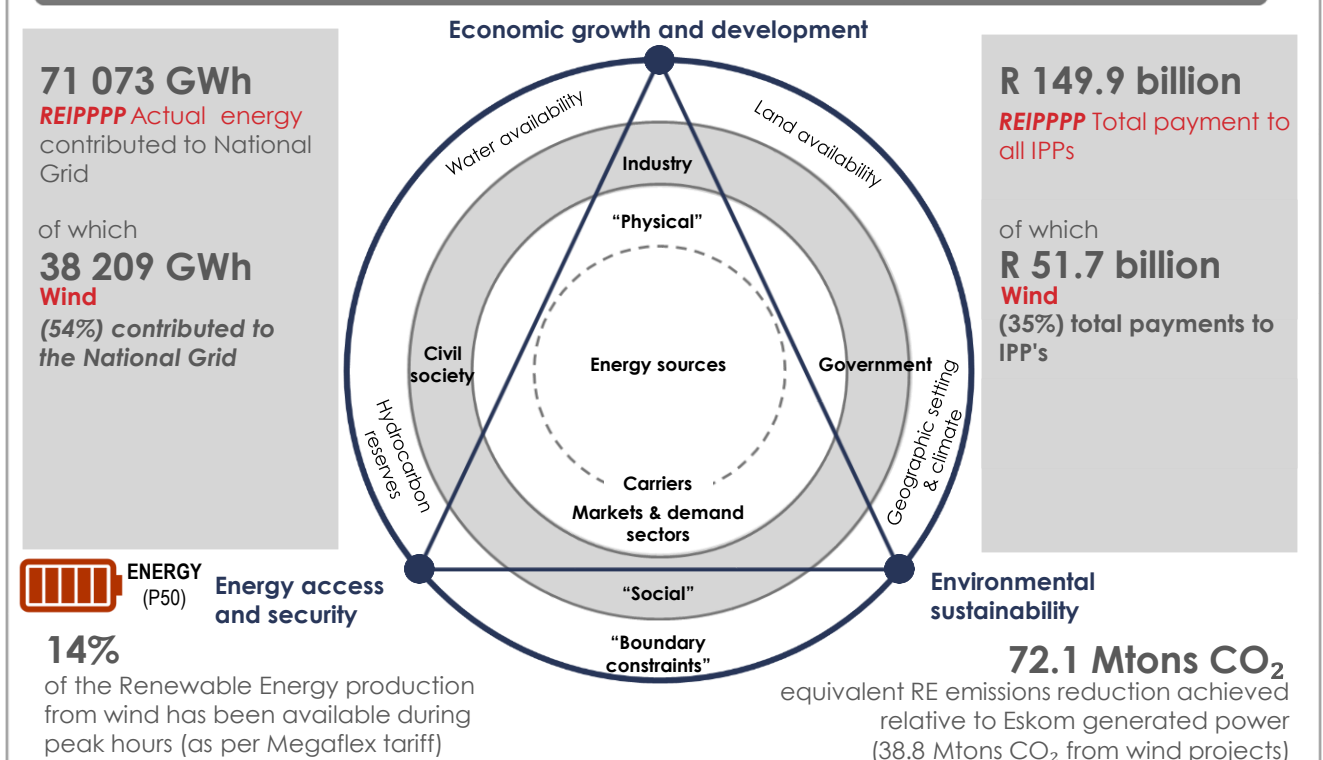
- Respective White Papers on Energy Policy (1998) and Renewable Energy (2003);
- The Electricity Regulation Act (2006) and National Environmental Management Act (1998);
- The South African National Development Plan (NDP);
- The Integrated Energy Plan (IEP); and
- The Integrated Resource Plan (IRP)² for 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. The REIPPPP has successfully procured 6 323 megawatt (MW) in Bid Window (BW) 1 to BW4, from 92 independent power producers (IPPs). Of these, 34 are wind IPPs to contribute 3 357 MW 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).

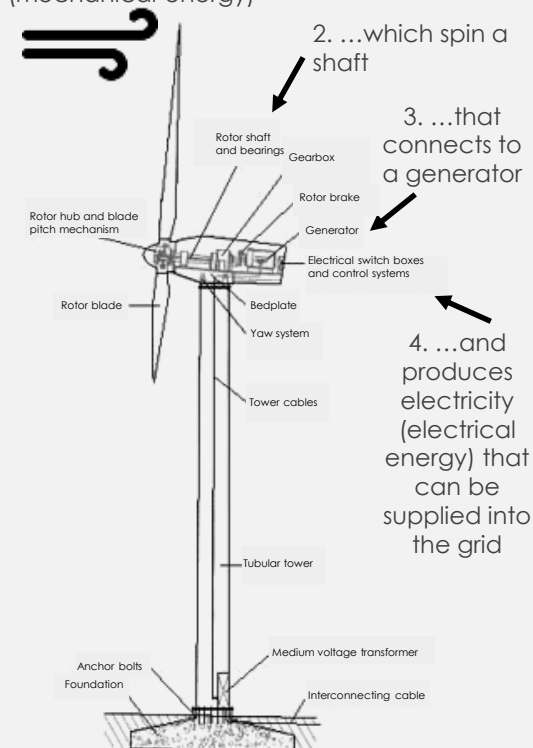
This publication celebrates the electrical energy and economic development contribution wind IPPs have made and continue to make in South Africa's pursuit of a cleaner, cost effective electricity mix.

Key REIPPPP Energy Triangle¹ Facts: Wind Technology (for period 11/2013 – 12/2021)



Note 1. Source: World Economic Forum – Global Energy Architecture Performance Index Report (2013). **Note 2.** 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)



Wind technology basics

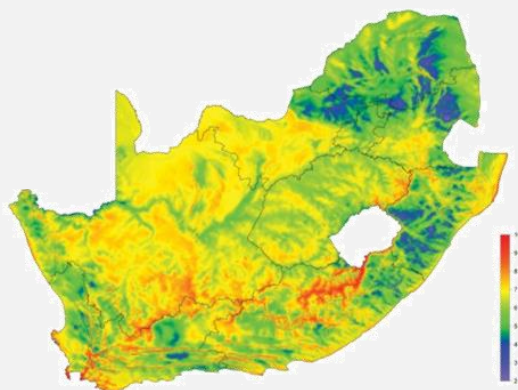
A wind turbine is a rotary device that extracts energy from the wind. The wind turns the blades (mechanical energy), which spin a shaft that connects to a generator and produces electricity (electrical energy). The mechanical energy can be used directly by machinery or the energy can be converted to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

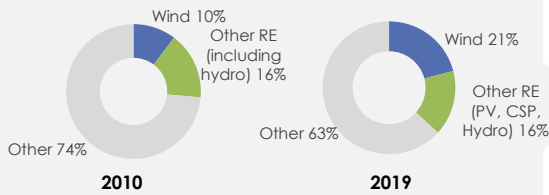
The first phase of the project (focusing on Western Cape, parts of the Eastern Cape and Northern Cape Provinces) was initiated in June 2009 and concluded in April 2014, delivering a large-scale, high-resolution, measurement-based, verified numerical Wind Atlas for South Africa that is publicly available, 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 (%)

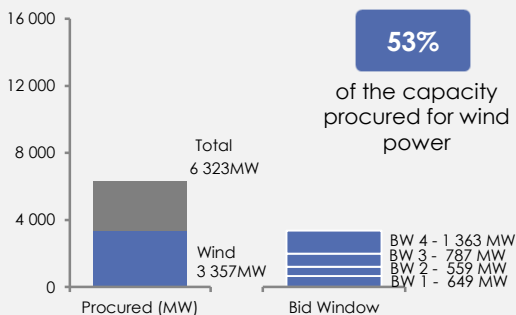


Wind power in South Africa's electricity plan to 2030

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).

Capacity procured

Wind as share of total procured in BW1-4

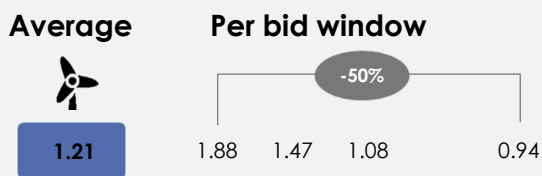


The Minister of Mineral Resources and Energy has to date determined 6 800 MW of solar and wind power to be procured from IPPs (under the IRP 2019), of which 4 800 MW of wind power needs to be procured between 2022 and 2024.

To date, 3 357 MW of wind power has been procured in BW1 – 4 under determinations made under the IRP 2010. This represents 53% of the RE technology mix capacity procured to date.

Average wind energy tariffs³

R/kWh



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.

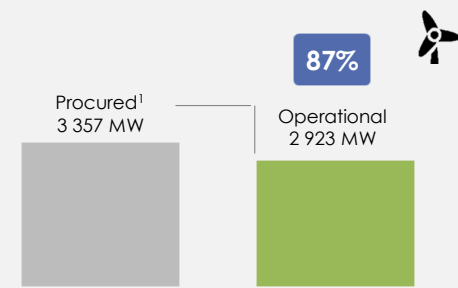
The REIPPPP has effectively captured this global downward trend with prices decreasing in every bid window (BW).

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 R0.94/kWh (in April 2021 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.** Fully indexed price, inflation adjusted (2021).

Procured¹ vs operational

Wind capacity (MW)



3 357

Megawatts

from

34

IPP projects



3.6 million households

Carbon emission reductions

Projected using P50 (Mton CO₂)



Projected (P50)

12.0

Mton CO₂ / annum



60%

Wind contribution to total

Carbon emission reductions ITD

of which

72.1

Mton CO₂

38.8 Mtons CO₂

from wind power



Wind power procured

By the end of December 2021, 3 357 MW of wind power, from 34 wind projects, had successfully been procured under South Africa's REIPPPP in BW1 - 4.

The South African portfolio includes some of the largest wind power plants in the world, with the average project size for the 34 wind IPPs being 98.7 MW. The collective wind capacity will deliver an annual projected energy output of 11 817 GWh². This is enough to power 3.6 million households³ annually.

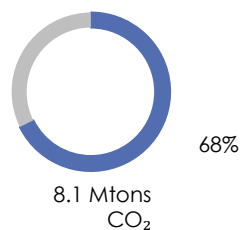
By the end of December 2021, 31 wind IPPs had started commercial operation, contributing 2 923 MW capacity to the national power system (87% of total wind power procured).

Contributing to cleaner energy

The electrical power generated by renewable energy sources contributes to the national objectives for a cleaner energy mix. The 92 IPP projects that have already been procured in BW1 – BW4 are expected to reduce the CO₂ emissions annually by 20.1 Mtons (using P50² figures). Of this, the 34 wind IPPs, that have been procured to date, are projected to contribute a reduction of 12.0 Mtons CO₂ (60%).

Over the past 12 month period alone (ending December 2021), the operational wind projects have reduced CO₂ emissions by 8.1 Mtons (68% of the total 12.0 Mtons annual P50 projection for wind IPPs).

Realised (12 month period)



68%

8.1 Mtons
CO₂

Since the first REIPP started commercial operations at the end of 2013, 71 073 GWh have been generated, reducing carbon emissions by 72.1 Mtons. Of this, wind projects have contributed 38 209 GWh and reduced carbon emissions by 38.8 Mtons.

Note 1. In BW1 to BW4. **Note 2.** 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. **Note 3.** Based on an annual usage for an average South African home of 3 319 kWh.

REIPPPP energy generation

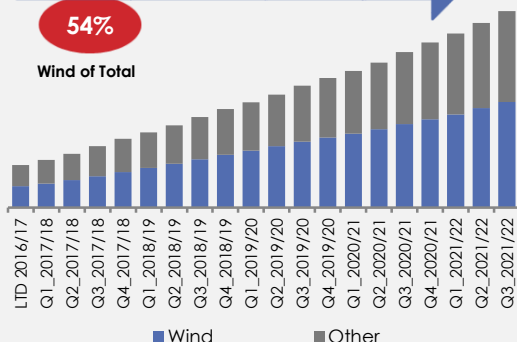
Energy ITD (GWh)



Gradual commissioning of 31 wind projects

54%

Wind of Total



Energy Generation ITD

71 073
GWh

of which

38 209 GWh

from wind power

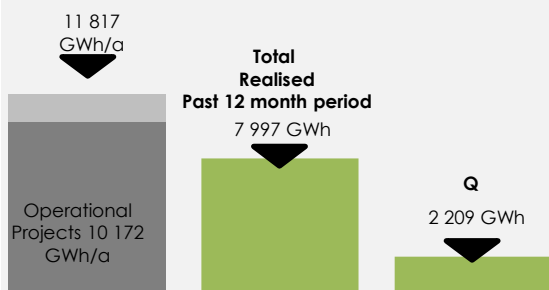


Energy supplied to the grid

Energy generated (GWh)



Projected generation for active Wind projects (P50)



Achievement of P50¹ projections

No. of projects



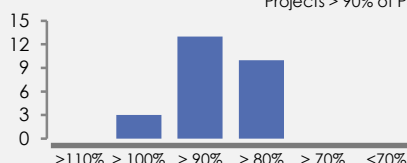
Projects in
COD > 1 year

62%

Projects > 90% of P50



26



Energy supplied

The first REIPP (a solar PV project) reached COD, supplying electrical power to the grid, in November 2013. Since inception, 71 073 GWh of energy has been generated by renewable energy sources from the 85 projects that are operational.

The first wind REIPP became operational on 1 February 2014, and since then wind power has contributed 38 209 GWh of energy, which is more than half of all renewable energy produced until the end of December 2021.

Of this energy, 2 209 GWh was generated during this reporting quarter (October to December 2021).

The energy generated over the past 12 months (January 2021 to December 2021), from the 31 projects that have reached COD, was 7 997 GWh.

This 7 997 GWh represents 79% of the annual projected energy production by all the operational Wind IPPs (P50¹ for the 31 operational IPPs is 10 172 GWh). This achievement is in the context of only twenty-two (26) of the 31 projects having been operational for more than 1 year.

Individually, three (3) of these 26 wind projects (12%) have exceeded its P50¹ projections, while 62% of the IPPs (16 projects) achieved greater than 90% of their P50¹ projections. Ten (10) projects fall short of achieving greater than 90% of their P50¹ projections.

Note 1. Projected annual energy contribution.

Committed investments

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



209.6

Rand billion

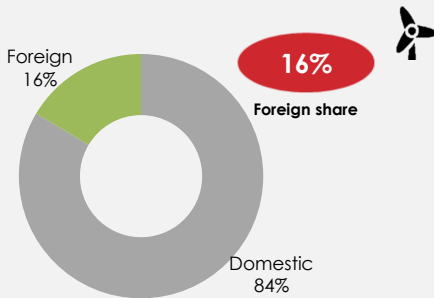
Committed **(total project costs¹)** for IPP development in BW 1, 2, 3, 3.5 & 4

of which

R80.3 billion from wind power

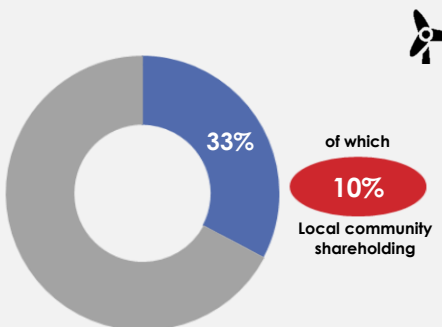
Foreign equity and financing share

Bid window 1 to 4 (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 procured projects⁴ in BW1 to BW4, is R209.6 billion of which R80.3 billion is from onshore wind IPPs.

The expected project value² for these 34 wind projects procured to date is R59.5 billion and at end December 2021, R52.1 billion (87%) had actually been spent by 34 active wind projects (in BW 1 to 4).

Wind IPPs have attracted R13.1 billion in foreign investment (debt and equity) in BW1 – BW4, of which R12.0 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 equates to 48% (R10.9 billion) of total equity (R22.9 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 active IPPs (those that have commenced construction and/or entered operations).

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.** One BW3 project (biomass project) has not yet reached financial close.

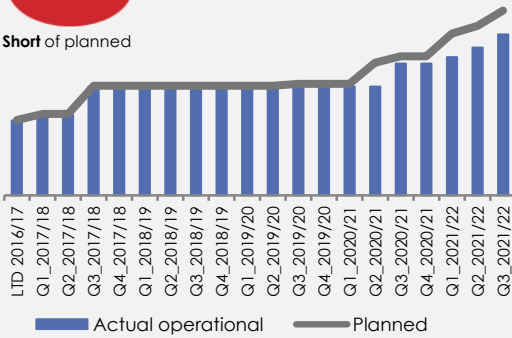
REIPPPP operational capacity

Capacity (MW)



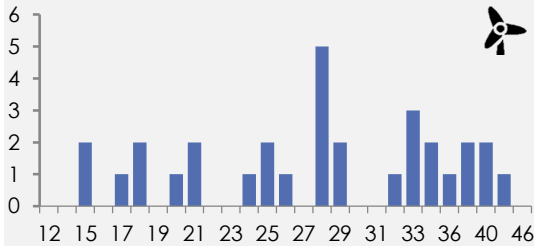
13%

Short of planned



Distribution of lead times

Construction (in months) for completed projects



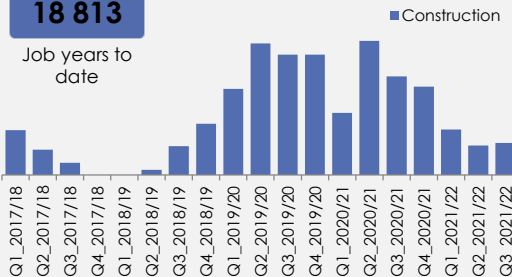
Construction Employment

Actual (Job years) (active projects¹)



18 813

Job years to date



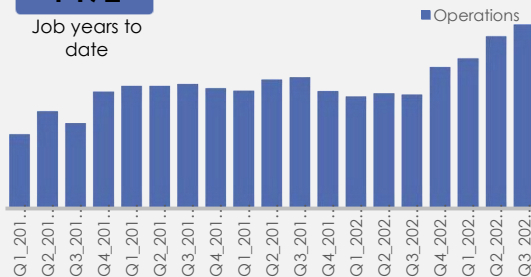
Operations Employment

Actual (Job years) (active projects¹)



4 172

Job years to date



Wind power delivering capacity quickly

By the end of December 2021, all 34 wind projects (with a capacity of 3 357 MW) were scheduled to have reached commercial operations. The actual achievement has been 31 projects delivering 2 923 MW³ (87% of the scheduled plan and a shortfall of 433.9 MW).



2 923

Megawatts

from

31

IPP 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 2021.

The average lead time for the 31 projects to reach commercial operations was 863 days (2.4 years). Lead times across the portfolio varied from 15 to 41 months.

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 48 110 job years² for SA citizens while in construction, of which 18 813 (39%) of these employment opportunities were for the construction of wind IPPs. This is 66% more than planned, since the active wind IPPs have committed to create 11 358 job year opportunities for SA citizens during the construction phase.

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 31 wind IPPs that have successfully reached commercial operations to date have reported 4 172 job years for SA citizens. This is 15% of the job years for SA citizens planned (27 622) over the operational life (20 years) by projects that have reached COD to date, with these 31 projects only being in operation an average of 51.2 months (approximately 4.3 years). Over the operational life of the full wind portfolio (BW 1 to BW4), 32 060 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 31 projects planned to deliver 2 938.1 MW, but only achieved 2 923.4 MW.

Local content spend¹

(Rand billion)

43%

local content planned
by wind IPPs

planned



R25.3
Rand billion

actual

(at Dec 2021)



R 24.5 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 to date:

R 29.8 billion

91%

of total procurement spend
achieved by wind IPPs



Total **procurement from QMEs & EMEs** by wind
IPPs during construction and operations to
date:

R 9.1 billion

28%

of total procurement spend
achieved by wind IPPs



Total **procurement from women owned
vendors** by wind IPPs during construction and
operations to date:

R 2.9 billion

8.7%

of total procurement spend
achieved by wind IPPs

Enterprise development



R 4.8 billion
committed



R0.2 billion

Actual ED spend by
wind IPPs to date



of which
R4.4 billion

committed to local communities

Socio-economic development



R 14.1 billion
committed



R0.7 billion

Actual SED spend by
wind IPPs to date



of which
R13.0 billion

committed to local communities

Local content

Local content commitments by the 34 wind IPPs amount to R25.3 billion or 43% of total project value (R59.5 billion for procured wind projects in BW1 to BW4). Actual local content spend reported for these wind IPPs (that have all started and/or concluded construction) amounts to R24.5 billion against a corresponding project value (as realised to date) of R52.1 billion. This means 47% of the project value for wind projects has been locally procured, exceeding the 43% commitment from IPPs, with three projects still in construction.

Preferential procurement

The actual share of procurement spend by the 34 active wind IPPs, from B-BBEE suppliers (R29.8 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 34 procured wind IPPs.

Total procurement spend by active wind IPPs from Qualifying Small Enterprises (QME) & Exempted Micro Enterprises (EME) has amounted to R9.1 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 8.7% 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 34 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 R205.6 million has already been made for enterprise development by the 31 operational wind IPP projects.

Socio-economic development

A total contribution of R14.1 billion has been committed to SED initiatives by the 34 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 31 operational wind IPPs amount to R692.2 million to date.

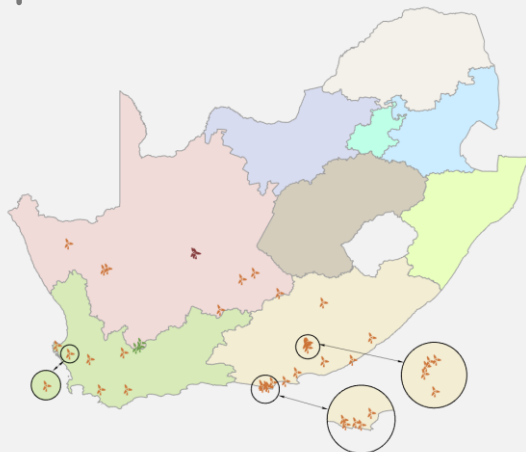
Note 1. Local content is expressed as % of total project value. **Note 2.** Socio-economic development and Enterprise Development obligations become effective only when operations commence and revenue is generated.

Geographic distribution

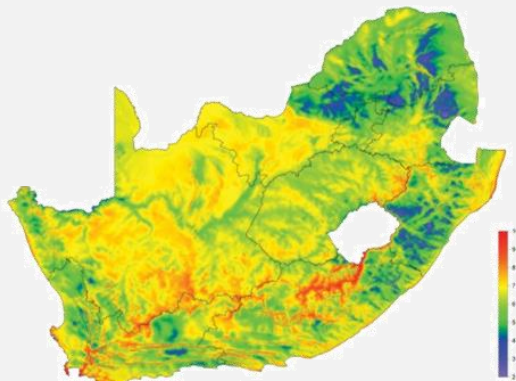
9



	No financial close yet		Came online last quarter
	Under construction		Expected to come online next quarter
	Operational		Completed – no Grid connection



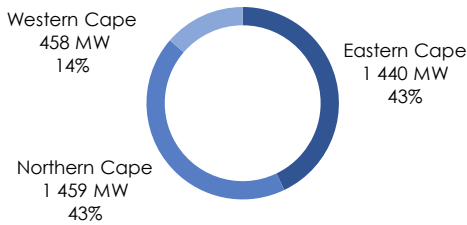
Wind Atlas of South Africa (WASA), Large Scale High Resolution Wind Resource map



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 6.

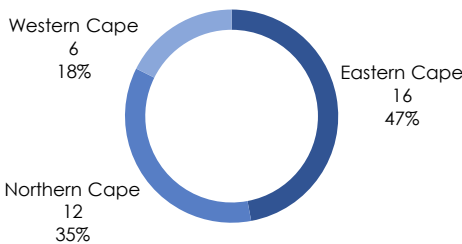
Share of wind capacity

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	1 496	1 426	70
Northern Cape	Number of projects	48	12	36
	Capacity procured (MW) ¹	3 566	1 459	2 107
	Capacity online (MW) ²	2 969	1 039	1 930
Western Cape	Number of projects	11	6	5
	Capacity procured (MW) ¹	592	458	134
	Capacity online (MW) ²	592	458	134
Other Provinces	Number of projects	16	0	16
	Capacity procured (MW) ¹	655	0	655
	Capacity online (MW) ²	604	0	604

Note 1. BW1 – 4. One BW3 project has 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

Colours used to denote technologies



Solar PV



CSP



Wind



Landfill, hydro, biomass, biogas
(when treated as a group e.g. IRP)



Hydro



Landfill



Biogas



Biomass

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