



Renewable Energy in South Africa: Solar and Wind

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1. Introduction

South Africa is attempting to reduce its carbon footprint by moving towards renewable energy, especially solar and wind. The South African government launched the Renewable Energy Independent Power Producer Program (REIPPP) in 2011. This includes wind and solar projects.

2. Solar Energy

This sector looks at the solar energy potential of South Africa and the Southern African Development Community (SADC) region at large.

2.1 Solar power projects in South Africa

The Northern Cape plays a key role in South Africa's solar industry as the province is home to most of the solar projects in the country. South Africa's solar power projects comprises of photovoltaics (PV) and concentrated solar power (CSP). Table 1 contains the list of solar power projects in South Africa.

Table 1: List of solar farms in South Africa

Project	Programme	Company	Technology	Net Capacity (MW)	Nearest Town	Province	Status
Aries Solar Energy Facility	REIPPP Window 1	Sevenstones 159 (Pty.) Ltd.	PV	9.65	Kenhardt	Northern Cape	Fully operational
Greefspan PV Power Plant	REIPPP Window 1	AE-AMD Independent Power Producer 1 (Pty) Ltd	PV	9.9	Douglas	Northern Cape	Fully operational
Herbert PV Power Plant	REIPPP Window 1	AE-AMD Independent Power Producer 3 (RF) (Pty) Ltd	PV	19.98	Douglas	Northern Cape	Fully operational
Kathu Solar Plant	REIPPP Window 1	Renewable Energy Investments SA (RF) (Pty) Ltd	PV	75	Kathu	Northern Cape	Fully operational
Konkoonies Solar Energy Facility	REIPPP Window 1	Limarco 77 (Pty) Ltd	PV	9.65	Pofadder	Northern Cape	Fully operational
Lesedi Solar Photovoltaic Park	REIPPP Window 1	Lesedi Power Company	PV	64	Postmasburg	Northern Cape	Fully operational
Letsatsi Solar Photovoltaic Park	REIPPP Window 1	Letsatsi Power Company	PV	64	Bloemfontein	Free State	Fully operational
Mulilo Solar PV De Aar	REIPPP Window 1	Mulilo Renewable Energy Solar PV De Aar (RF) (Pty) Ltd	PV	10	De Aar	Northern Cape	Fully operational
Mulilo Solar PV Prieska	REIPPP Window 1	Mulilo Renewable Energy Solar PV Prieska (RF) (Pty) Ltd	PV	20	Prieska	Northern Cape	Fully operational
RustMo1 Solar Farm	REIPPP Window 1	RustMo1 Solar Farm (RF) (Pty) Ltd	PV	6.93	Rustenburg	North-West	Fully operational
SlimSun Swartland Solar Park	REIPPP Window 1	Slimsun (RF) (Pty) Limited	PV	5	Swartland	Western Cape	Fully operational
Solar Capital De Aar	REIPPP Window 1	Solar Capital De Aar (RF) (Pty) Ltd	PV	75	De Aar	Northern Cape	Fully operational
Soutpan Solar Park	REIPPP Window 1	Erika Energy (RF) Pty Ltd	PV	28	Mokopane	Limpopo	Fully operational
Touwsrivier Solar Park	REIPPP Window 1	CPV Power Plant No. 1 (Pty) Ltd	PV	36	Touwsrivier	Western Cape	Fully operational
Witkop Solar Park	REIPPP Window 1	Core Energy (Pty) Ltd	PV	30	Polokwane	Limpopo	Fully operational
South African Mainstream Renewable Power De Aar PV RF (Pty) Ltd	REIPPP Window 1	South Africa Mainstream Renewable Power De Aar PV (Pty) Ltd	PV	45.6	De Aar	Northern Cape	Fully operational
South African Mainstream Renewable Power Droogfontein (RF) (Pty) Ltd	REIPPP Window 1	South Africa Mainstream Renewable Power Droogfontein (RF) (Pty) Ltd	PV	45.6	Kimberley	Northern Cape	Fully operational
Khi Solar One	REIPPP Window 1	Khi Solar One (RF) (Pty) Ltd	CSP	50	Upington	Northern Cape	Fully operational
KaXu Solar One	REIPPP Window 1	KaXu Solar One (RF) (Pty) Ltd	CSP	100	Pofadder	Northern Cape	Fully operational
Kalkbult	REIPPP Window 1	Scatec Solar Kalkbult (RF) (Pty) Ltd	PV	72.5	De Aar	Northern Cape	Fully operational
Aurora-Rietvlei Solar Power	REIPPP Window 2	Solairedirect	PV	9	Aurora	Western Cape	Fully operational
Boshoff Solar Park	REIPPP Window 2	Sun Edison	PV	60	Boshof	Free State	Fully operational
Dreunberg	REIPPP Window 2	Scatec	PV	69.6	Dreunberg	Eastern Cape	Fully operational
Jasper Power Company	REIPPP Window 2	Solar Reserve - Jasper	PV	75	Postmasburg	Northern Cape	Fully operational
Linde	REIPPP Window 2	Simacel	PV	36.8	Hanover	Northern Cape	Fully operational
Sishen Solar Facility	REIPPP Window 2	Windfall	PV	74	Sishen	Northern Cape	Fully operational
Solar Capital De Aar 3	REIPPP Window 2	Solar Capital	PV	75	De Aar	Northern Cape	Fully operational
Upington Solar PV	REIPPP Window 2	ACSA	PV	8.9	Upington	Northern Cape	Fully operational
Vredendal	REIPPP Window 2	Solairedirect	PV	8.82	Vredendal	Western Cape	Fully operational
Bokpoort CSP Project	REIPPP Window 2	ACWA	CSP	50	Groblershoop	Northern Cape	Fully operational

Table 1: List of solar farms in South Africa (Continued)

Project	Programme	Company	Technology	Net Capacity (MW)	Nearest Town	Province	Status
Adams Solar PV 2	REIPPP Window 3	Adams Solar PV Project Two Pty Ltd	PV	75	Hotazel	Northern Cape	Fully operational
Electra Capital	REIPPP Window 3	Electra Capital (RF) Proprietary Limited	PV	75	Clanwilliam	Western Cape	Fully operational
Mulilo Prieska PV	REIPPP Window 3	Mulilo Prieska PV (RF) Proprietary Limited	PV	75	Prieska	Northern Cape	Fully operational
Mulilo Sonnedix Prieska PV	REIPPP Window 3	Mulilo Sonnedix Prieska PV (RF) Proprietary Limited	PV	75	Prieska	Northern Cape	Fully operational
Pulida Solar Park	REIPPP Window 3	Pulida Energy (RF) Proprietary Limited	PV	75	Kimberley	Free State	Fully operational
Tom Burke Solar Park	REIPPP Window 3	Tobivox (RF) Proprietary Limited	PV	60	Lephalale	Limpopo	Fully operational
Ilanga CSP 1 (Karoshhoek Solar One)	REIPPP Window 3	Karoshhoek Solar One (RF) Proprietary Limited	CSP	100	Kimberley	Northern Cape	Fully operational
Kathu Solar Park	REIPPP Window 3	Kathu Solar Park Consortium	CSP	100	Kuruman	Northern Cape	Fully operational
Redstone CSP	REIPPP Window 3	Redstone Solar Thermal Power Project Consortium	CSP	100	Postmasburg	Northern Cape	Awaiting construction
XiNa CSP South Africa	REIPPP Window 3	XiNa Solar One (RF) Proprietary Limited	CSP	100	Pofadder	Northern Cape	Fully operational
Aggeneys Solar Project	REIPPP Window 4	Main Street 957 (Pty) Ltd	PV	40	Aggeneys	Northern Cape	Fully operational
Bokamoso	REIPPP Window 4	Bokamoso Energy (RF) (Pty) Ltd	PV	67.9	Leeudoringstad	North-West	Fully operational
De Wildt	REIPPP Window 4	Zolograph Investments (RF) (Pty) Ltd	PV	50	Brits	North-West	Fully operational
Droogfontein 2 Solar	REIPPP Window 4	Droogfontein 2 Solar (Pty) Ltd	PV	75	Kimberley	Northern Cape	Fully operational
Dyason's Klip 1	REIPPP Window 4	RE Capital 3 (Pty) Ltd	PV	75	Upington	Northern Cape	Fully operational
Dyason's Klip 2	REIPPP Window 4	RE Capital 3B (Pty) Ltd	PV	75	Upington	Northern Cape	Fully operational
Greefspan PV Power Plant No. 2 Solar Park	REIPPP Window 4	Greefspan PV Power Plant No. 2 (RF) (Pty) Ltd	PV	55	Douglas	Northern Cape	Fully operational
Konkoonsies II Solar Facility	REIPPP Window 4	Ramizone (Pty) Ltd	PV	75	Pofadder	Northern Cape	Fully operational
Sirius Solar PV Project One	REIPPP Window 4	Sirius Solar PV Project One (Pty) Ltd	PV	75	Upington	Northern Cape	Fully operational
Solar Capital Orange	REIPPP Window 4	Consortium comprising of Solar Capital (Pty) Ltd, JA Solar Investment (Hongkong) Ltd, Solar Capital Orange Community Trust, Phakwe Power (Pty) Ltd	PV	75	Loeriesfontein	Northern Cape	Construction
Waterloo Solar Park	REIPPP Window 4	DP S79 Solar Energy (RF) (Pty) Ltd	PV	75	Vryburg	North-West	Fully operational
Zeerust	REIPPP Window 4	Re Capital 2 (Pty) Ltd	PV	75	Zeerust	North-West	Fully operational

Source: Energyblog (2021) and Parliamentary Monitoring Group (2019)

2.2 Solar power generation within SADC

The table below contains the solar energy capacity of countries within the SADC region as of mid-2018.

Table 2: Solar energy capacity in the SADC region as of mid-2018

	Installed		Financed but not yet commissioned	
	Solar PV	Solar CSP	Solar PV	Solar CSP
Angola	13.0		3436.0	
Botswana	1.3			
DRC	3.0			
Eswatini	0.5			
Lesotho	0.3			
Madagascar	2.3		50.0	
Malawi	0.9		70.0	
Mauritius	27.0			
Mozambique	1.3		80.0	
Namibia	52.5		134.5	
Seychelles	2.7		9.0	
South Africa	2392.0	600.0	1400.0	400.0
Tanzania			150.0	
Zambia	2.0			
Zimbabwe	4.0		4.0	
SADC	2502.8	600.0	5333.5	400.0

Source: SACREEE (2018)

The SADC region is endowed with abundant solar radiation, having about 2 500 hours of sunshine per annum (SADC Energy Monitor, 2018). Namibia and Botswana have the highest solar irradiance potential in Africa, with the ability to capture approximately 10 hours of strong sunlight per day for 300 days in a given year (World Economic Forum). However, much of the region's solar power potential remains untapped due to a lack of public-private partnerships in most member states (except for South Africa and Zambia). In collaboration with the World Economic Forum's Global Future Council on Energy, Namibia and Botswana are seeking to develop a mega-solar project that has the potential to generate about 5 000 MW of solar power over the next two decades.

Zambia was the first country to implement the Scaling Solar program, which is designed by the World Bank Group to help governments to expedite the procurement of solar power at low cost. Zambia's Industrial Development Corporation (IDC) signed an agreement with the International Finance Corporation (IFC) in July 2015 for the development of two large-scale solar projects. Both plants have been developed and became operational in 2019, adding 75.7 MW to the country's electricity generation. The Zambian government has also mandated the procurement of 600 MW of solar PV, and aims to increase the country's total electricity generation to 6 000 MW by 2030 (World Bank, 2019).

According to Afrik21 (2020), authorities in Lesotho have announced that construction of the Mafeteng solar PV power plant, with a capacity of 70 MWp, will commence in 2021. Mozambique is set to build three new solar power plants in Dondo, Lichinga and Manje, with a total capacity of 120 MWp (Afrik21, 2020). The government recently published a tender notice, inviting prospective Independent Power Producers (IPPs).

3. Wind energy

This section highlights the leading manufacturers of wind turbines in the world as well as wind farms in South Africa and its neighbours.

3.1 Wind turbine manufacturers

The 2019 top 10 wind turbine manufacturers, according to Energy Acuity (2019), are as follows:

3.1.1 Siemens (including subsidiaries)

It is a Spanish-German wind engineering company with its headquarters in Spain. The company has offshore operations in Germany and Denmark. Blade production takes place in Denmark, Morocco, China, Canada and the United States (US). As a global leader in the wind industry with advanced digital technologies, Siemens operates both onshore and offshore. The company has more than 100GW installed capacity across over 90 countries. Siemens' annual turnover in 2020 was \$11.7 billion (Owler, 2021).

Total pipeline capacity (MW): 103 620.605

Projects: 1 383

3.1.1 Vestas

Vestas is a Danish manufacturer of wind turbines, with approximately 23% of the Wind industry's market share. As a leader in sustainable energy, Vestas has more than 100GW of wind turbines in 80 countries. The company has manufacturing plants in Denmark, Sweden, The Netherlands, Germany, Taiwan, Spain, Italy, Poland, Romania, The United Kingdom, Norway, Australia, China, India, Brazil and the US. Vestas has global installed wind capacity of over 591GW. Vestas's 2020 annual revenue was \$16 billion (Owler, 2021).

Total pipeline capacity (MW): 101 531.04

Projects: 2 592

3.1.3 GE Renewable Energy

GE Renewable Energy has its headquarters in France, and is one of the global leaders in onshore wind energy. The company has installed capacity of 62GW, and has installed more than 40 000 onshore wind turbines in over 35 countries. GE Renewable Energy pioneered the Digital Wind Farm. The company's annual turnover was \$15.67 billion in 2020 (Annual report, 2020).

Total pipeline capacity (MW): 80 541.14
Projects: 1 129

3.1.4 Enercon

Enercon is a wind turbine manufacturer based in Germany. The company has production facilities in Sweden, Portugal, Brazil, Turkey, Canada and India. Enercon had installed more than 26 300 wind turbines as of December 2017, with over 43GW power generating capacity. Enercon had a turnover of \$5.3 billion in 2020 (Owler, 2021).

Total pipeline capacity (MW): 20 975.99
Projects: 1 068

3.1.5 Nordex SE

Nordex is headquartered in Germany. The company has production plants in Germany, Spain, the US, Brazil and India. Nordex has offices and subsidiaries in more than 20 countries, and delivers more than 18GW of sustainable energy worldwide. The company has installed over 23GW of wind power in over 25 markets. Nordex's annual turnover was 524.4 million in 2020 (Owler, 2021).

Total pipeline capacity (MW): 19 965.73
Projects: 632

3.1.6 Senvion SE

Headquartered in Germany, Senvion is a global leader in the manufacturing of onshore and offshore wind turbines. The company develops, manufactures and markets wind turbines in several locations. Senvion has its biggest plant in Portugal. The company's turnover in 2020 was \$ 1.6 billion (Owler, 2021).

Total pipeline capacity (MW): 18 469.04
Projects: 771

3.1.7 Goldwind

Goldwind is a Chinese company that deals in large-sized wind turbine generator sets and medium-sized wind power plants. The company has more than 50GW of installed wind capacity capacity, and has offices and facilities throughout Asia, the Americas and Europe. Goldwind is shaping a new standard in wind energy with its revolutionary Permanent Magnet Direct Drive (PMDD) technology. In 2019, Goldwind's revenue was \$5.42 billion (Statista, 2021).

Total pipeline capacity (MW): 15 321.21
Projects: 246

3.1.8 Sinovel Wind

With its headquarters in China, Sinovel is the first Chinese establishment to be involved in the development and manufacturing of large-scale onshore, offshore and intertidal wind turbines. The company ventured into the African wind energy market with the establishment of Dassiesklip in South Africa. Sinovel has installed capacity of over 45GW worldwide. The company recorded a turnover of \$598.9 million in 2020 (Owler, 2021).

Total pipeline capacity (MW): 14 020.95
Projects: 159

3.1.9 Suzlon

Suzlon is the largest wind turbine company in India, with a domestic market share of more than 50%. The company has a dozen manufacturing plants in China, the US and India. Suzlon has 18 000+ installed capacity, and has operations in 18 countries across 6 continents. The company's annual revenue in 2020 was \$371.5 million (Owler, 2021).

Total pipeline capacity (MW): 13 268.37

Projects: 253

3.1.10 MHI Vestas Offshore Wind

MHI Vestas is a joint venture between Vestas Wind Systems and Mitsubishi Heavy Industries (MHI), with its headquarters in Denmark. The company has been an innovative force in offshore wind since 2014, and has installed approximately 1 000 turbines.

Total pipeline capacity (MW): 12 164.60

Projects: 25

3.2 Inward FDI from the host countries of the top wind turbine manufacturers to South Africa

Table 3 contains the list of inward FDI project and capital inflow to South Africa from the countries of origin of the top global manufacturers of wind turbines. Three of the leading wind turbine manufacturers are from Germany, whereas Denmark and China each have top companies on the list. Among these countries, Germany (51 projects) had the highest number of FDI projects in South Africa between 2013 and 2020, while the largest amount of capex originated from China.

Table 3: FDI inflows into South from host countries of the top manufacturers of wind turbines

Manufacturer	Headquarters	Inward FDI from host country to South Africa, 2013-2020	
		Projects	Capex (US\$ m)
Siemens	Spain	28	446.64
Vestas	Denmark	7	100.68
MHI Vestas Offshore Wind	Denmark		
GE Renewable Energy	France	50	1371.29
Enercon	Germany	51	2594.01
Nordex SE	Germany		
Senvion SE	Germany		
Goldwind	China	38	3194.77
Sinovel Wind	China		
Suzlon	India	28	730.14

Source: Bureau Van Dijk, 2021

3.3 Wind farms in South Africa

According to the Global Wind Energy Council (2021), South Africa remains the number one wind power market in Africa with 2.5GW of cumulative wind power capacity installed in the country. South Africa has 33 wind farms at various stages of development across the Western Cape, Eastern Cape and Northern Cape. The country has over 1 365 wind turbine generators (ESI Africa, 219). Below is the List of wind farms in South Africa:

Table 4: List of wind farms in South Africa

Name	Installed capacity (MW)	Wind turbine generators	Rating (MW)	Original equipment manufacturer	Status
Amakhala Wind Farm	134.4	56	2.4	Nordex	Fully operational
Chaba Wind Farm	21	7	3	Vestas	Fully operational
Cookhouse Wind Farm	138.6	66	2.1	Suzlon	Fully operational
Copperton	107.1	34	3.15	Acciona	In construction
Dassiesklip Wind Farm	27	9	3	Sinovel	Fully operational
Dorper Wind Farm	100	40	2.5	Nordex	Fully operational
Excelsior	32.5	13	2.5	Goldwind	In construction
Garob	144.9	46	3.15	Acciona	In construction
Gibson Bay Wind Farm	111	37	3	Nordex	Fully operational
Golden Valley	120	48	2.5	Goldwind	In construction
Gouda Wind Farm	138	46	3	Acciona	Fully operational

Grassridge Wind Farm	60	20	3	Vestas	Fully operational
Hopefield Wind Farm	66.6	37	1.8	Vestas	Fully operational
Jeffreys Bay Wind Farm	138	60	2.3	Siemens	Fully operational
Kangnas	140.3	61	2.3	Siemens	In construction
Karusa	147	35	4.2	Vestas	In construction
Khobab Wind Farm	140.3	61	2.3	Siemens	Fully operational
Kouga Wind Farm	80	32	2.5	Nordex	Fully operational
Loeriesfontein 2 Wind Farm	140.3	61	2.3	Siemens	Fully operational
Longyuan Mulilu De Aar 1 Wind Farm	100.5	67	1.5	United Power	Fully operational
Longyuan Mulilu De Aar 2 Wind Farm	144	96	1.5	United Power	Fully operational
MetroWind Wind Farm	27	9	3	Sinovel	Fully operational
Noblesfontein Wind Farm	73.8	41	1.8	Vestas	Fully operational
Nojoli Wind Farm	88	44	2	Vestas	Fully operational
Noupoort Wind Farm	80.5	35	2.3	Siemens	Fully operational
Nxaba	148	47	3.15	Acciona	In construction
Oyster Bay	147.6	41	3.6	Vestas	In construction
Perdekraal East	110.4	48	2.3	Siemens	In construction
Roggeveld	147	47	(40)x3.13+(7)x3	Acciona	In construction
Soetwater	147	35	4.2	Vestas	In construction
Tsitsikamma Community Wind Farm	93	31	3	Vestas	Fully operational
Waainek Wind Farm	24	8	3	Vestas	Fully operational
West Coast 1 Wind Farm	94	47	2	Vestas	Fully operational

Source: South African Wind Energy Association, 2021

3.4 Wind farms in other SADC member countries

The Southern African Development Community (SADC) has an estimated wind energy potential of around 18GW according to the Global Wind Energy Council. The other SADC countries, besides South Africa, with wind energy potential are Namibia, Tanzania, Mauritius and Zambia. Tanzania, which recently announced the construction of a 300MW wind farm, plans to develop four offshore wind energy projects with a total capacity of 550MW (IT Web, 2019). Namibia also has plans to develop 149MW of wind energy by 2035 (IT Web, 2019). The Namibian government recently approved the development of 4 wind farms in the Tsau//Khaeb National Park.

4. Conclusion

There is a growing consensus towards renewable energy given rising concerns about climate change and high oil prices. The use of renewable energy is key to dealing with energy security, climate change, and environmental degradation. Over the past couple of years, South Africa has taken significant steps toward the adoption of renewable energy.

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