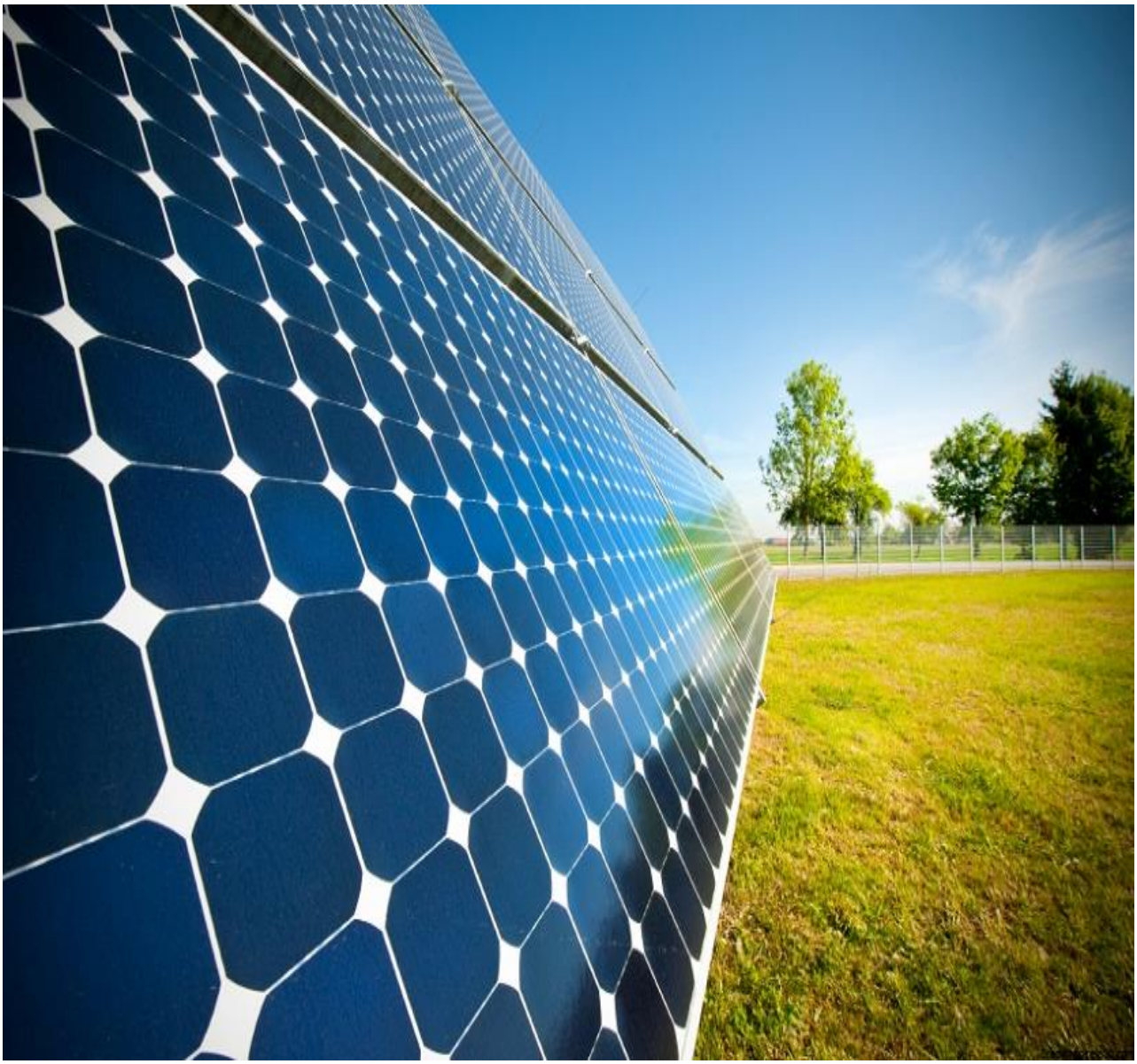


REIPPPP focus on solar photovoltaic (PV)

As at 30 June 2020

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

DBSA
DEVELOPMENT BANK OF SOUTHERN AFRICA
Building Africa's Prosperity

national treasury
Department:
National Treasury
REPUBLIC OF SOUTH AFRICA

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 solar photovoltaic (PV) 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 2019.

Renewable Energy (RE) capacity for the programme is pursued from the different RE technologies identified in the IRP, including onshore wind, PV, concentrating solar power (CSP), biomass, biogas, landfill gas and small hydroelectric power plants. By the end of June 2020, the REIPPPP had successfully implemented seven bid windows[2] from which it procured 6 422 megawatt (MW) from 112 independent power producers (IPPs). Of these, 61 are solar PV IPPs to contribute 2 372 MW[3] to the electricity grid.

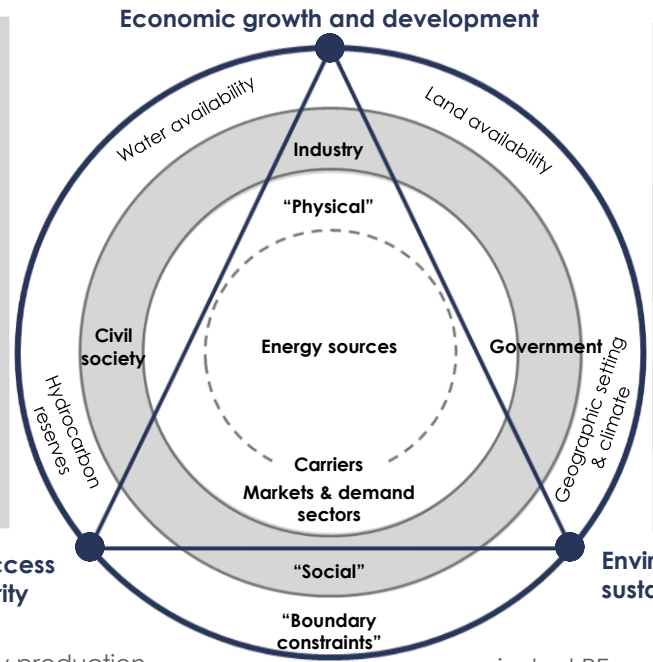
South Africa's solar resource potential is amongst the highest in the world, with most areas in the country averaging 2 500 hours of sunshine per year, combined with high solar irradiation levels (between 4.5 and 6.5 kWh/m^2 per day). IPPs participating in the REIPPPP have been harvesting this clean 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 solar PV IPPs under the REIPPPP, below).

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

Key REIPPPP Energy Triangle[1] Facts: PV Technology (for period 11/2013 – 06/2020)

49 461 GWh
REIPPPP[2] Actual energy contributed to National Grid

of which
17 636 GWh
PV
(36%) contributed to the National Grid



R 105 billion
REIPPPP Total payment to all IPPs as per PPA

of which
R 50 billion
PV
(48%) total payments to IPP's as per PPA

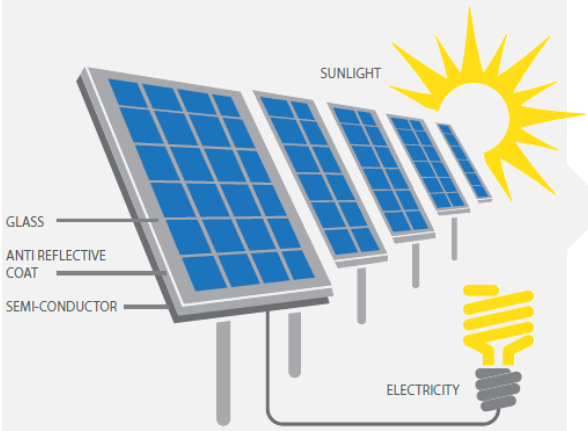
ENERGY (P50)
Energy access and security

20%
of the Renewable Energy production from PV has been available during peak hours (as per Megaflex tariff)

Environmental sustainability

50.2 Mtons CO_2
equivalent RE emissions reduction achieved relative to Eskom generated power (17.9 Mtons CO_2 from PV projects)

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 16 smalls projects with a capacity of 80 MW. **Note 4.** The IRP 2019 was promulgated in October 2019 and replaced the IRP 2010 as the country's official electricity infrastructure plan.



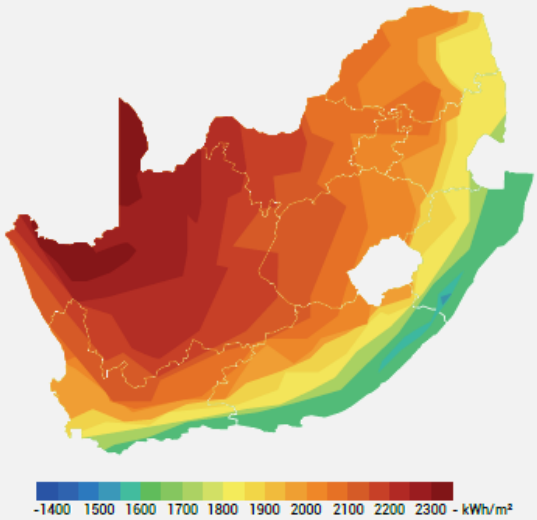
Solar PV technology basics

A solar PV installation consists of solar PV panels. A solar PV panel works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity.

PV cell technologies are broadly categorised as either crystalline or thin-film. Crystalline silicon cells provide higher efficiency modules than thin-film cells, which provides a cheaper alternative.

Modules are either mounted on fixed-angle frames or on sun tracking frames, and can be bifacial (producing power from both sides of the module). Fixed frames are simpler to install, cheaper and require less maintenance. However, tracking systems can have a higher yield and can enable a smoother power output, especially in areas with a high direct/diffuse irradiation ratio. Bifacial solar modules also increase the total energy generation, are more durable because both sides are UV resistant, and can reduce balance of system costs because more power can be generated in a smaller array footprint.

Solar resource map for South Africa, Lesotho and Swaziland (annual sum of global horizontal irradiation, kWh/m2), GeoModel Solar



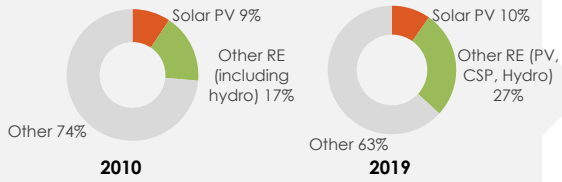
Solar resource potential in South Africa

South Africa is blessed with abundant sunlight. A large part of the country is classified as semi-arid with large expanses of flat terrain and high solar irradiation, making it well-suited to the development of solar energy. As a result South Africa's solar resource is considered to be among the best in the world.

High quality, satellite-derived solar data and resource mapping are being compiled as empirical evidence of the quantity and quality of the available solar resource in South Africa and the region. Measurement data and maps are publically available, free of charge at www.sauran.net.

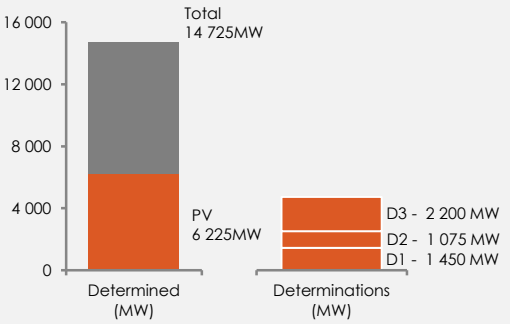
IRP 2030 electricity mix[4]

Technology capacity share 2010 vs 2019 (%)



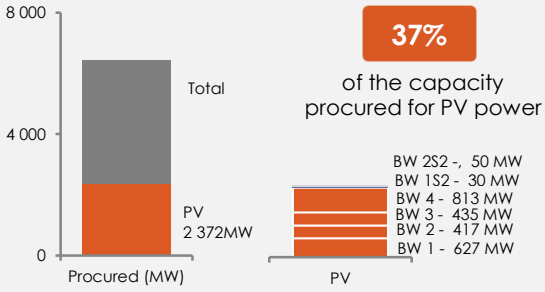
Capacity determined[2,4]

PV as share of total determined



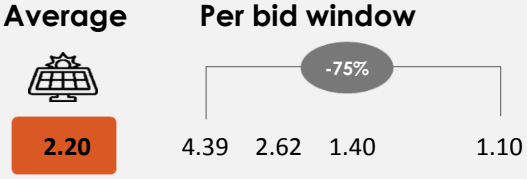
Capacity procured[3,4]

PV as share of total procured



Average PV energy tariffs[1]

R/kWh



Solar PV power in South Africa's electricity plan to 2030

In terms of South Africa's Integrated Resource Plan 2010, solar PV was expected to contribute 9% (8 400 MW) 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 solar PV in 2030 has increased to 10% (8 288 MW[5]).

The Minister of Mineral Resources and Energy has to date determined 6 225 MW[4] of solar PV power to be procured from IPPs (under the IRP 2010), targeting full operation by 2025. Ministerial determinations for the continued procurement of energy from IPPs under the IPPPP in fulfilment of the capacity allocations in the IRP 2019 is undergoing public consultation and awaiting concurrence by NERSA. The determination for solar PV, which is awaiting concurrence, is 2 000 MW to be procured between 2022 and 2024.

To date, 2 372 MW of solar PV power has been procured. This represents 37% of the RE technology mix capacity procured to date and 38% of the determined capacity by the Minister of Mineral Resources and Energy under the IRP 2010[4].

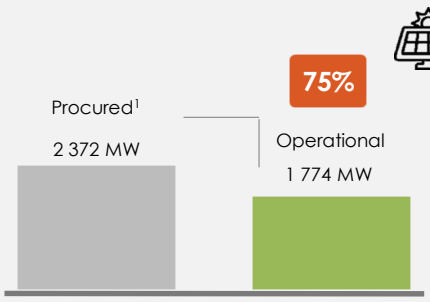
Offering an increasingly cost competitive energy alternative

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 and has approached a point where the wholesale pricing for new coal- and renewable-generated electrical energy intersects.

Solar PV is one of the cheapest forms of generating electricity. The real price for solar PV power has dropped by 75% to R1.10/kWh (in April 2020 terms).

Note 1. Fully indexed price, inflation adjusted (2020). **Note 2.** Determined solar PV capacity (under IRP 2010) excludes contribution from smalls projects, and includes 1 500 MW allocated for the Solar Park Procurement Programme. **Note 3.** Procured capacity includes contribution from smalls projects – 16 projects with a capacity of 80 MW. **Note 4.** To be updated once NERSA concurred with new Ministerial determinations in fulfilment of the capacity allocations in the IRP 2019. **Note 5.** Including committed / already contracted capacity (2019 – 2022) as well as new capacity (2022 to 2030).

Procured[1] vs operational
PV capacity (MW)



2 372 Megawatts from **61** IPP projects

1.6 million households

Solar PV power procured

By the end of June 2020, 2 372 MW[1] of solar PV power, from 61 solar PV projects, had successfully been procured under South Africa's REIPPPP.

The average project size for the 61 solar PV IPPs is 38.9 MW. The collective solar PV capacity will deliver an annual projected energy output of 5 460 GWh[3]. This is enough to power 1.6 million households[2] annually.

By the end of June 2020, 37 solar PV IPPs had started commercial operation, contributing 1 774 MW capacity to the national power system.

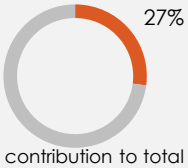
Contributing to cleaner energy

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 CO_2 emissions annually by 20.5 Mtons (using P50[3] figures). Of this, the 61 solar PV IPPs, that have been procured to date, are projected to contribute a reduction of 5.5 Mtons CO_2 (27%).

Carbon emission reductions
Projected using P50 (Mton CO_2)

Projected (P50)

5.5 Mton CO_2 / annum



PV contribution to total REIPPPP CO_2 reductions

Over the past 12 month period alone (ending June 2020), the operational solar PV projects have reduced CO_2 emissions by 3.6 Mtons (already 64% of the total 5.5 Mtons annual P50 projection for solar PV IPPs).

Realised (12 month period)

3.6 Mtons CO_2

Carbon emission reductions ITD

50.2 Mton CO_2

of which **17.9 Mtons CO_2** from PV power

Since the first REIPP started commercial operations at the end of 2013, 49 461 GWh have been generated, reducing carbon emissions by 50.2 Mtons. Of this, solar PV projects have contributed 17 636 GWh and reduced carbon emissions by 17.9 Mtons.

Note 1. Procured capacity includes 80 MW procured by smalls projects in smalls BW1 and BW2 (1S2 and 2S2). **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.

Energy supplied

The first REIPP (a solar PV project) reached COD, supplying electrical power to the grid, in November 2013. Since inception, 49 461 GWh of energy has been generated by renewable energy sources from the 68 projects that are operational.

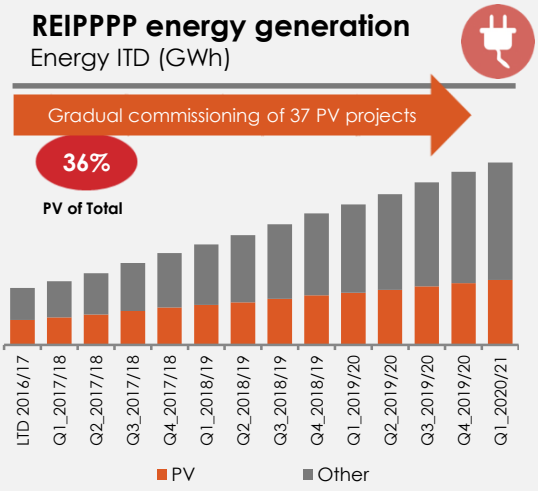
Solar PV power is contributing 17 636 GWh, which represents 36% of all renewable energy produced to date[2]. Of this energy, 860 GWh was generated during this reporting quarter (April to June 2020).

The energy generated over the past 12 months (June 2019 to June 2020), from the 37 projects that have reached COD, was 3 498 GWh.

This 3 498 GWh represents 87% of the annual projected energy production by all the operational solar PV IPPs (P50[1] for the 37 operational IPPs is 4 002 GWh). This achievement is in the context of only thirty-three (33) of these 37 projects having been operational for more than 1 year.

Individually, twenty-two (22) of these 37 solar PV projects (67%) have exceeded their P50[1] projections, while 85% of the IPPs achieved greater than 90% of their P50[1] projections. Five (5) projects fall short of achieving greater than 90% of their P50[1] projections.

REIPPPP energy generation
Energy ITD (GWh)



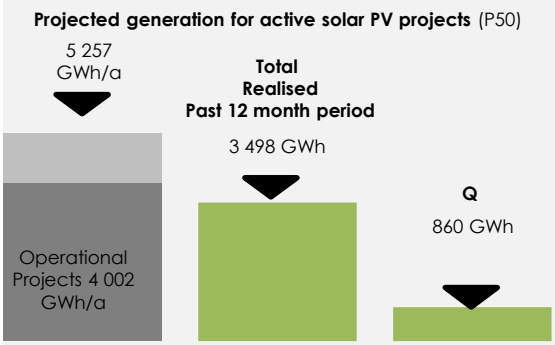
Energy Generation ITD

49 461 GWh

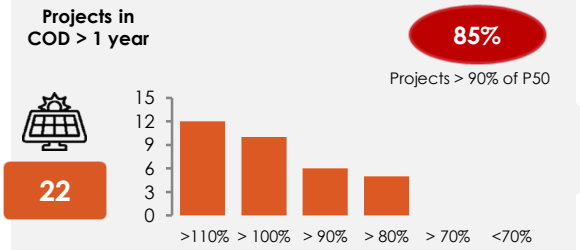
of which

17 636 GWh from PV power

Energy supplied to the grid
Energy generated (GWh)



Achievement of P50[1] projections
No. of projects



Note 1. Projected annual energy contribution. **Note 2.** As at June 2020.

Committed investments

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

209.7

Rand billion

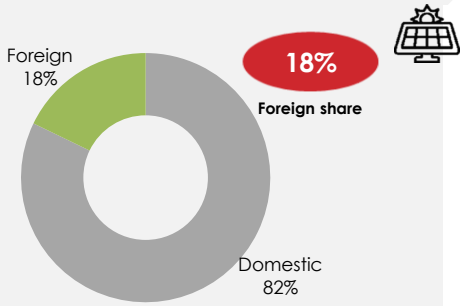
Committed (**total project costs[1]**) for IPP development in BW 1, 2, 3, 3.5, 4, 1S2 & 2S2

of which

R65.9 billion from PV power

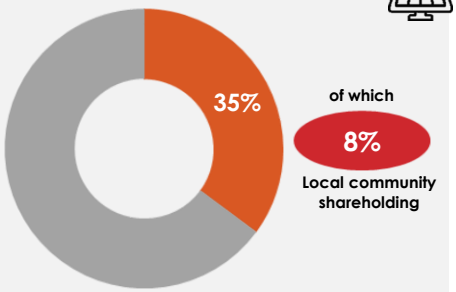
Foreign equity and financing share

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



Shareholding by black South Africans

Active projects[3]



Investment attracted for solar PV power

Solar PV IPPs have attracted significant investment, in the development of these projects, into the country. The total investment (total project costs[1]), of all projects under construction and projects in the process of reaching financial closure[4], is R209.7 billion of which R65.9 billion is from solar PV IPPs.

The expected project value[2] for these 61 solar PV projects procured to date is R48.8 billion and at end June 2020, R39.8 billion (81%) had actually been spent by the 45 active solar PV projects (in BW1 to BW4).

Solar PV IPPs have attracted R11.8 billion in foreign investment (debt and equity) in the seven bid windows (BW1 – BW4, 1S2 and 2S2), of which R9.3 billion is foreign equity. Foreign investment has therefore represented 18% of total investment in solar PV projects under the REIPPPP to date. Whilst retaining shareholding for South Africans is a priority, the associated influx of foreign investment and funding is also of significance to the economy. The NDP (Outcome 11) set a target of a R230 billion increase in FDI (facilitated by the dti) by 2019[5].

Equitable shareholding in solar PV IPPs

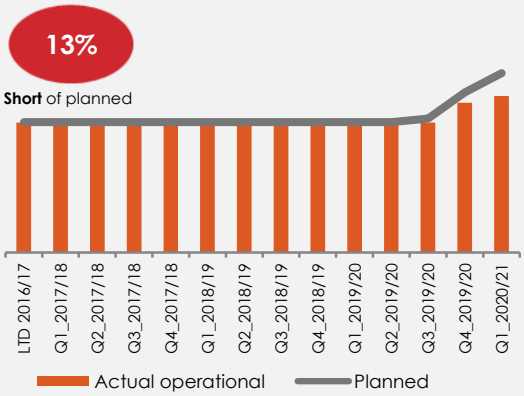
South African (local) equity shareholding across BW1 to BW4, 1S2 and 2S2 equates to 54% (R18.8 billion) of total equity (R20.1 billion). Black South Africans own, on average, a 35% share of solar PV projects that have reached financial close.

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

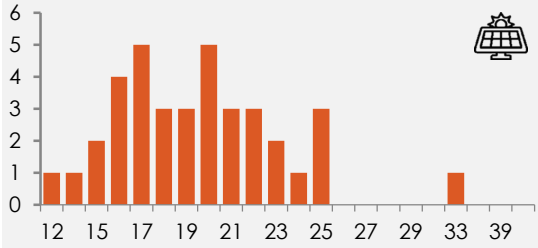
Black people in local communities also hold ownership in the IPP projects operating in or nearby their vicinities. On average, black people in local communities own 8% of IPPs at financial close.

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 PV projects) and BW4. **Note 4.** BW3 (one project), and 1S2 and 2S2 have not yet reached financial close. **Note 5.** NDP targets, based on the IRP 2010, will be amended to reflect the promulgated IRP 2019.

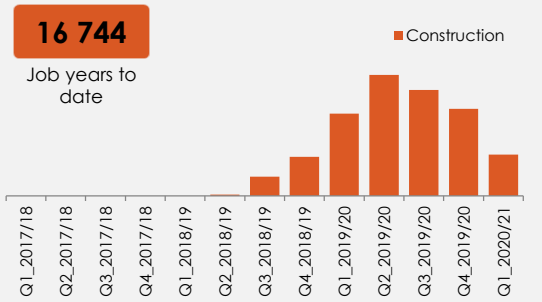
REIPPPP operational capacity
MW



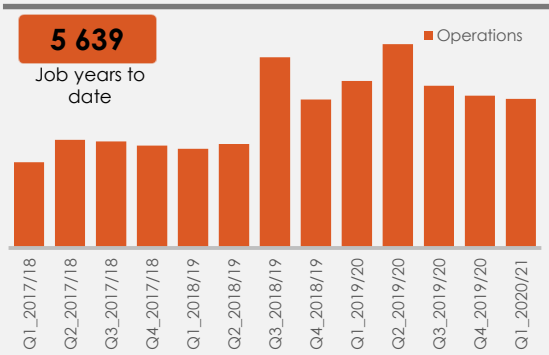
Distribution of lead times
Construction (in months) for completed projects



Employment opportunities
Actual (Job years) (active projects[1])



Operations employment
Actual (Job years) (active projects[1])



Solar PV power delivering capacity quickly

By the end of June 2020, 41 projects with a capacity of 2 037 MW were scheduled to have reached commercial operations. The actual achievement has been 37 projects delivering 1 774 MW[3] (87% of the scheduled plan and a shortfall of 263 MW). The main reason for this shortfall is the disruptions caused by COVID-19, which delayed many IPPs to reach their scheduled operations date.

1 774 Megawatts from **37** IPP projects

A few IPPs that have started operations have done so below the contracted capacity. As a result there was a 4.8 MW shortfall between contracted and delivered capacity for active[1] projects at the end of June 2020.

The average lead time for the 37 projects to reach commercial operations was 599 days (1.6 years). Lead times across the portfolio varied from 12 to 33 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 operations[1]) delivered 42 355 job years[2] for SA citizens while in construction, of which 16 744 (40%) of these employment opportunities were for the construction of solar PV IPPs. This is 25% more than planned, since the active solar PV IPPs have committed to create 13 356 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 37 solar PV IPPs that have successfully reached commercial operations to date have reported 5 639 job years for SA citizens. This is 24% of the job years for SA citizens planned (23 149) over the operational life (20 years) by projects that have reached COD to date, with projects only being in operation an average of 56 months (approximately 4.6 years). Over the operational life of the full solar PV portfolio (BW 1 to BW4, 1S2 and 2S2), 36 555 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 solar PV projects) and BW4. **Note 2.** The equivalent of a full time employment opportunity for one person for one year. **Note 3.** The 37 projects planned to deliver 1 779 MW, but only achieved 1 774 MW.

Local content spend[1] (Rand billion)

50% local content planned by PV IPPs

planned

R24.2 Rand billion

actual (at June 2020)

R 18.9 billion

48% of total project value for PV IPPs realised to date

Preferential procurement

65% B-BBEE spend planned by PV IPPs

81% of total procurement spend by PV IPPs

R 25.8 billion

Total B-BBEE spend by PV IPPs during construction and operations until end June 2020

9% QME & EME spend planned by PV IPPs

29% of total procurement spend by PV IPPs

R 9.3 billion

Total **procurement spend from Qualifying Small Enterprises (QME) & Exempted Micro Enterprises (EME)** by PV IPPs during construction and operations until end June 2020

4% Women-owned vendor spend planned by PV IPPs

4% of total procurement spend by PV IPPs

R 1.2 billion

Total **procurement spend from women owned vendors** by PV IPPs during construction and operations until end June 2020

Enterprise development

R 2.1 billion committed

R210.5 million Actual ED spend to date by PV IPPs

of which **R974 million** committed to local communities

Socio-economic development

R 5.8 billion committed

R568.7 million Actual SED spend to date by PV IPPs

of which **R2.9 billion** committed to local communities

Local content

Local content commitments by the 61 solar PV IPPs amount to R24.2 billion or 50% of total project value (R48.8 billion for procured solar PV projects). Actual local content spend reported for the 45 solar PV IPPs that have started (and/or concluded) construction amounts to R18.9 billion against a corresponding project value (as realised to date) of R39.8 billion. This means 48% of the total project value (as realised to date) by the active solar PV projects has been spent locally, with 16 PV projects that still need to commence construction.

Preferential procurement

The actual share of procurement spend, by the 45 active solar PV IPPs, from B-BBEE suppliers (for construction and operations) is currently reported as 81%, which is significantly higher than the target of 60% and commitment of 65% made by the 61 procured solar PV IPPs.

Total procurement spend by the active solar PV IPPs from QSE and EMEs has amounted to R9.3 billion (construction and operations) to date, which is 29% of total procurement spend to date (while the required target is 10% and the commitment by procured solar PV IPPs is 9%).

Procurement by active solar PV IPPs from women-owned vendors of 4% of total procurement spend is in line with the 4% committed spend by procured solar PV IPPs, albeit 1% below the 5% target.

Enterprise development

Enterprise development contributions[2] committed by the 61 procured solar PV IPPs amount to R2.1 billion. Of the total commitment, R974 million is specifically allocated for local communities where the solar PV IPPs operate.

A total contribution of R210.5 million has already been made for enterprise development by the 37 operational solar PV IPP projects.

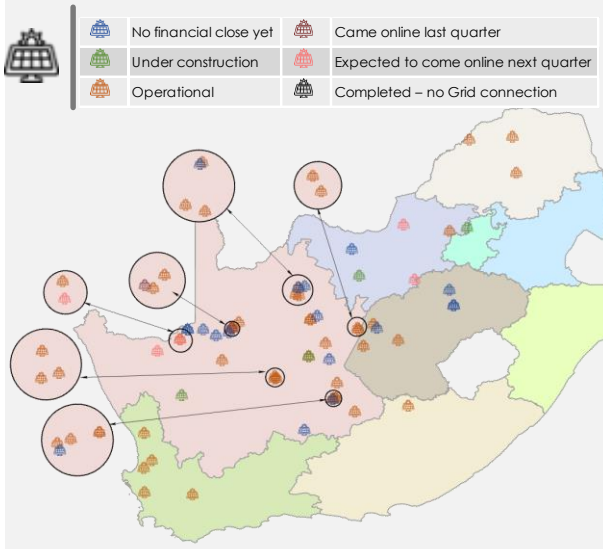
Socio-economic development

A total contribution of R5.8 billion has been committed to SED initiatives by the 61 procured solar PV projects. Of the total commitment, R2.9 billion is specifically allocated for local communities where the solar PV IPPs operate.

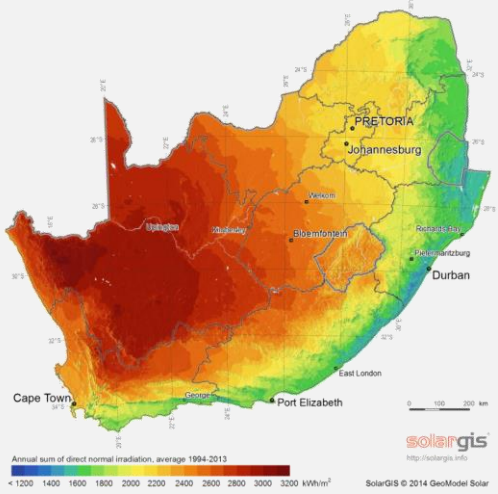
SED contributions[2] made by the 37 operational solar PV IPPs amount to R568.7 million to date.

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



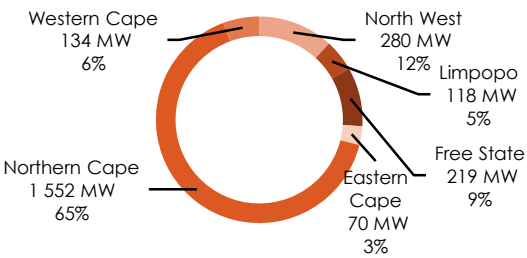
Solar maps for South Africa, Lesotho and Swaziland, GeoModel Solar



Solar PV IPPs are largely located in the Northern Cape province, based on the exceptionally high radiation levels making the province particularly suited for electrical power generation from solar energy. The North West, Free State and Western Cape are also very well endowed with solar irradiation potential and together make up 27% of the capacity, with 280 MW, 219 MW and 134 MW located respectively in each province. The Northern Cape has the highest number of solar PV projects at 39, while the North West has 6 projects, Free State has 7 projects and the Western Cape has 5.

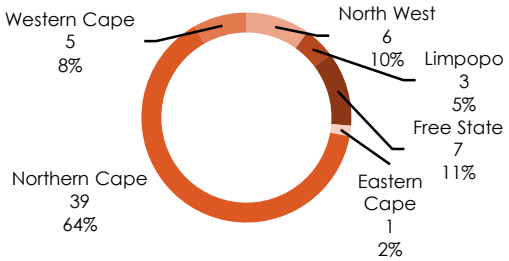
Share of PV capacity

Provincial distribution of capacity (MW)



Share of PV projects

Provincial distribution of projects (#)



Province	Provincial totals		Technology share	
			PV	Other RE
Eastern Cape	Number of projects	**17**	1	16
	Capacity procured (MW)[1]	**1 509**	70	1 440
	Capacity online (MW)[2]	**1 066**	70	997
Northern Cape	Number of projects	**59**	39	20
	Capacity procured (MW)[1]	**3 621**	1 552	2 069
	Capacity online (MW)[2]	**2 425**	1 250	1 174
Western Cape	Number of projects	**14**	5	9
	Capacity procured (MW)[1]	**606**	134	472
	Capacity online (MW)[2]	**452**	134	319
Other Provinces	Number of projects	**22**	16	6
	Capacity procured (MW)[1]	**685**	617	69
	Capacity online (MW)[2]	**332**	321	12

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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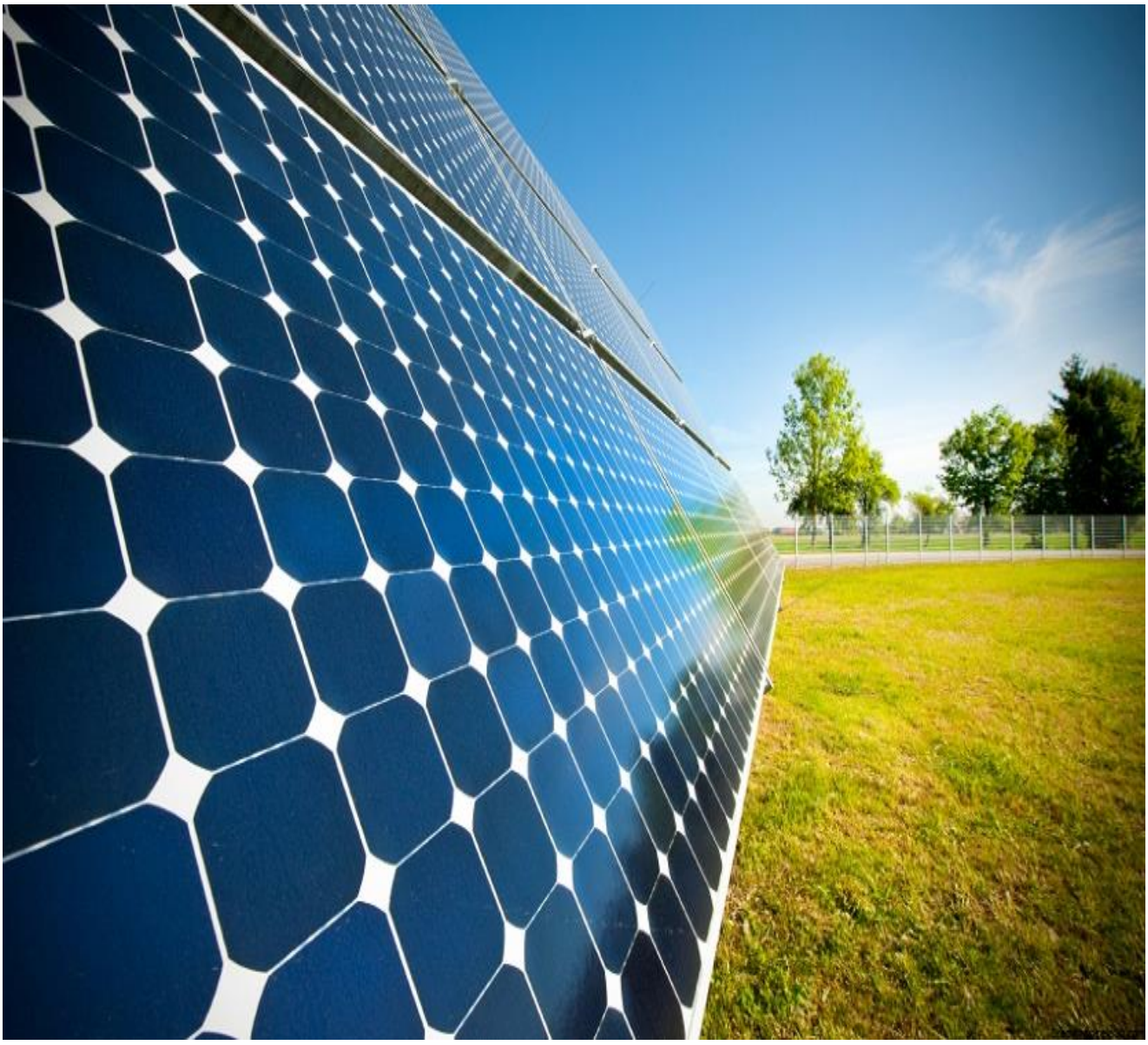

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