Bokpoort CSP Plant and Production Overview

Nandu Bhula –
Deputy Managing Director (Southern Africa)
CEO Redstone CSP (designate)

ACWA Power – Who are we?

- Head-quartered in the Kingdom of Saudi Arabia: owned by eight Saudi conglomerates, Sanabil Direct Investment Company (owned by the Public Investment Fund of Saudi Arabia), the Saudi Public Pensions Agency and the International Finance Corporation (a member of the World Bank Group).
- A developer, investor, co-owner and operator of a portfolio of power generation and desalinated water production plants; Total portfolio of **35** assets with a contractual capacity of more than **22,000 MW** of power and **2.5 Mn m^3 per day** of desalinated water, and total investment in excess of **USD 30.5 billion;** and
- Currently present in **11 countries** in the Middle East and North Africa, Southern Africa and South East Asia regions.

Our clients are:

- Mostly Investment Grade Sovereign linked Off-Takers
- Commodity Resource based credit worthy Off-Takers

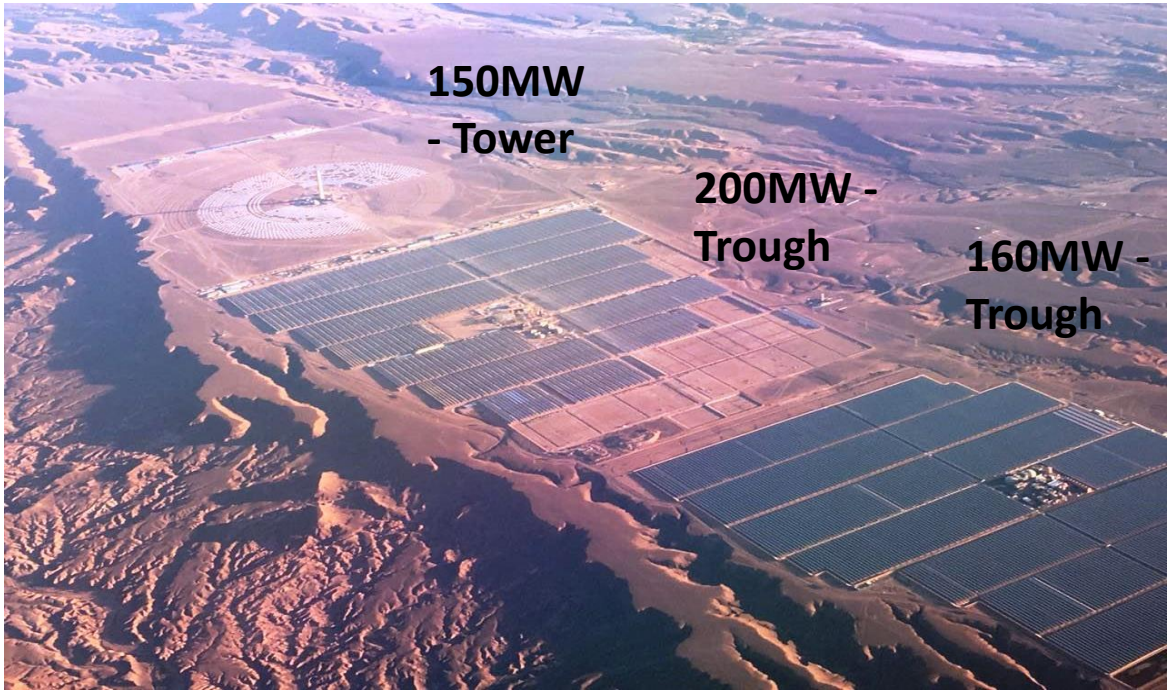
2004

2017-2018

ACWA Power is seeking to sustain its growth momentum through a combination of:

- Green-field development projects;
- Acquiring portfolio of assets through privatization and/or negotiated sales;
- New expansion of existing assets; and
- Increasing ownership of existing assets

ACWA Power – Noor Solar Complex Ouarzazate – 510MW CSP



The Way Ahead in Southern Africa

Acwa's Mission: *To reliably deliver electricity and desalinated water at the lowest possible cost while seeking to maximize local content and local employment creation, thereby contributing to the social and economic development of the communities and countries we invests in and serve.*

- **The Southern Cone of Africa** (RSA, Botswana, Mozambique, Namibia) is one of ACWA Power's strategic growth markets;
- We have a well developed strategy towards building a **multi-fuel, multi-technology generation portfolio**;
- Fully committed as a very long-term utility investor with approximately **US$ 670 million** of capital invested or committed for projects under construction, advanced development or already bid in the Region;
- Established a **fully capacitated office** in South Africa to serve its projects in the Region; and
- We are fully committed to foster holistic and **integrated socio-economic development** in communities surrounding and the countries in which projects are located.

50 MW (net) **Bokpoort** CSP Trough Project

100 MW (net) **Redstone** CSP Tower Project

300 MW (net) **Khanyisa** Coal Project

150 MW (net) **Round 4.5** CSP Project

Strong Regional pipeline of projects

And expanding into other geographies in Sub Saharan Africa

Bokpoort CSP – Project Overview

Overview of Company and Project

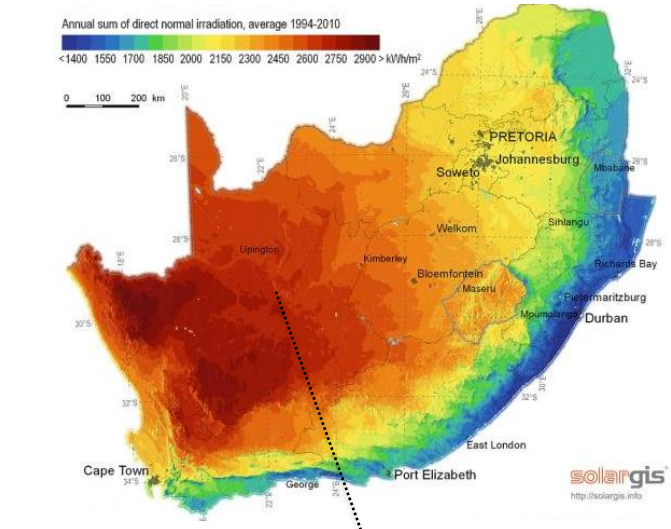
- Founded: Ring-fenced project company effective June 2013
  - Owners: ACWA 40%, PIC 25%, Lereko Solafrica Investment 13%, Lereko Metier Solafrica Fund 1 9%, Lereko Metier Sustainable Capital Fund 3%, Kurisani Solafrica Investments 5%, Solafrica Community Investment Company 5%.
- Total staff: ±1300 during Construction peak and 62 during Operations
- The site: Bokpoort Farm, 125km south-east of Upington (300 hectare Greenfield)
- Technology used: Concentrated solar thermal trough and 1300MWht molten salt thermal energy storage (9.3hrs at 50MW)
- 20 year PPA with Eskom, through the Garona Substation located next to the site

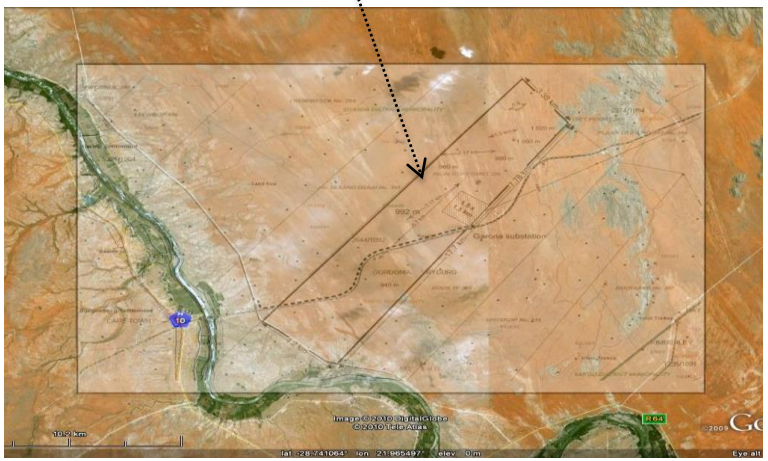
EPC - Project status

- Procurement and Suppliers: EPC consortium (Acciona, Sener, TSK, Crowie)
- 1st Synchronisation – 13th November 2015
- Early Operating Date – 6th February 2016
- COD – 19th March 2016

Site Location

Site Coordinates: Latt. 28°44'26.96"S Long. 21°59'34.88"E



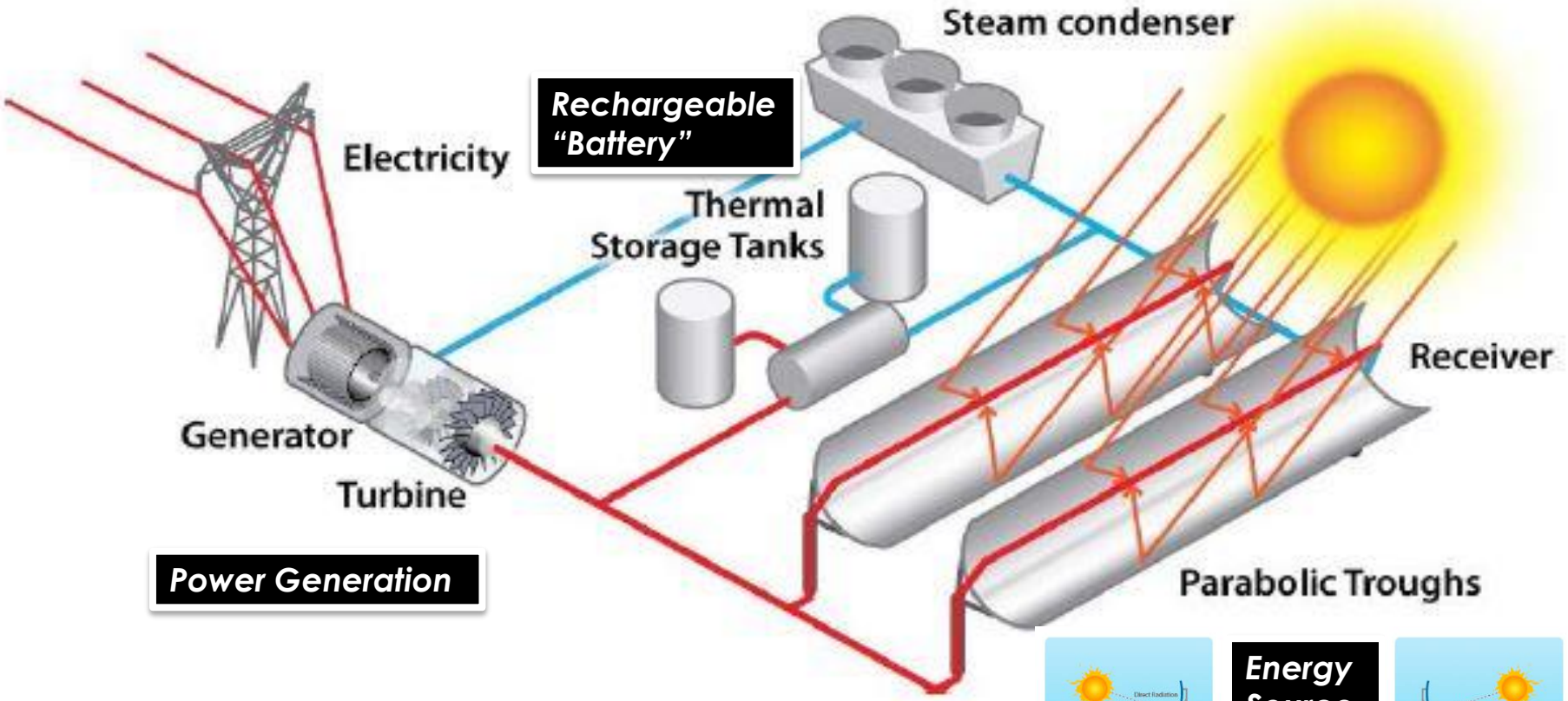


www.acwapower.com

Riyadh | Dubai | Beijing | Istanbul | **Johannesburg** | Rabat | Hanoi| Cairo

Bokpoort CSP – Plant Layout

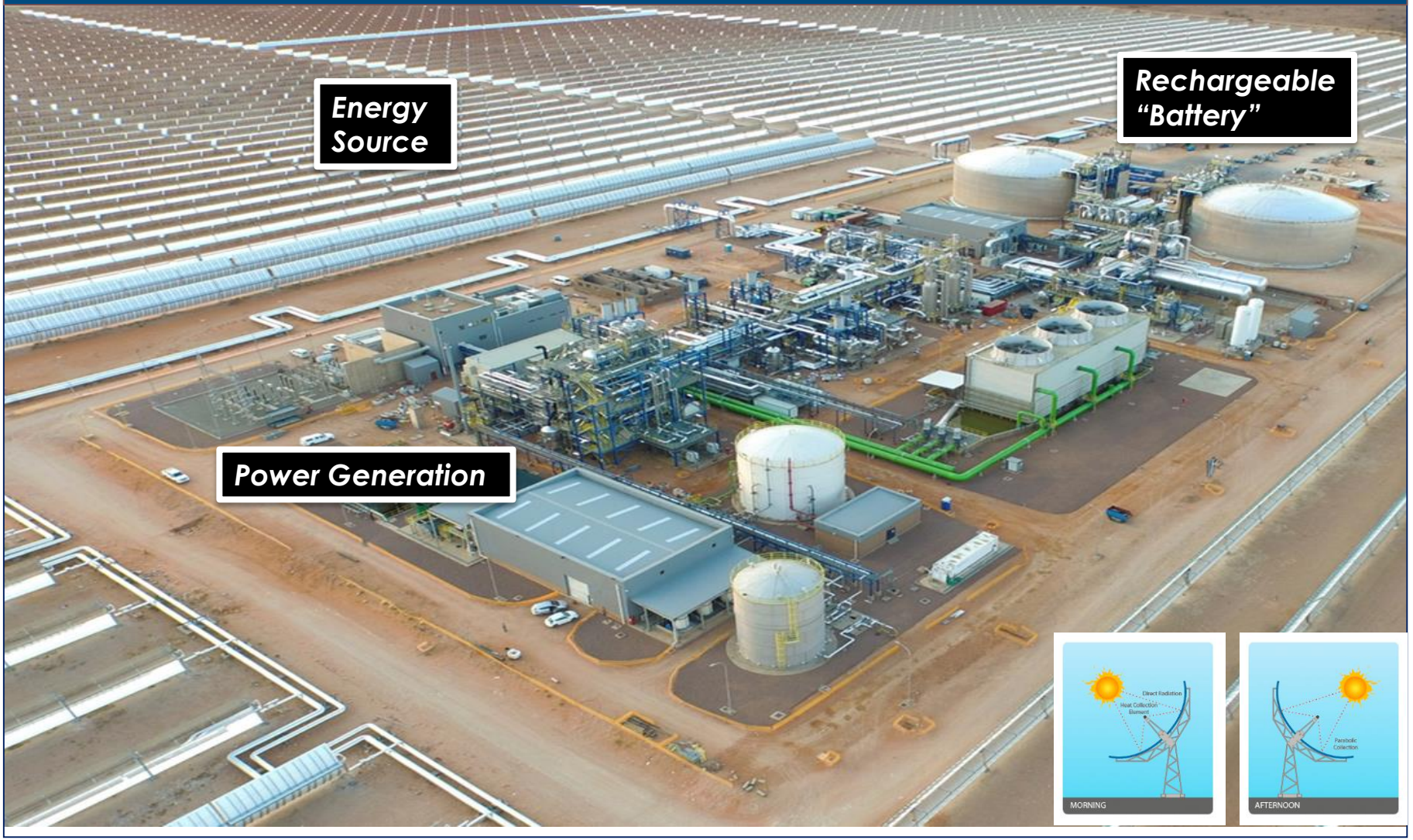
CSP Parabolic Trough Technology with Storage



- *50 MW Parabolic Trough CSP Plant: Wet Cooled*
- ***Thermal Energy Storage = 9.3 hrs at 50 MW***
  (Largest in World for Trough Plant)

Bokpoort CSP – Plant Layout

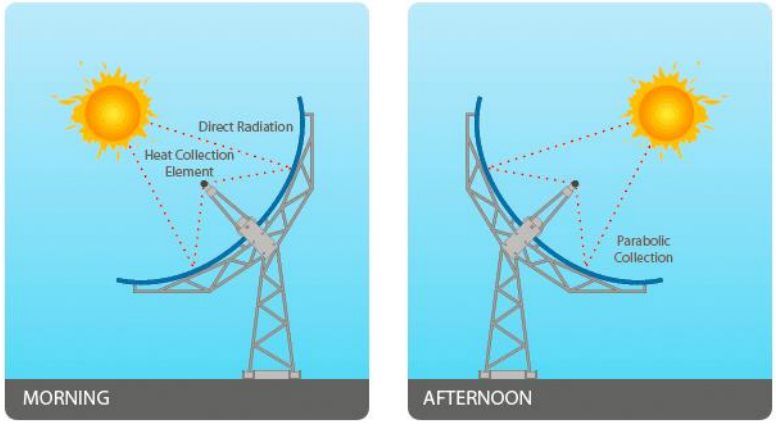
CSP Parabolic Trough Technology with Storage



Bokpoort CSP – Technical Overview

Solar Field

- Eight Solar Fields - 180 Loops
  - 48 Solar Collector Elements per Loop
  - 8,640 SCEs Installed
- Flabeg Glass Mirrors
  - 241,920 Mirrors
  - 658,000 m2 of reflective surface
- SENER Trough Technology
- Schott Heat Collector Elements (25,920)
- HTF – Dow Chemical (2,640 tons)

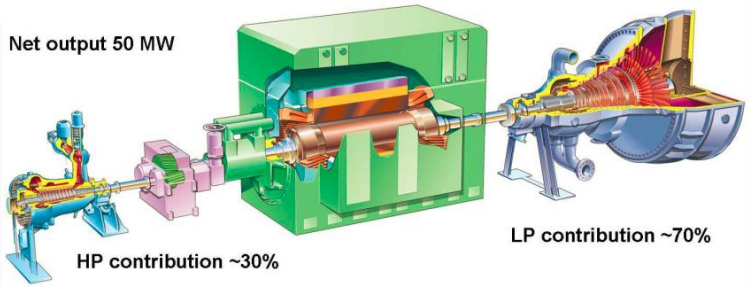


Thermal Energy Storage

- 38,100 Tons of Salt (Potassium and Sodium Nitrate)
- Two Tanks – Hot & Cold
  - 40 m Diameter
  - 14 m Height
- Bank Solar Energy during the day and release it at night or as needed

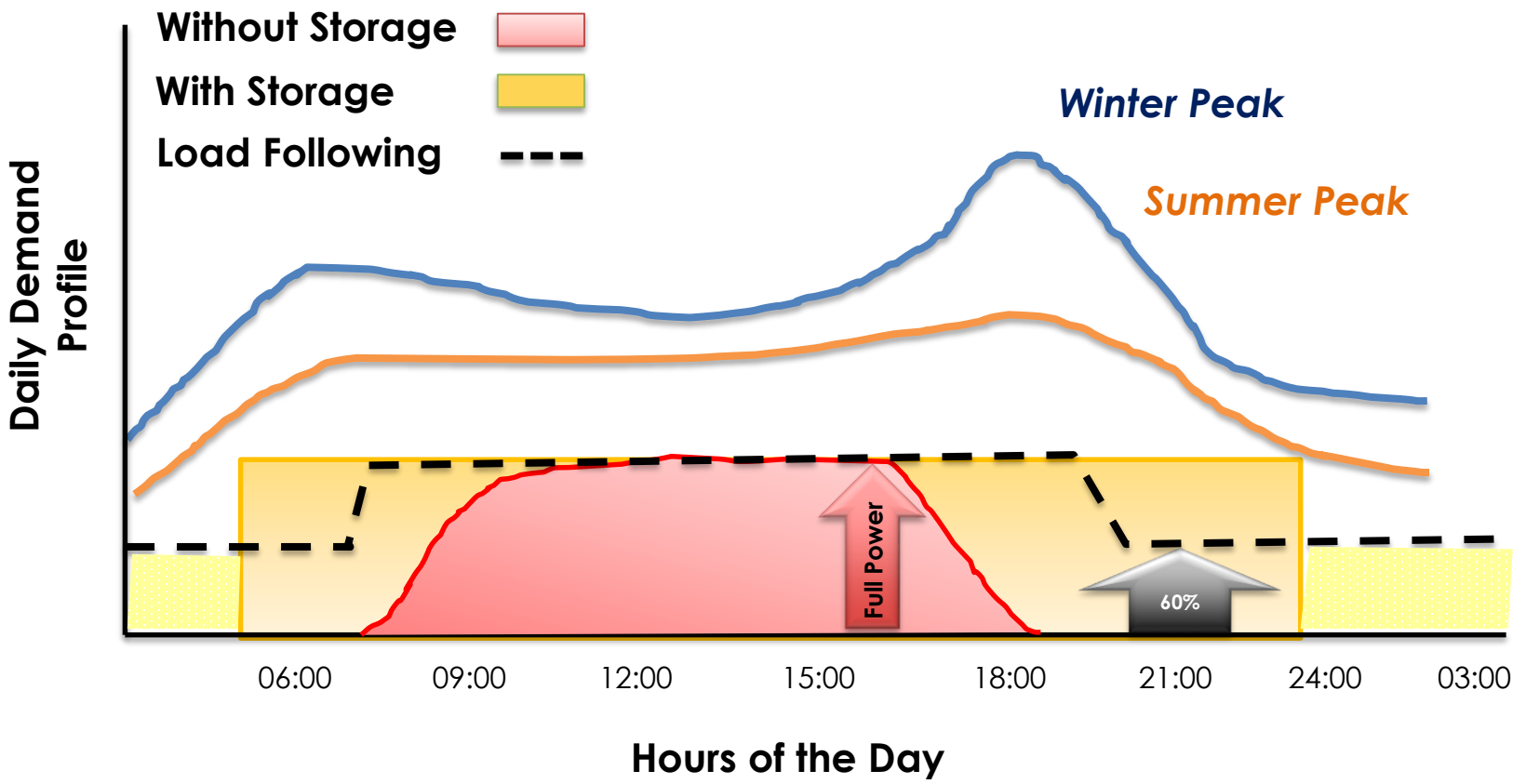
Steam Generation

- Two Trains of Steam Generation
  - Steam Supply 103.6 bar @380°C (@ Turbine Inlet)
  - Enthalpy 3028.7kJ/kg, Steam Flow 60.0 kg/s
- Siemens Steam Turbine SST-700
  - Single Reheat (HP, LP)
  - Siemens Generator



Benefit of CSP with Adequate Storage

CSP + Storage = Base maybe not yet but Load Following (depending on size)



Note: Not to Scale for Illustration Purposes only

Bokpoort CSP Delivers Record Performance

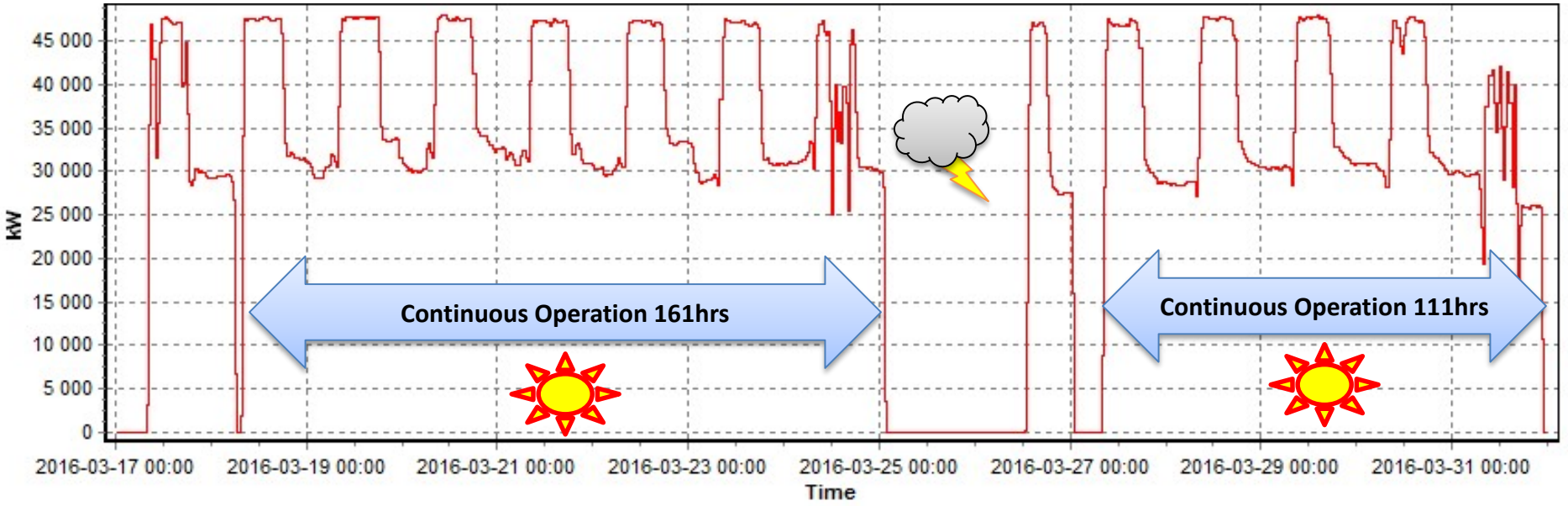
African Record*:

Busting Myths about Renewables

***Possibly World Record performance in 1st month of commercial production**

Period: 18 March 2016 7:00am to 25 March 2016 1:00am
Record: **161 hours of Operation Continuously (Load Following)**
Load Factor: **76% (based on Energy Sent Out)**

Period: 17 March 2016 8:00am to 31 March 2016 11:00pm
Record: **310/352 hours of operation (88% of time on Load)**
Load Factor: **66% (based on Energy Sent Out)**



Bokpoort CSP - Effectiveness over Peak and standard Demand Hours

Typical Summer and Winter Months			
Typical	**Summer - March 2016**	**Winter - August 2016**	**Summer - November 2016**
Monthly Load Factor	**59%**	**42%**	**58%**
Peak Production LF (Peak 4pm-10pm MWh)	**64%**	**55%**	**71%**
Standard Production LF (Standard 6am-4pm MWh)	**66%**	**54%**	**62%**
Off Peak Production LF	**45%**	**16%**	**43%**

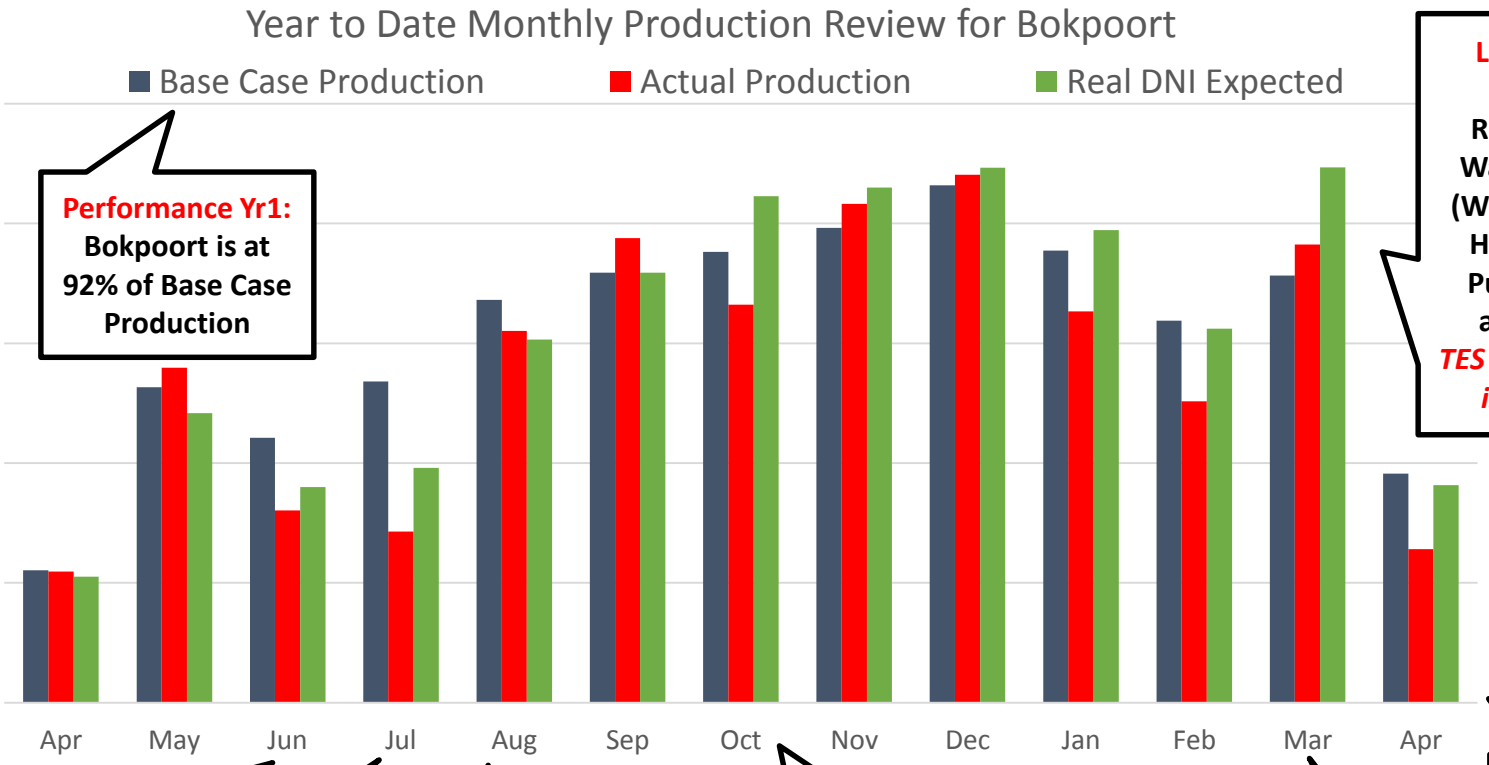
- Clearly Bokpoort is delivering consistently towards the Peak demand periods in aid of the grid
- Performance over the Peak periods in terms of Load Factor has shown significant increase (comparison of Mar 2016 vs Nov 2016)
- The Storage capacity can also be optimized to guarantee highest load factors over the Peak if so required and encouraged by the PPA

Bokpoort CSP - Effectiveness over Peak and standard Demand Hours

Recent Summer Records	
Typical	**Latest Records**
Max Daily Production (MWh)	**999** (28th Nov 2016)
Daily Load Factor	**83.3%**
Max 3-day Continuous Prod (MWh)	**2941** (26th-28th Nov 2016)
Max 3-day Load Factor	**81.7%**
3-day Peak Production LF (Peak 4pm-10pm MWh)	**90.5%**
3-day Standard Production LF (Standard 6am-4pm MWh)	**82.9%**
3-day Off Peak Production LF (Off Peak 10pm-6am MWh)	**73.6%**

- Performance records set in months of Oct. 2016 and Nov. 2016 after initial records set in March 2016
- Daily maximum net sent out of 999.129MWh set on 28th Nov 2016 (LF = 83.3%)

Bokpoort CSP – Production Performance Overview – 1st yr Ramp-up



Performance Yr1: **Bokpoort is at 92% of Base Case Production**

Lessons Yr1: **Design Redundancy, Water Balance (WTP Capacity), Heat Tracing, Pumps (FFP – availability)** ***TES Management is a Science***

Jun16: Cold Salt Tank Valve Gland failure and Low Water Availability (WTP)

Jul16: Losses due to Water Treatment Plant issues and Salt Valve Gland Repairs

Aug16: Impacted by Recovery from Water Treatment Plant Load Losses

Sep16: Failure of VFD on Salt Pumps caused 12 days of TES underperformance but still above base Case

Oct16: Turbine Oil Leak, Fire in Enclosure

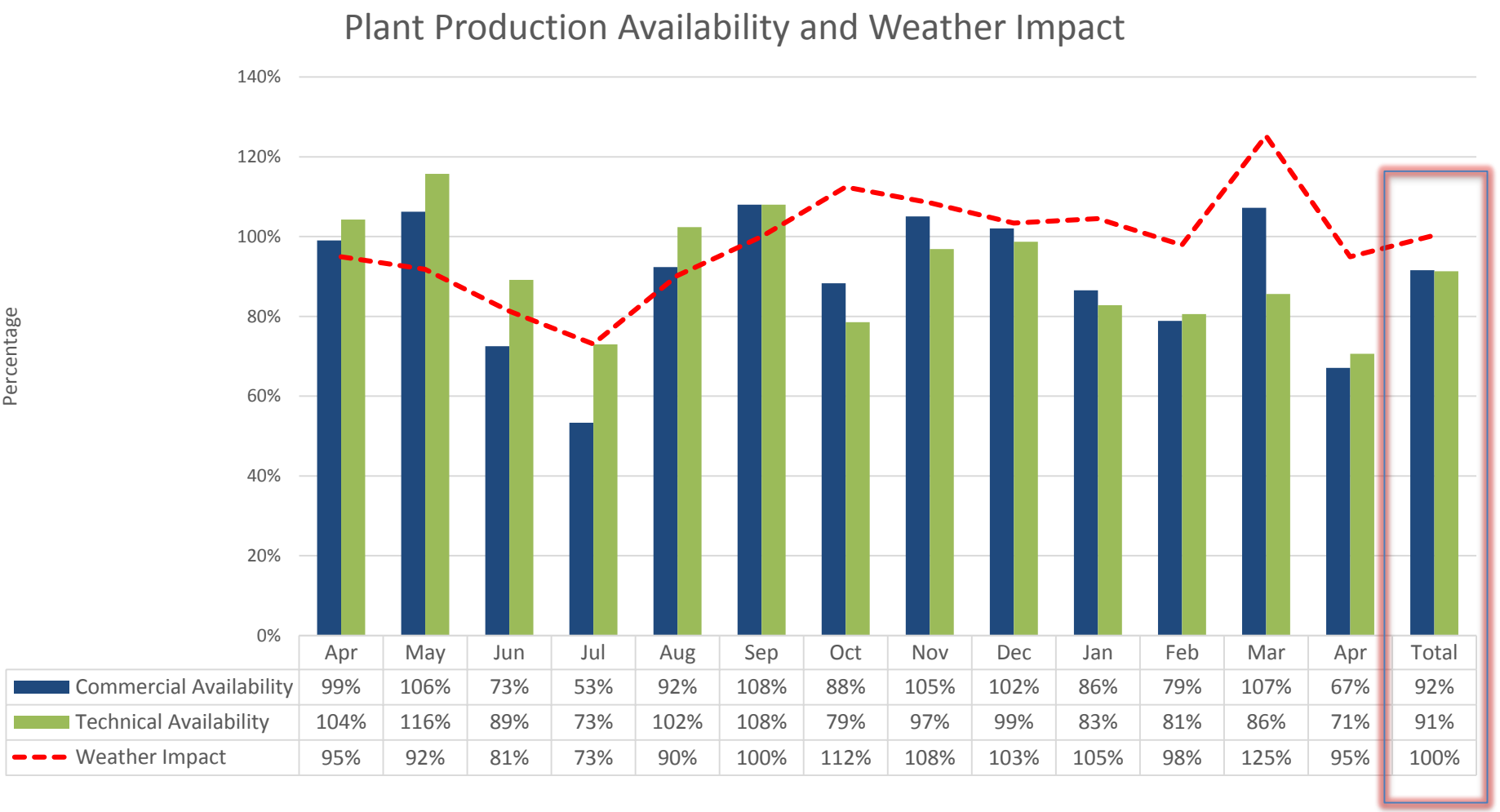
Jan17: Grid Fault, Loss of Barring

Feb17: Poor DNI, HTF Micro Pumps, Turbine Trips

Mar17: DCS Failures, TES Management

Apr17: Anti-Freeze pumps and air compressors

Bokpoort CSP – Production Performance Overview



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Commercial Availability	99%	106%	73%	53%	92%	108%	88%	105%	102%	86%	79%	107%	67%	92%
Technical Availability	104%	116%	89%	73%	102%	108%	79%	97%	99%	83%	81%	86%	71%	91%
Weather Impact	95%	92%	81%	73%	90%	100%	112%	108%	103%	105%	98%	125%	95%	100%

- First year experience in DNI suggest that Base Case TMY underestimated production over summer months and over estimated production in Winter

Bokpoort's Industry Accolades to date:

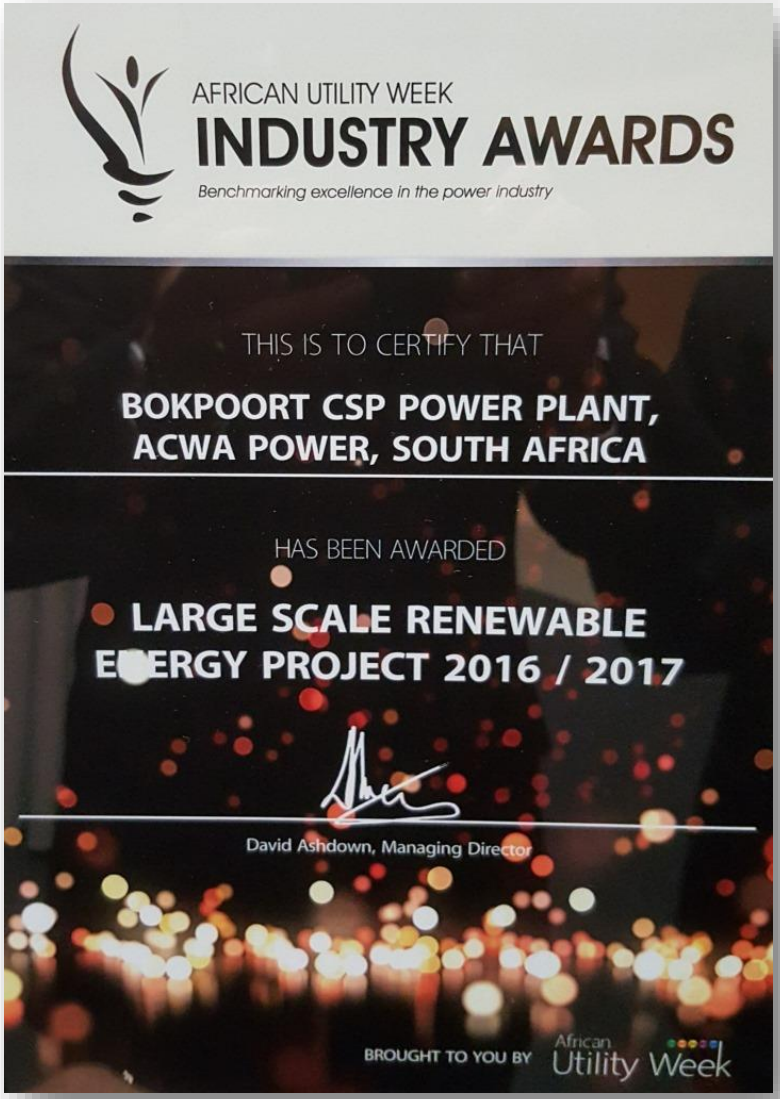
Bokpoort CSP – African Community Project of the Year 2015

- Excelled in all aspects targeted for this category with Key contributions:
  - Impact on skills development & focus on community upliftment.
  - The contribution to the community from the onset of construction was recognized as setting a new standard for IPP's

Bokpoort CSP – SANEA Energy Project of the Year 2016

- According to SANEA/SANEDI the ACWA Power SolAfrica Bokpoort CSP was awarded for:
  - its innovative design which enables the plant to operate almost as a base load-facility and
  - secondly, the successful manner in which the socio-economic commitments of the project are being met

Bokpoort's Industry Accolades to date:



Bokpoort CSP – Large Scale Renewable Energy Project of the Year 2016/2017

Key Socio-Economic Considerations

Support to Local Communities: The Project has targeted key community well being initiatives focusing on ensuring the needs of the community are taken into consideration

Community Engagement

Solar Lighting Project – 300 homes

Topline Water Reticulation Project – drinking water to 77 homes)

Solar Geysers & Solar Power Systems for Schools and Creche

Uitsig Primary – Bicycles and Road Safety

Key Socio-Economic Considerations

Local Employment: The Project has successfully managed to increase the number of employees from the local Municipality (averaged around 40%).

Skills Development: The Project has also successfully started the focus on development of youth from Crèches through Schooling to Further Studies.

Palms Training Centre

(180 trained – 50% female) Courses Business skills, Problem solving skills & semi-skills training.

Welding apprenticeship

Support to local high school

Educational material for 7 Crèches

Bursary Scheme for Locals – Technical and Non-Technical

Thank you

ACWA Power remains committed to creating long term value, not only for ourselves in isolation, but to the communities within which our assets are located, with whom we live and work, and the people and the nations we serve.

Paddy Padmanathan (CEO Acwa Power)