RENEWABLE ENERGY – THE “NEW NORMAL”

SAIBPP CONVENTION – 8 AUGUST 2018 AT IDC, SANDTON

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PRESENTATION OUTLINE

⇒ Company introduction

⇒ Does renewable energy make “cents” ?

⇒ Renewable energy technologies & global trends

⇒ Myths about renewable energy

⇒ The future of renewable energy

⇒ What this means for property & the built environment

SENER
Strategic business units

AEROSPACE

- Space
- Defense
- Aeronautics

INFRASTRUCTURE & TRANSPORT

- High speed railways
- Freight & mainline railways
- Metro systems
- LRT's & tramways
- Roads & highways
- Airports
- Ports
- Architecture
- Water & environment

RENEWABLES, POWER, OIL & GAS

- Thermoelectric solar energy
- Biomass
- Waste to energy
- Farm waste treatment
- Power & industrial solutions
- Oil & Gas

MARINE

- Marine engineering
- FORAN

Global footprint
Group 2018

AMERICA

USA
Los Angeles
Oakland

MEXICO
Mexico City

ARGENTINA
Buenos Aires

BRAZIL
São Paulo
Rio de Janeiro

CHILE
Santiago de Chile

COLOMBIA
Bogota

EUROPE / AFRICA

POLAND
Warsaw

UNITED KINGDOM
London
Manchester

SPAIN
Biscay
Madrid
Barcelona
Valencia
Seville
Cadiz

PORTUGAL
Lisbon

MOROCCO
Rabat

ALGERIA
Algiers

SOUTH AFRICA
Johannesburg

ASIA

QATAR
Doha

UAE
Abu Dhabi

CHINA
Shanghai

SOUTH KOREA
Busan

INDIA
Bangalore

Engineering & Construction
Environment
Torresol Energy

Product Lines

Project types

RENEWABLES

- Parabolic trough (SENERtrough®)
- Central tower
- Biomass power plants
- Waste to energy
- Farm waste treatment

POWER & INDUSTRIAL SOLUTIONS

- Open cycle
- Combined cycle
- Cogeneration
- Conventional power
- Mining and industrial plants

OIL & GAS

- Upstream
- Downstream
- Petrochemical
- LNG terminals (onshore, offshore)
- NG liquefaction
- Virtual gas pipelines
- Underground gas storage

Why SENER?

GLOBAL FIRM

WORLDWIDE

SENER is present worldwide, with international offices and a large experience in different countries.

ENGINEERING

SERVICES

SENER is a large Engineering and Technology Company, experienced in every field of activity in Industrial applications, covering Renewables, Power, and Oil & Gas.

EPC & EPCM

CONTRACTOR

SENER has a powerful experience as EPC/EPCM Contractor in Power, Oil & Gas, with a trustable background and a wide range of references.

DIGIPLANT

O&M, DIGITAL

SENER can design and construct fully digitalized assets, including the Operation and the Maintenance (O&M) of the plant, from a traditional point of view or under the DIGIPLANT full cover approach.

BUSINESS

MODEL

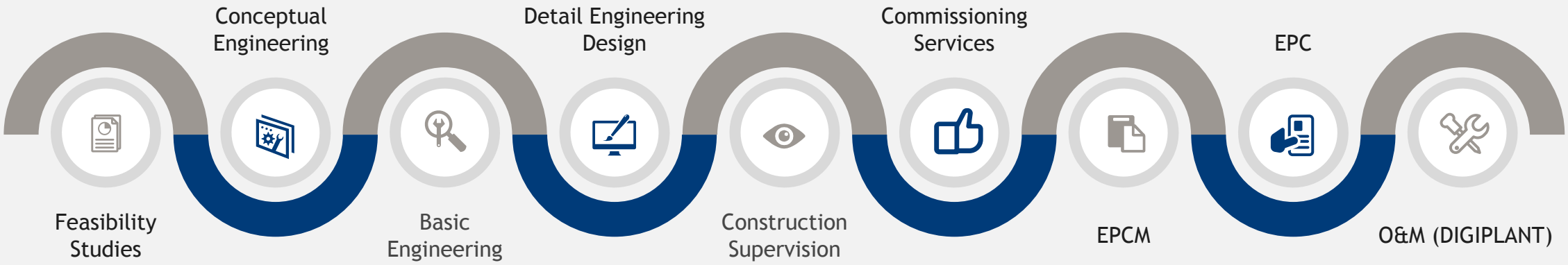
Our business model points towards self-performance for engineering, procurement, construction, commissioning, operation and maintenance capabilities.

PROJECT

FINANCE

SENER provides technological commitment and financial trustworthiness towards our clients and financial institutions. SENER is recognized as fully bankable for project financing.

SERVICES: SENER HANDLES EVERY SINGLE STAGE OF THE PROJECT CYCLE



Financing support

DOES RENEWABLE ENERGY MAKES “CENTS” ?

PRIMARY REASONS:

THE WORLD HAS CHANGED !

⇒ SA one of the top 20 largest emitters of greenhouse gas emissions in the world!
  ⇒ Ghg emissions cause climate change eg Cape Town drought

⇒ Fossil fuels getting depleted over time:
  ⇒ In 2018 SA suffered blackouts due to coal shortages at some of their key power stations

⇒ Fossil fuel prices rising exponentially
  ⇒ Source of energy could be free (eg the sun, wind or waste)

DOES RENEWABLE ENERGY MAKES “CENTS” ?

SECONDARY REASONS:

⇒ ***“As at mid 2017, 62,5% of the population in Sub Saharan Africa do not have access to electricity.”*** source: World Economic Forum 2018

⇒ Need annual electrification growth rate of at least 8,5% for universal energy access by 2030.

⇒ Smaller plants quicker to build > improves energy access & security of supply

⇒ Local industrial & rural development > skills development, employment creation & economic growth

⇒ Renewable energy corporate PPA’s allow corporates to hedge against unpredictable future energy cost increases by locking-in the price upfront

RENEWABLE ENERGY TECHNOLOGIES & GLOBAL TRENDS

ENERGY SOURCE / FEED STOCK	TECHNOLOGY	TECHNOLOGY OPTIONS	Examples in South Africa
The sun	Solar Photovoltaic (PV)	Tracker Fixed Ground mounted Rooftop	Northern Cape (2,292MW – BW1 – BW4) Property industry – rooftops
The sun	Concentrated Solar Power (CSP)	Parabolic trough Central tower Fresnel	REIPPPP - 7 approved projects in Northern Cape (550MW) Smaller scale: R&D purposes
Wind	Wind turbines	Dutch windmills Onshore wind turbines Off shore wind turbines	REIPPPP in Eastern & Western Cape – (3,358MW) 100MW SERE - Eskom

RENEWABLE ENERGY TECHNOLOGIES & GLOBAL TRENDS

ENERGY SOURCE / FEED STOCK	TECHNOLOGY	TECHNOLOGY OPTIONS	Examples in South Africa
Municipal waste	Waste to energy	Incineration Gasification Anaerobic digestion	Athlone Cape Town – 8,000tons of waste per day
Any organic matter – wood, crops, sea weed, animal waste	Biomass	Combustion direct firing Biogas	Ngodwana / SAPPI 25MW plant
Water	Hydro electric power	Conventional reservoir Run off river plant Pumped storage plant	Steenbras, Cape Town Ingula Pumped Storage, Drakensburg Palmiet pumped Storage, CT
Water waves	Ocean or marine energy	Thermal energy from sun's heat Mechanical energy	None
Heat & steam from earth's crust	Geothermal energy	Dry steam plant Flash steam plant	None

RENEWABLE ENERGY TECHNOLOGIES & GLOBAL TRENDS

TECHNOLOGY	GLOBAL CAPACITY IN 2016 (GW)	GLOBAL CAPACITY IN 2017 (GW)	INCREASE (MW)	INCREASE (%)	STATUS
Hydro power	1,095	1,114	19,000MW	1,7%	40% of new in China 95% pumped storage
Bio power	114	122	8,000MW	7%	Heating, cooking & transport. China & US leaders
Geothermal power	12,1	12,8	700MW	0,6%	Growth in Turkey & Indonesia Long lead times & technology
Solar PV	**303**	**402**	**99,000MW**	**32,7%**	**Total capacity 2,5GW 2007 (15,080%) More MW than fossil fuels & nuclear Largest growth in China (52MW)**
CSP	4,8	4,9	100MW	2%	Only new plant in South Africa 2GW u/construction (Morocco & China)
Wind power	487	539	52,000MW	10,7%	India & Europe dominated Decline in China
Ocean energy	0,5	0,5	0	0%	Largely in Scotland

LARGEST SOLAR COMPLEX IN THE WORLD

Renewables

Bokpoort parabolic trough plants - 50 MWe

Total mirror surface: 588,600 m^2
Number of SCA/loops: 720/180 SENERtrough®
Field surface area: 350 Ha
Nominal solar field thermal output: 290 MWt
Thermal storage capacity: 1,300 MWht
Turbine capacity: 50 MWe

GENERAL DATA	
Location:	Bokpoort (South Africa)
Client:	ACWA POWER led Consortium
Contact type:	EPC
Investment (MU$D):	> 175
Construction manpower (mh):	> 2,200,000
Engineering manpower (mh):	> 90,000
Date:	2013 - 2015

Renewables

Kathu parabolic trough plant - 100 MWe

Technology: Parabolic trough collector, SENERtrough®-2
Generation capacity: 100 Mwe net power
Thermal storage capacity: 1,550 MWth
Number of loops: 250
Main cooling method: Air cooled condenser
Heat transfer fluid: HTF

GENERAL DATA	
Location:	Kathu (South Africa)
Client:	Engie led Consortium
Contact type:	EPC
Investment (MU$D):	> 500
Construction manpower (mh):	> 2,500,000
Engineering manpower (mh):	> 175,000
Date:	2015 - 2018

MYTHS ABOUT RENEWABLE ENERGY

⇒ Renewable energy is expensive

⇒ Renewable energy is not reliable

⇒ We do not need renewable energy as we have a surplus

⇒ Renewable energy is taking away valuable coal related jobs

MYTHS ABOUT RENEWABLE ENERGY

⇒ **Renewable energy is “expensive”**

⇒ Some costs are not included when such statements are made eg:
- ⇒ Cost of climate change
- ⇒ Cost of pollution and impact on our health
- ⇒ Cost of fossil fuels such as coal

⇒ Global Trends:
- ⇒ In 2017, wind & PV prices tumbled including Africa eg Senegal & Zambia
- ⇒ In 2017, record low tariffs for CSP in Australia, Dubai & Chile

MYTHS ABOUT RENEWABLE ENERGY

⇒ **Renewable energy is "expensive"**

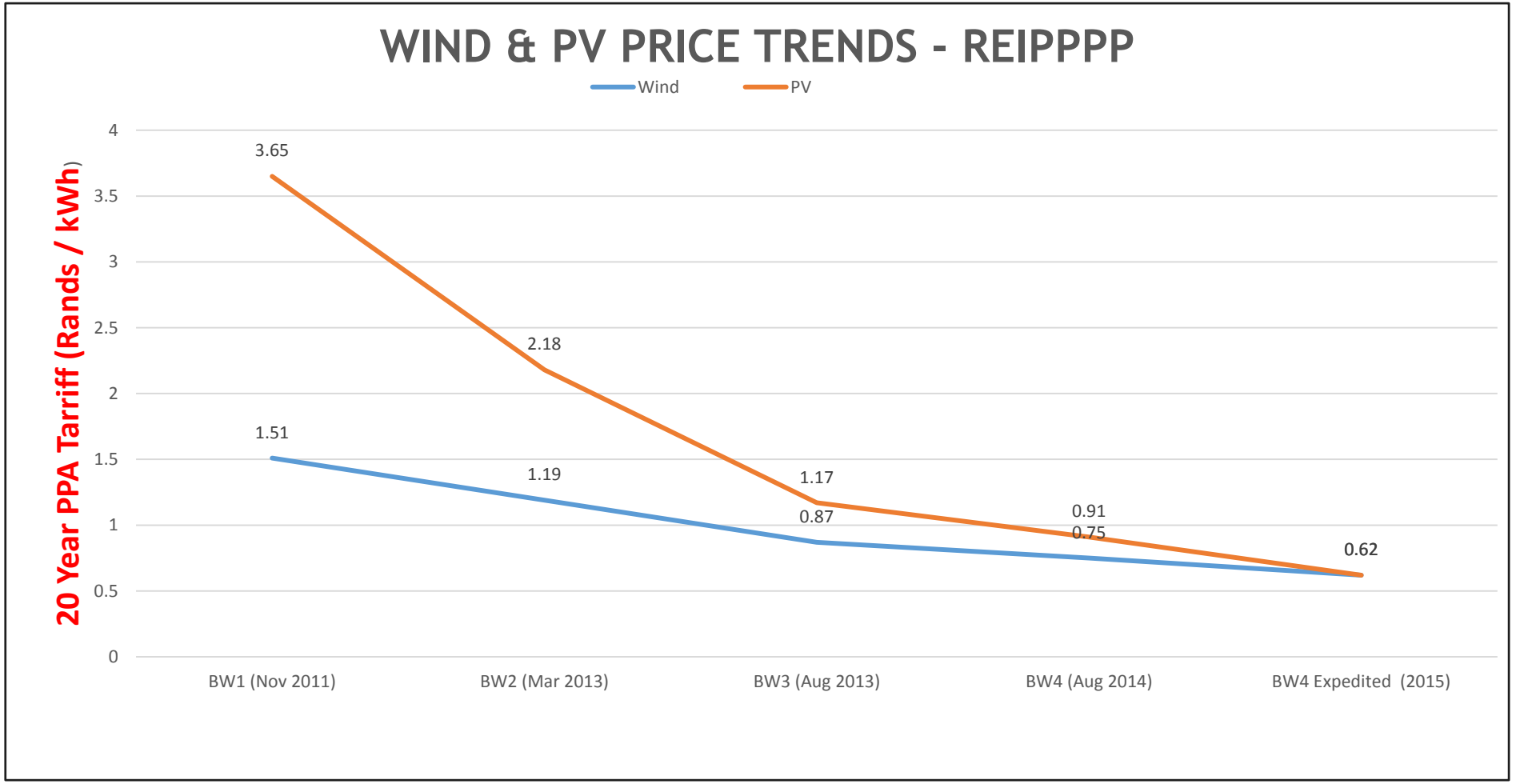
⇒ *CSIR* study shows that the least costly energy mix for SA by 2050 will be:
⇒ 90% renewables (PV, wind)
⇒ 10% natural gas, hydro & cleaner coal.

Such energy mix would be 30% cheaper than the energy portfolio proposed in the draft IRP published in November 2016.

⇒ Similar study done by *UCT's Energy Research Centre* published in May 2018: Approved **coal IPP's** (306MW Khanyisa @ R1,03/kwh & 557MW Thabametsi @R1,04/kwh) & new nuclear **not necessary until 2050** to achieve least cost LCOE. Additional cost – min R16bn

MYTHS ABOUT RENEWABLE ENERGY

⇒ Renewable energy is “expensive”



MYTHS ABOUT RENEWABLE ENERGY

⇒ **“Renewable energy is not reliable”**

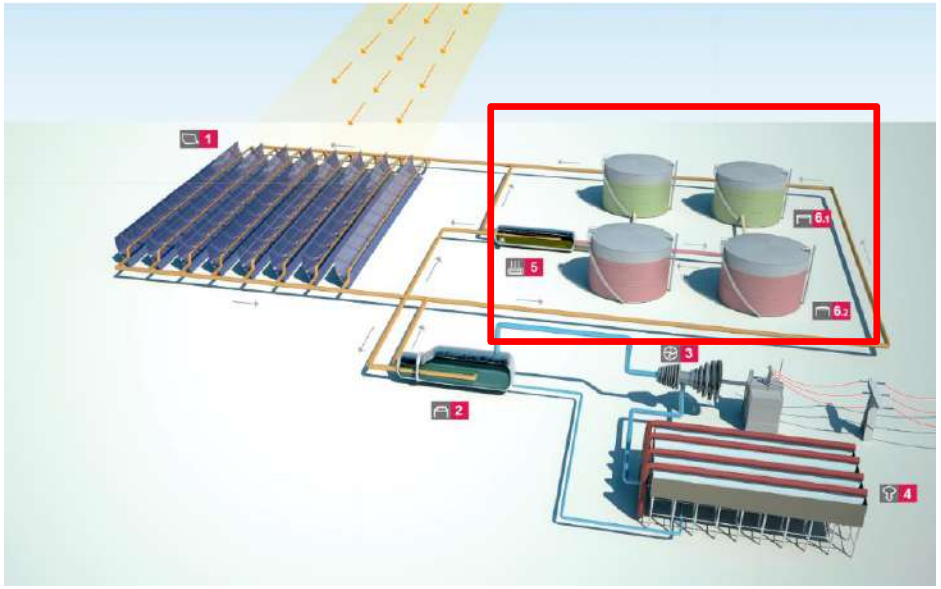
⇒ Can be used in conjunction with other technologies such as natural gas.

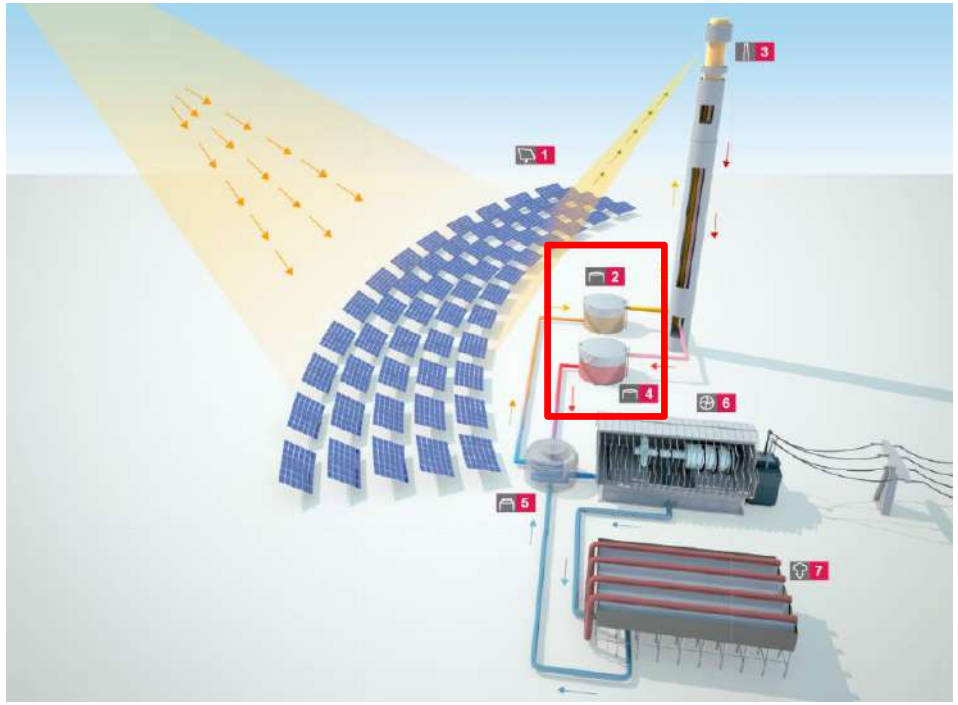
⇒ R&D into affordable batteries with less impact on environment for PV being developed at very fast pace eg. Elon Mask’s giant lithium-ion battery in S. Australia

⇒ CSP Technology has storage & despatchability capability through molten salts

CSP Dispatchability – Thermal Storage System

⇒ Molten Salts Thermal Storage System: well-proven technology



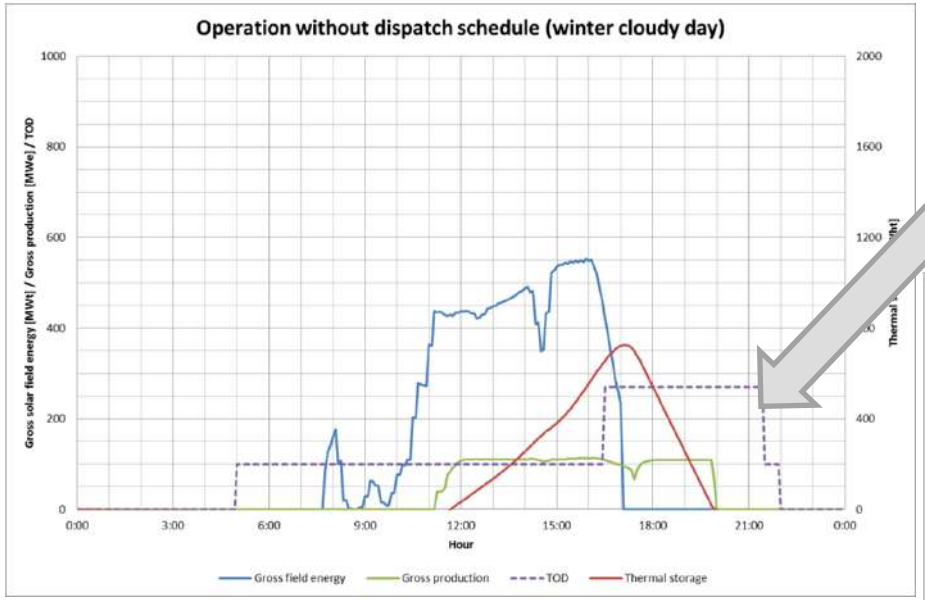


Molten Salts Thermal Storage:

- **cheaper than other ways of storing energy**
- **Provides total flexibility**

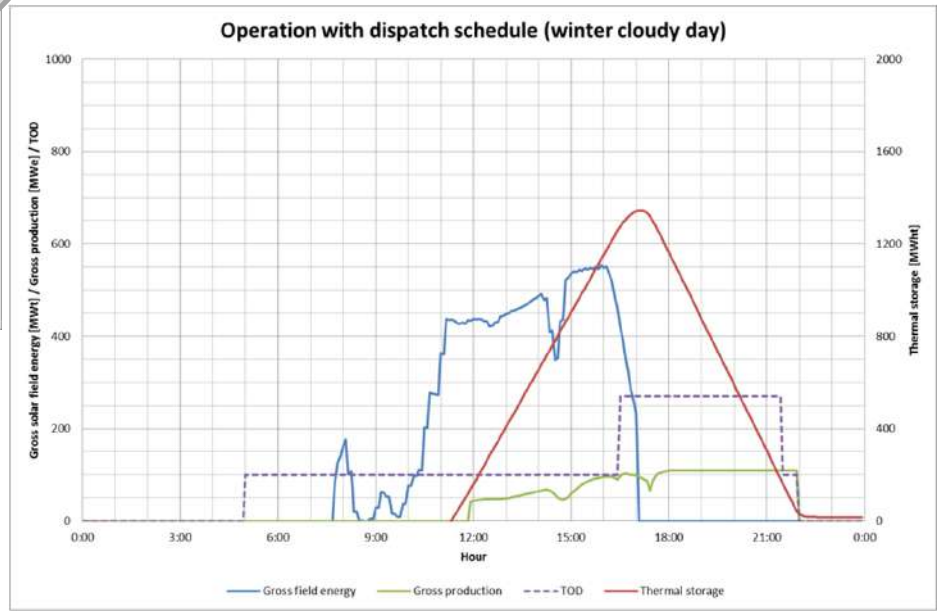
CSP Dispatchability – South African TODs

Thermal Storage System can adapt electricity production to grid demand



Turbine priority

Peak demand from 16:30 to 21:30



TES priority

Mid-merit design

MYTHS ABOUT RENEWABLE ENERGY

⇒ **We do not need renewable energy as we have a surplus**

- ⇒ Not planning for short term but for medium to long term.
- ⇒ Drop in energy demand due to drop in economic performance

⇒ **Renewable energy is taking away valuable coal related jobs**

- ⇒ Coal fired power plant decommissioning was planned as far back as 2008
- ⇒ Decommissioning confirmed in IRP 2010
- ⇒ Need to adapt to changing environment and the world by creating new types of jobs

THE FUTURE OF RENEWABLES

⇒ REIPPPP – to continue with BW5 (subject to IRP) scheduled for Nov 2018 - resistance

⇒ Distributed renewables for energy access –
  ⇒ huge potential in Africa's rural areas for mini grids & off grid systems

⇒ What China does will drive renewable energy generation trends

⇒ Renewables will continue to outstrip fossil fuels in terms of annual net additions to capacity

⇒ No "subsidies" will be required for mature renewables

⇒ Large scale PPA's for companies with data centres & cloud computing, such as Google (3,1GW wind & PV), Amazon (1,2GW), Microsoft (759MW), Apple (749MW) & Facebook (736MW) to grow

WHAT IT MEANS FOR PROPERTY & THE BUILT ENVIRONMENT

- ✓ More than enough reasons to consider renewables for property developments & investments
- ✓ Renewables developing at phenomenal rate – chose the right technology for you
- ✓ If working in rest of the African continent. Consider how Africa can leapfrog developed nations through rollout of renewables to those with no energy access
- ✓ Support utility scale roll out of renewables as this will have positive impact on your bottom line
- ✓ Accept that the world has changed and **be a change agent**

THANK YOU

www.poweroilandgas.sener

www.linkedin.com/company/sener

www.youtube.com/user/senerengineering