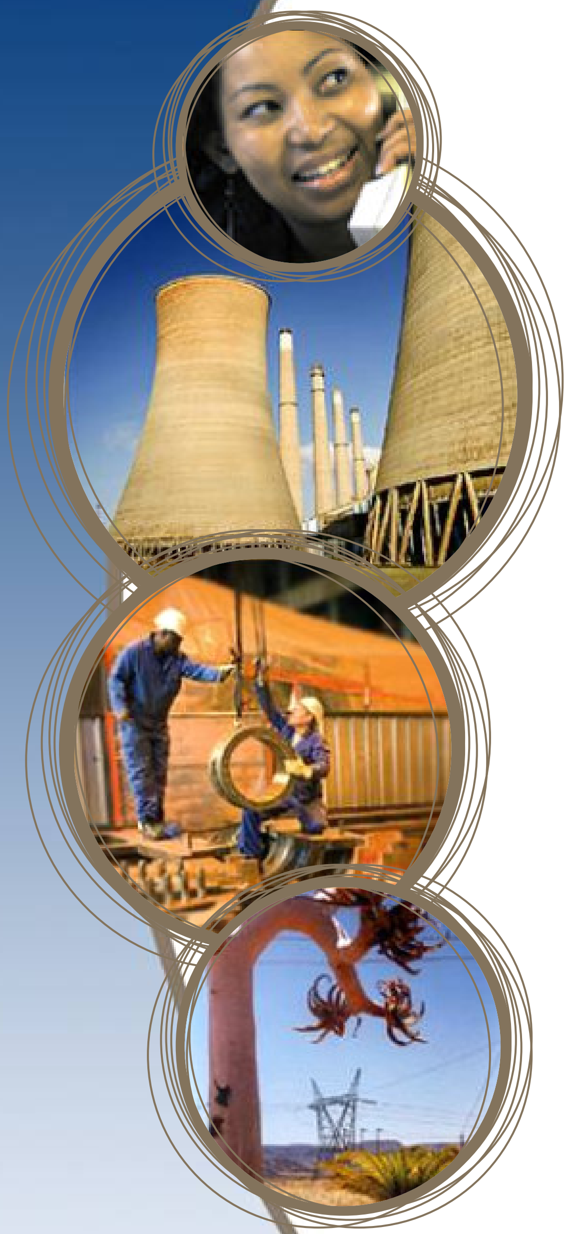


Eskom Solar Projects & Opportunities

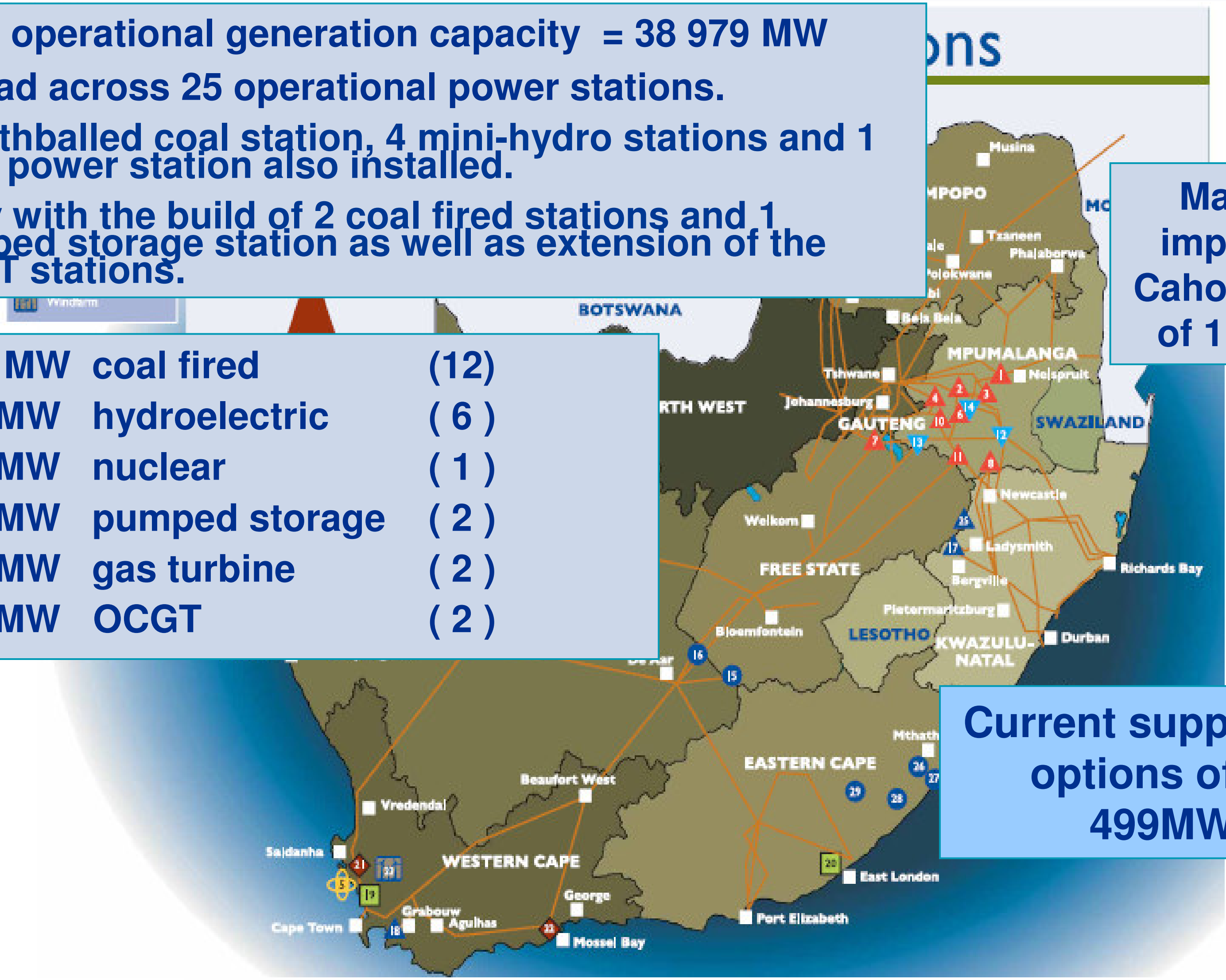
Barry MacColl

Technology Strategy and Planning Manager

Eskom Generation Resources and Imports

- Total operational generation capacity = 38 979 MW
- Spread across 25 operational power stations.
- 1 mothballed coal station, 4 mini-hydro stations and 1 wind power station also installed.
- Busy with the build of 2 coal fired stations and 1 pumped storage station as well as extension of the OCGT stations.

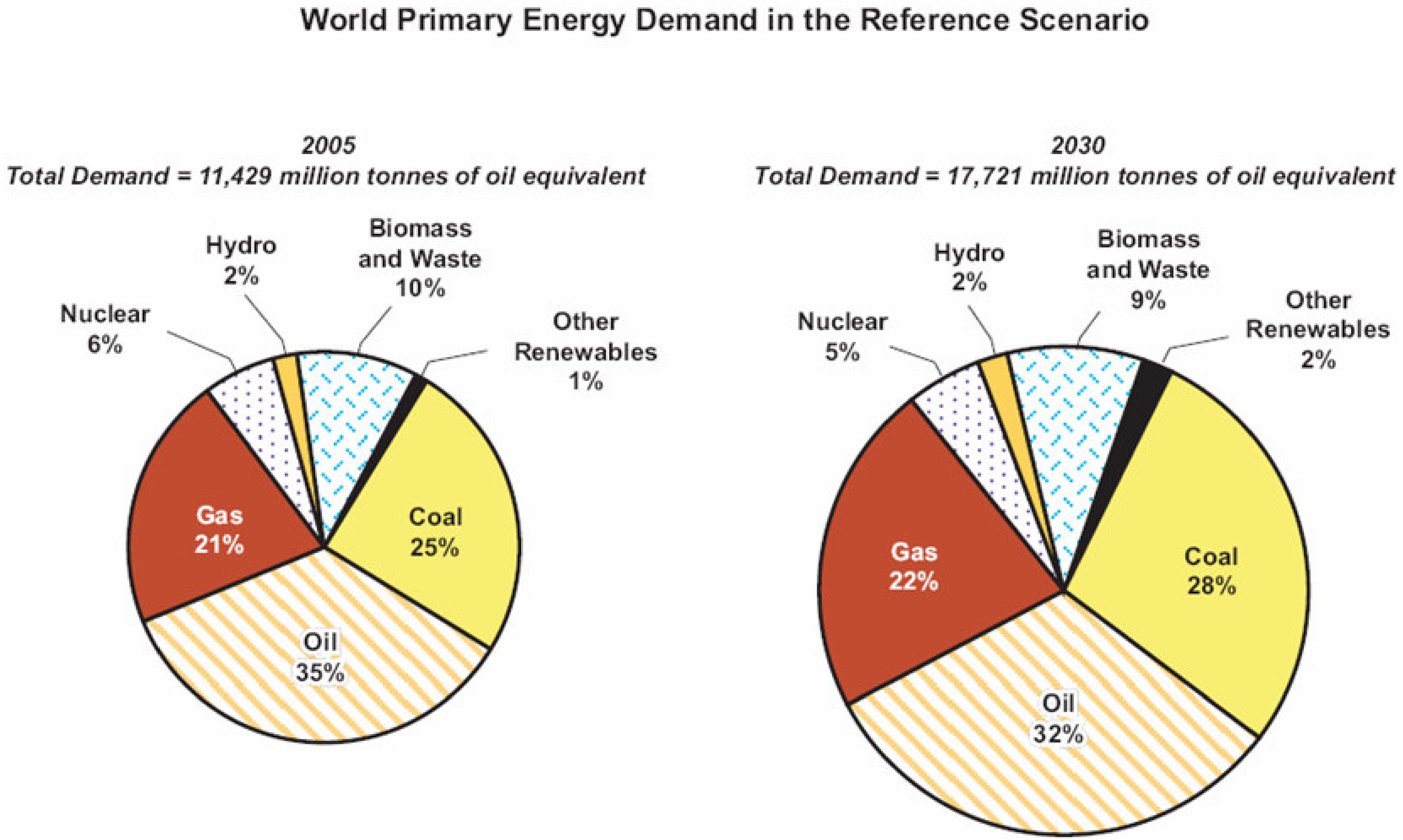
•	33 801 MW	coal fired	(12)
•	600 MW	hydroelectric	(6)
•	1 800 MW	nuclear	(1)
•	1 400 MW	pumped storage	(2)
•	342 MW	gas turbine	(2)
•	1036 MW	OCGT	(2)



Maximum import from Cahorra Bassa of 1 520 MW

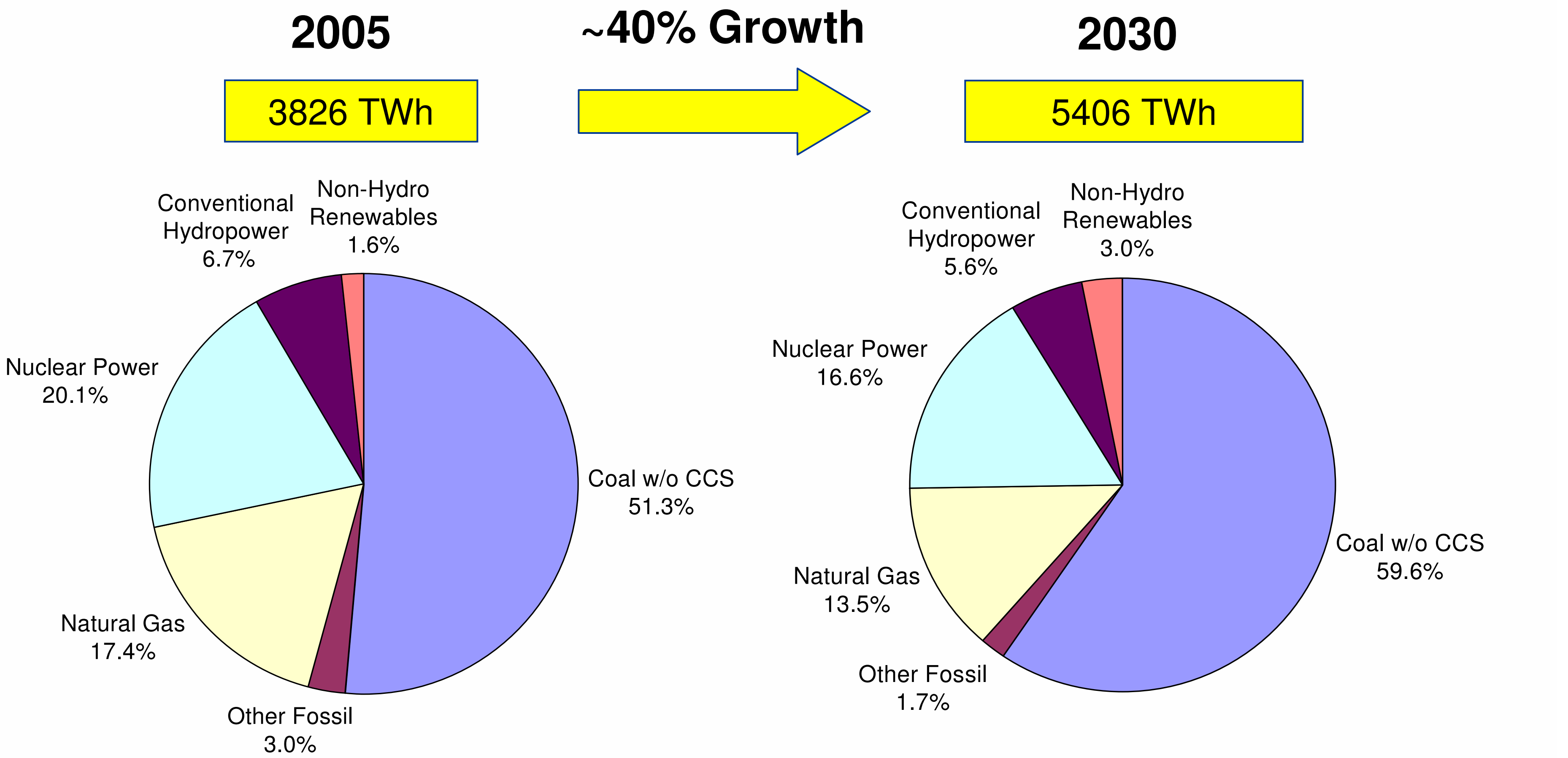
Current supply side options of 40 499MW

Is climate change going to get worse….?



Source: © OECD/IEA, 2007, World Energy Outlook.
71103-3

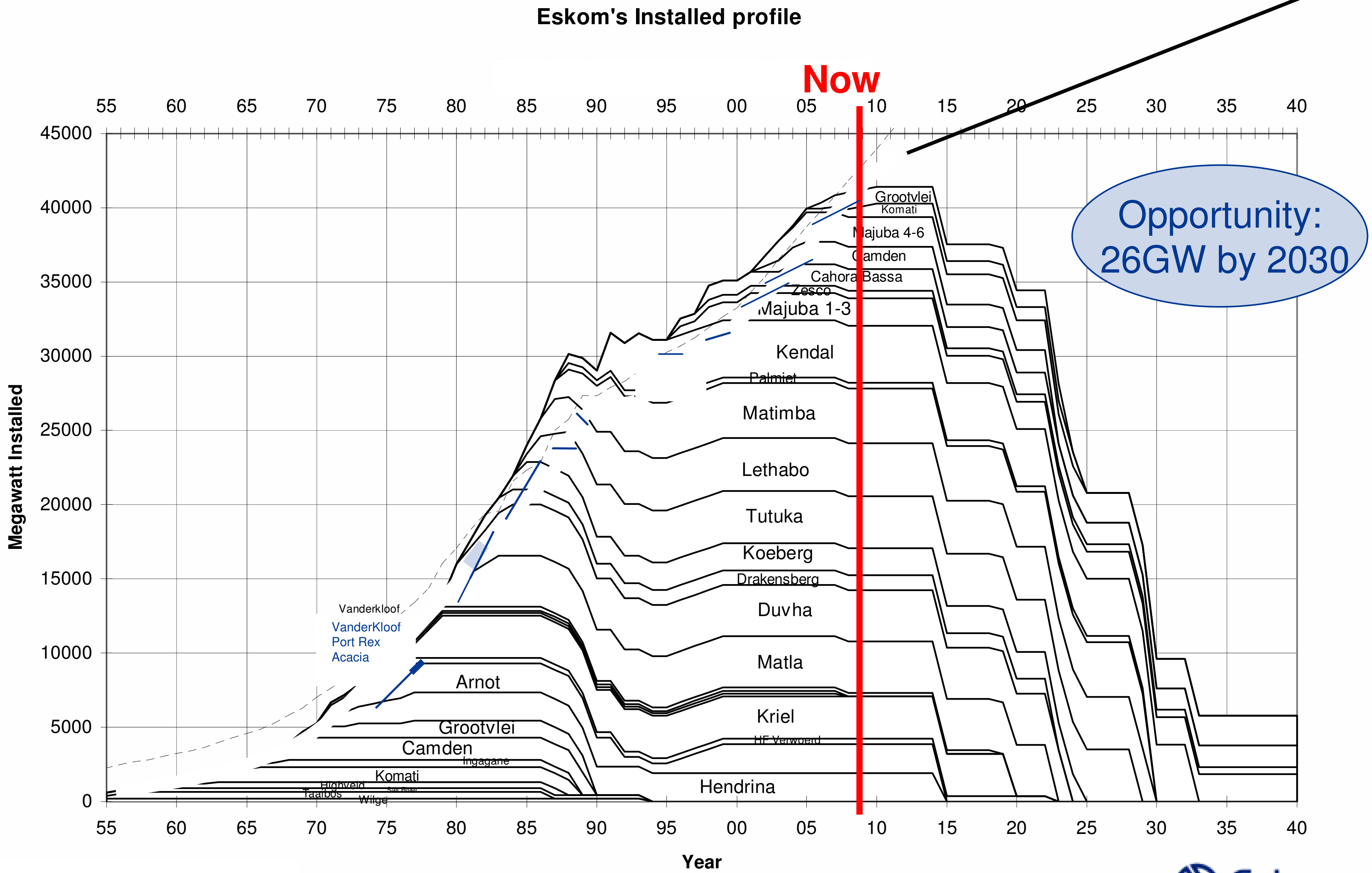
U.S. Electricity Generation Forecast*



** Base case from EIA "Annual Energy Outlook 2007"*

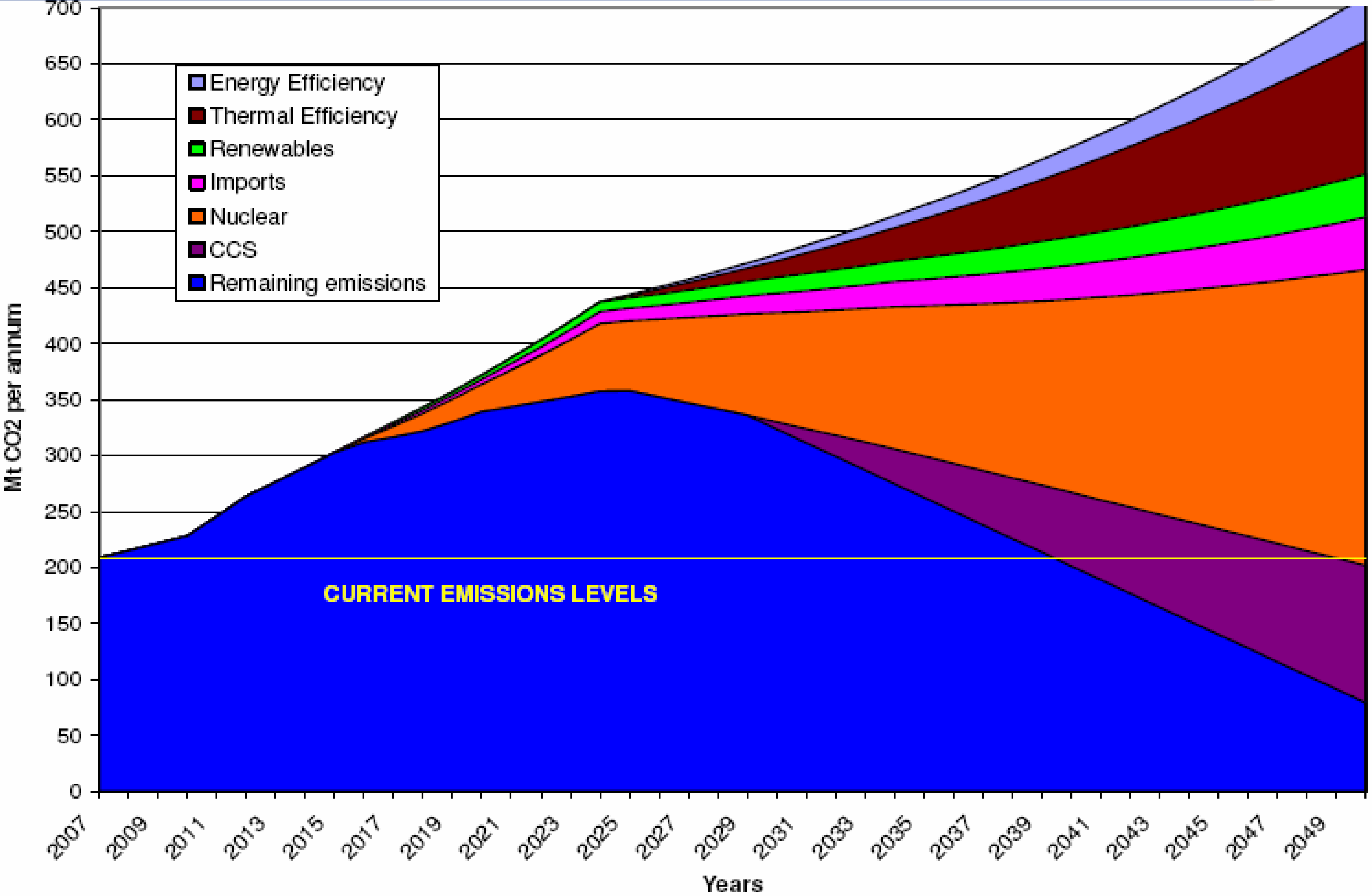
Eskom

Existing Plant Requires Replacement between 2025 and 2050



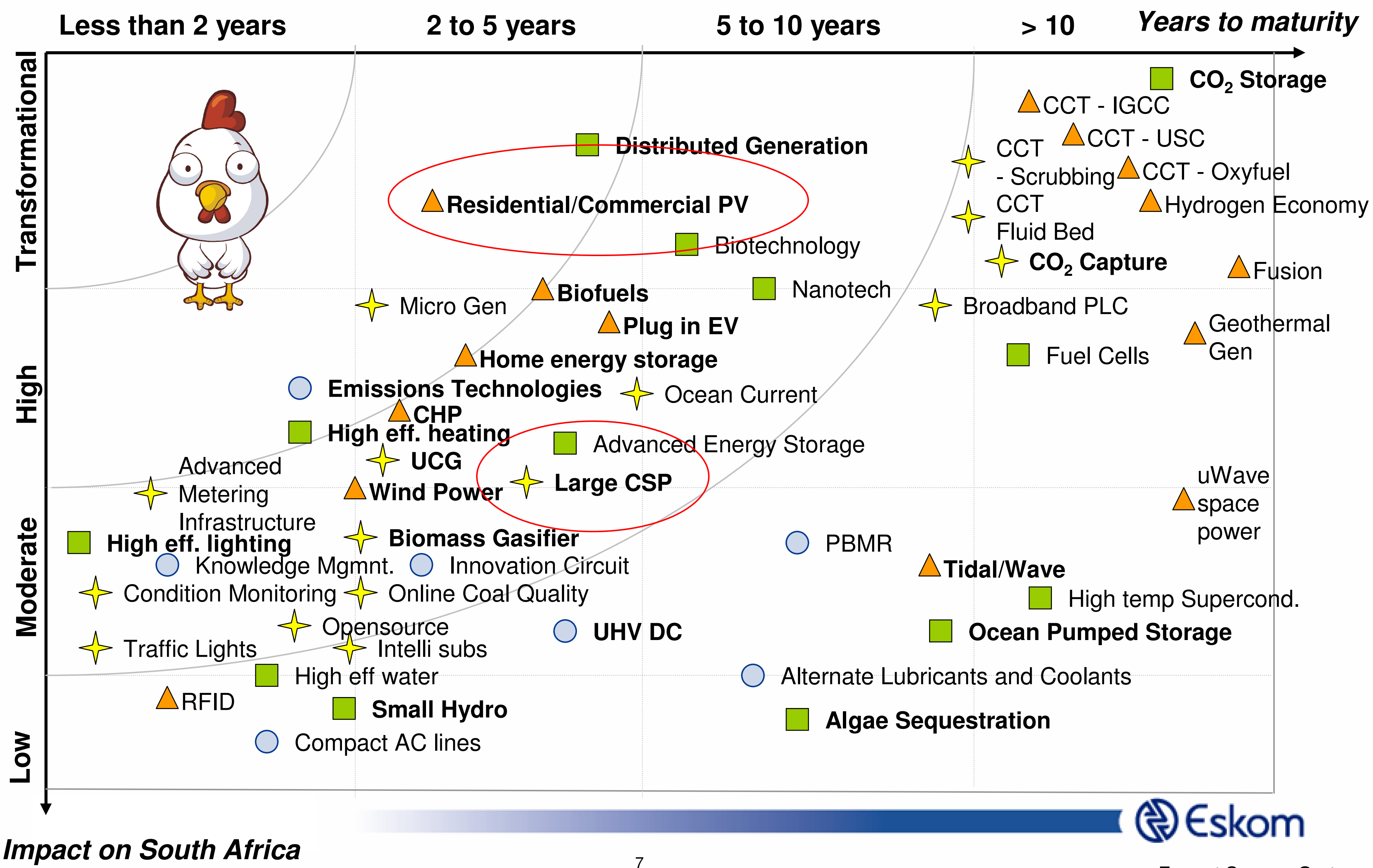
Most stations at mid life refurbishment point.

Some longer term thinking……



Our intent is to reduce our relative CO2 footprint until 2025 and thereafter continually reduce absolute emissions in support of national and global targets.

A view of emerging technologies (2009)

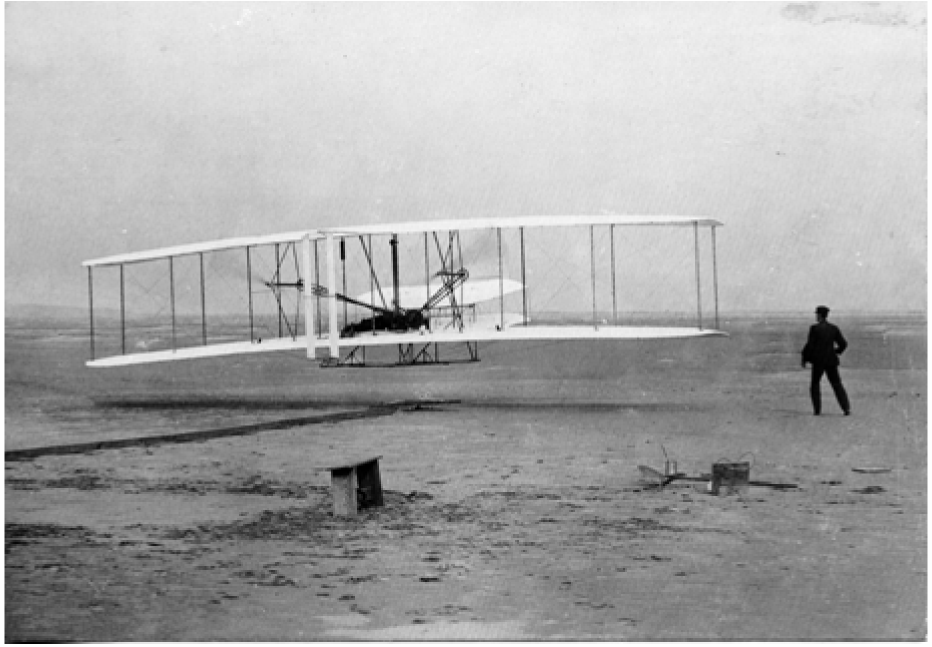


Format Source: Gartner

CLIMATE CHANGE/RENEWABLE RESEARCH

- •Cofiring of Biomass (Wood, Grass, Crop residues) in PF Stations
- •Municipal Solid Waste
- •Continued support for SWH
- •Commission 100 mW Wind and 100MW Solar
- •Research into off-grid or stand alone options is acceptable in support of national objectives, though implementation will be done by other parties.
- •Wind and Solar Resource Assessment will be site specific.
- •STRATEGIC FUTURE
- •Combine with CSP with UCG in Eskom/SASOL strategic partnership for Hybrid PS
- •Retrofit Solar Hybrid to PF Stations
- •Hybrid UCG Gas, CSP combined cycle powerstation
- •UCG Co-firing

We need a fast solar technical revolution…



December 1903
Range 36.5m (in 12 seconds)
Top Speed 10km/h

102 years

April 2005
Range 15200km
Top Speed 990 km/h (0.89 Mach)

1 year

November 1904
2 ¾ miles in 5m04s
4430m @ 52.5km/h

Driven by….?

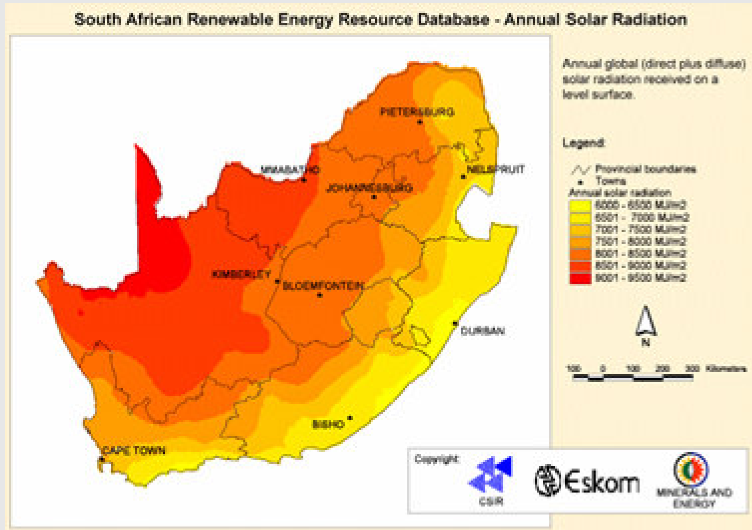
Eskom

Motivation for CSP in South Africa

- Solar energy is currently South Africa's single biggest renewable resource. Between 4.5 and 8 kWh/m2.
- Solar power is the only renewable energy option that could potentially have a significant impact on a supply-side scale.
- The potential in the Northern Cape and Northwest Provinces is in the GW range.
- CSP is the only large-scale renewable technology with a proven energy storage.
- Potential GW supply of dispatchable power in future
- Economies of scale apply
  (optimal size established at 200MWe / unit)

  R/kW installed is reduced by app. 14% if size is doubled - Pilkinton CSP study
- Economy of scale reduction on capital costs of components possible- Local supply is maximised
- Experience curve on subsequent plants reduces CapEx and O&M

South Africa's Solar Irradiation levels is amongst the best in the world



NC Surface area: approx 361,830km²

NW Surface area: approx 129,730km²

Assume: $^1/_3$ NC available: 119,404km²

Assume 1% of the above = 1,518km²

100MWe requires 4km²

Potential in SA = 37,950 MW installed

Motivation for CSP in South Africa

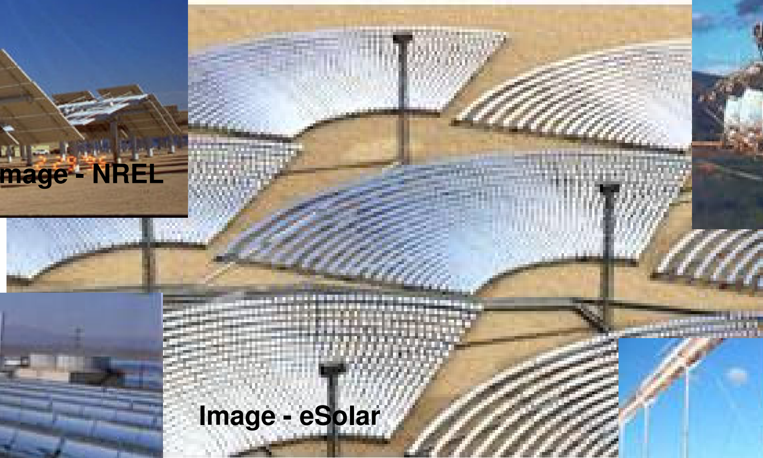
Location	Site Latitude	Annual DNI (kWh/m2)	Relative Resource
South Africa			
Upington, North Cape	28ºS	2,955	100%
United States			
Barstow, California	35ºN	2,725	92%
Las Vegas, Nevada	36ºN	2,573	87%
Albuquerque, New Mexico	35ºN	2,443	83%
International			
Northern Mexico	26-30ºN	2,835	96%
Wadi Rum, Jordan	30ºN	2,500	85%
Ouarzazate, Morocco	31ºN	2,364	80%
Crete	35ºN	2,293	78%
Jodhpur, India	26ºN	2,200	74%
Spain	34ºN	2,100	71%

CSP

Concentrated Solar Power

Concentrating Solar Power

CSP Technologies



Trough technology

Parabolic Trough Technology - Basics

- A long parabolic mirror with a absorber tube running its length at the focal point.
- Sunlight is reflected by the mirror and concentrated on the absorber tube. The trough is usually aligned on a north-south axis, and rotated to track the sun.
- Heat transfer fluid (normally oil) runs through the tube to absorb the concentrated sunlight. The heat transfer fluid is then used to generate steam and power a traditional turbine generator.
- Recent innovations include a oil to molten salt heat exchanger and storage system.
- Trough systems are sensitive to economies of scale and are most cost effective at large sizes.

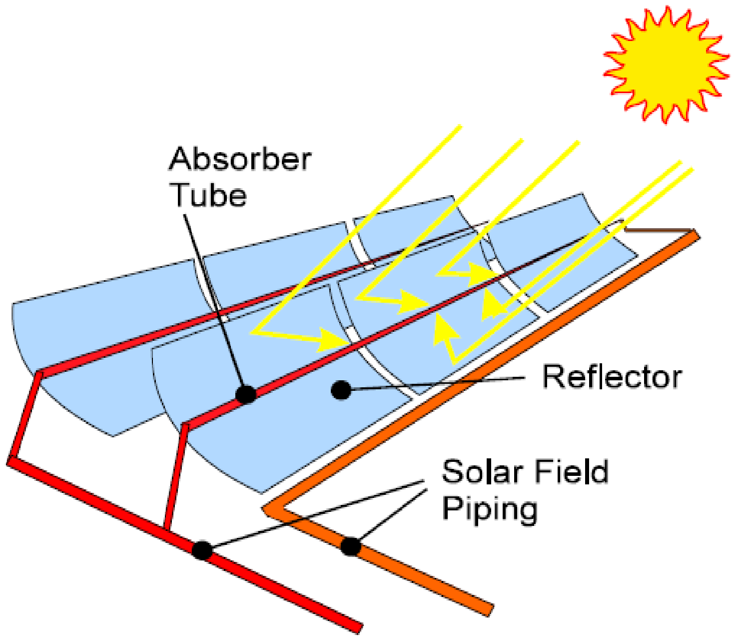
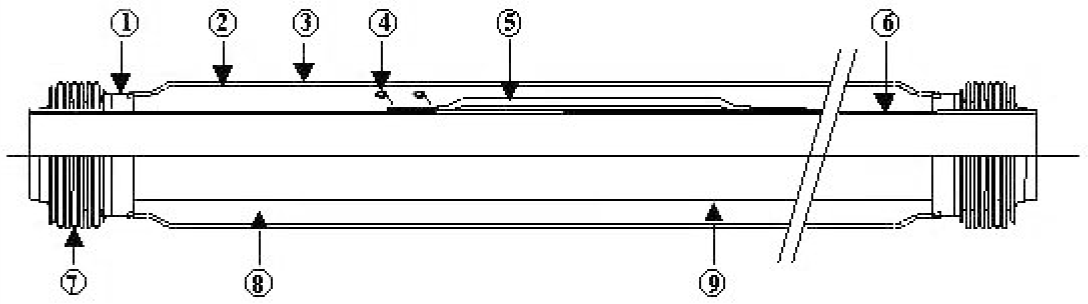
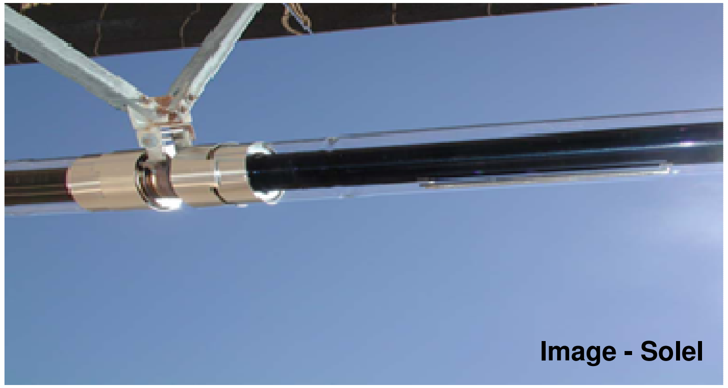


Image - SolarPACES

Key Components - Heat Collection Element (HCE)



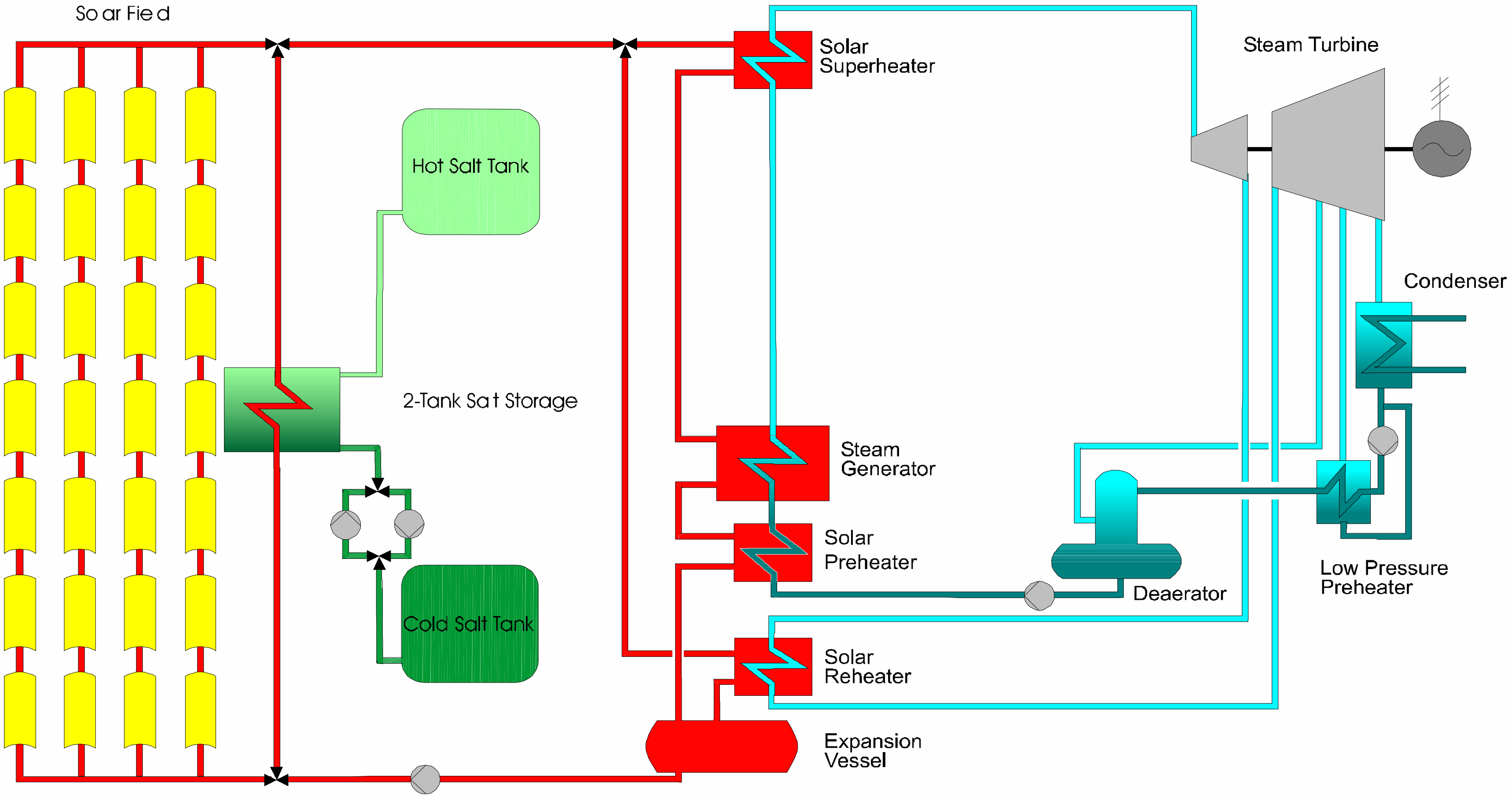
1. Glass to metal connection	6. Stainless steel tube
2. Glass envelope (BoSi)	7. Expansion Compensating Bellows
3. Anti reflection coating: 97% transmission of solar radiation (AMS 1.5)	8. Evacuated space
4. Barium getters - vacuum indicators	9. Solar coating (CERMET):
5. Getters for vacuum stability	



Parabolic Trough Technology - History

- In the late 70's and early 80's Sandia and SERI (later NREL) funded and carried out parabolic trough technology R&D
- A US/Israeli company then developed the concept further, made thermal improvements, and following an agreement with Southern California Edison, constructed a 14MW trough system (referred to as SEGS) in 1985.
- Luz installed 9 trough systems in total from 1985 to 1991– 1x14MW, 5X30MW, 2X80MW.
- After facing regulatory, financial and internal hurdles that resulted in failure of the SEGS X development, Luz went bankrupt in 1991.
- While no commercial developments followed the demise of Luz, significant research work continued. During this period, Flabeg of Germany and Solel of Israel (rising from Luz) supplied mirrors and receivers to the SEGS plants.
- The 1st commercial development to follow was the EuroTrough collector project, a cost-shared activity by the EU and a group of European companies. Since then, several systems have developed.

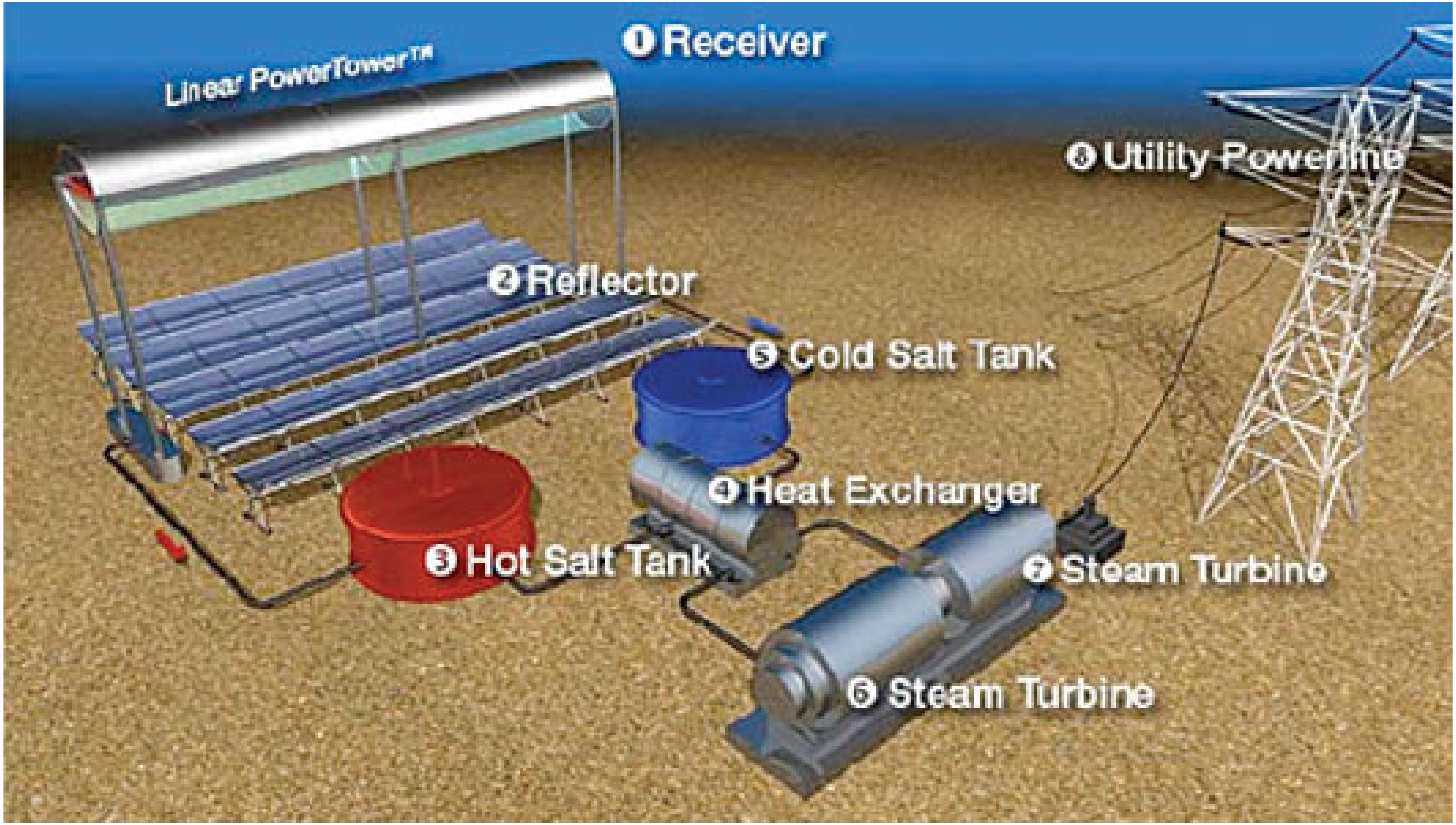
Parabolic Trough Technology - Components



Components - trough collectors (single axis tracking), heat-collection elements, reflectors, drives, controls, pylons, heat-transfer oil,

Oil to water steam generator, oil to salt heat exchanger, salt storage, conventional steam-Rankine cycle power block

Example



http://www.mnn.com/earth-matters/energy/stories/solar-thermal-power-just-got-hotter#

Key Components – Solar Collector Array (SCA) Frame

Critical factors considered in producing a collector:

- High optical efficiency and tracking accuracy
- Reduced heat losses and increased torsional and bending stiffness
- Manufacturing and assembly simplicity
- Increased aperture area per SCA (reduced drive, control and power requirements per unit reflector area)

- Three generations of SCAs were used at the SEGS plants, with the LS-2 collector the best performer.
- Recent development have led to the development of several new SCAs – their cost and performance yet to be verified through commercial operation.

150MW Trough – Kramer Junction California

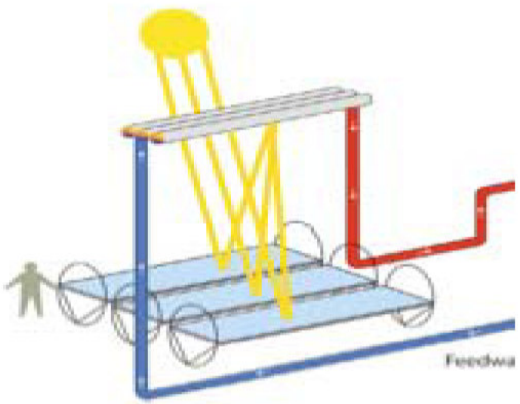
Plumbing

Ops and Maintenance

Trough Images

Compact Linear Fresnel Reflector (CLFR)

- The CLFR improves on the LFR concept by using multiple receivers. This allows the mirror collector to focus on the receiver on either side, minimising shading of mirrors.
- The concentrated sunlight boils the water in the receiver tubes, generating high-pressure steam for direct use in power generation and industrial steam applications without the need for costly heat exchangers.
- CLFR individual reflectors can have the option of directing reflected solar radiation to at least two absorbers in linear systems.
- The CLFR uses flat or elastically curved mirrors mounted close to the ground, which is expected to have cost advantages.



Linear Fresnel Reflector Technology (LFR)

- The LFR technology produces steam by direct steam generation, as opposed to using the conventional oil HTF option.
- It differs fundamentally from the parabolic trough in that the absorber is fixed in space above the mirror field. Further, the reflector is composed of many low row segments, which focus collectively on an elevated long tower receiver running parallel to the reflector rotational axis.
- The LFR system has only one linear receiver, and therefore there is no choice about the direction of orientation of a given reflector.
- Because the receiver is fixed it does not require flexible hose or ball joint piping connections to connect to the header.

Image - Novatec

Compact Linear Fresnel Reflector Technology (CLFR)

- The Ausra CLFR uses an inverted cavity receiver containing a water/steam mixture which becomes drier as the mixture is pumped through the array. The steam is separated and flows through a heat exchanger where the thermal energy passes to the powerplant system.
- Initially a Chrome Black selective coating will be used but a new air stable selective coating is being developed for higher temperature operation required by stand alone plants (320-360°C).
- The reflectors are of glass slightly curved and laminated with a composite/metal backing. Each reflector row is 600 metres long, and contains three segments of 200 metres, each of which are tracked by one motor/gearbox. The structure below is lightweight coated steel. Headers are minimised, with steam down and up each receiver row.
- The reliability and tracking accuracy of the CLFR field remains a concern, given the divorce between collector and receiver.


Linear Fresnel Reflector Technology (LFR)

On top of the receiver a small parabolic mirror can be attached for further focusing the light.

The mirrors also do not need to support the receiver, so they are structurally simpler.

However, one fundamental difficulty with the LFR technology is the avoidance of shading of incoming solar radiation and blocking of reflected solar radiation by adjacent reflectors.

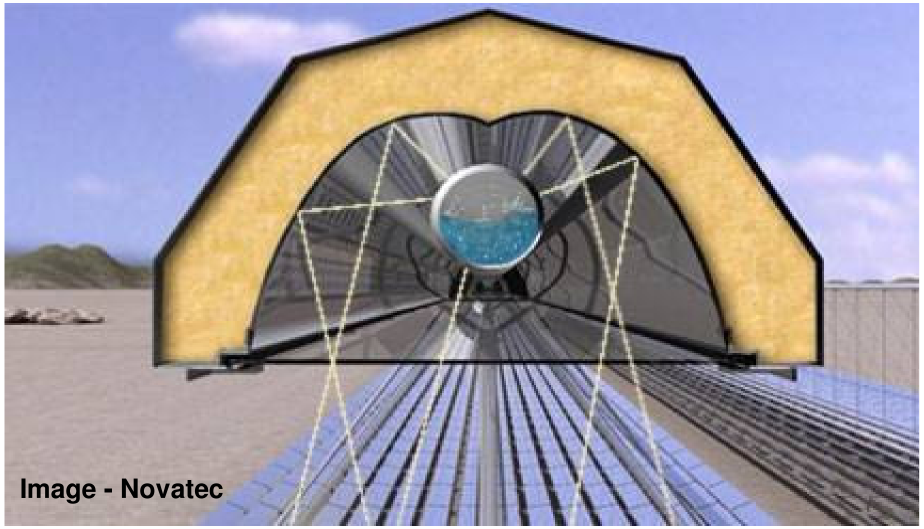


Image - Novatec

Blocking and shading can be reduced by using absorber towers elevated higher or by increasing the absorber size, which allows increased spacing between reflectors remote from the absorber. Both these solutions increase costs, as larger ground usage is required.

Dish Stirling Technology


Image - SES


Image - Abengoa

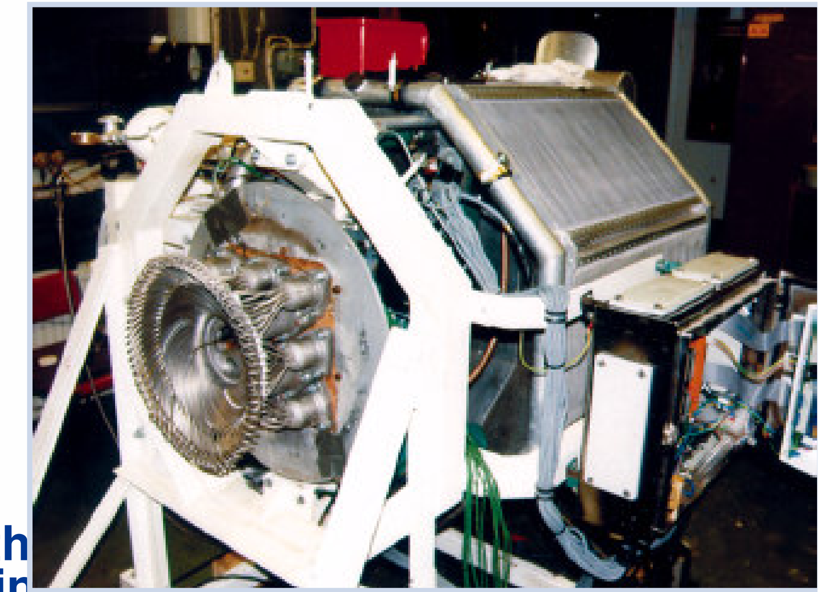
Dish Stirling Technology

Collector Facts

- Mirror or polished aluminum collector
- Collector area varies from 80 to 500m^2
- Pedestal or frame mounted.
- Engine mounted at collector focal point

PCU Consists of three basic components

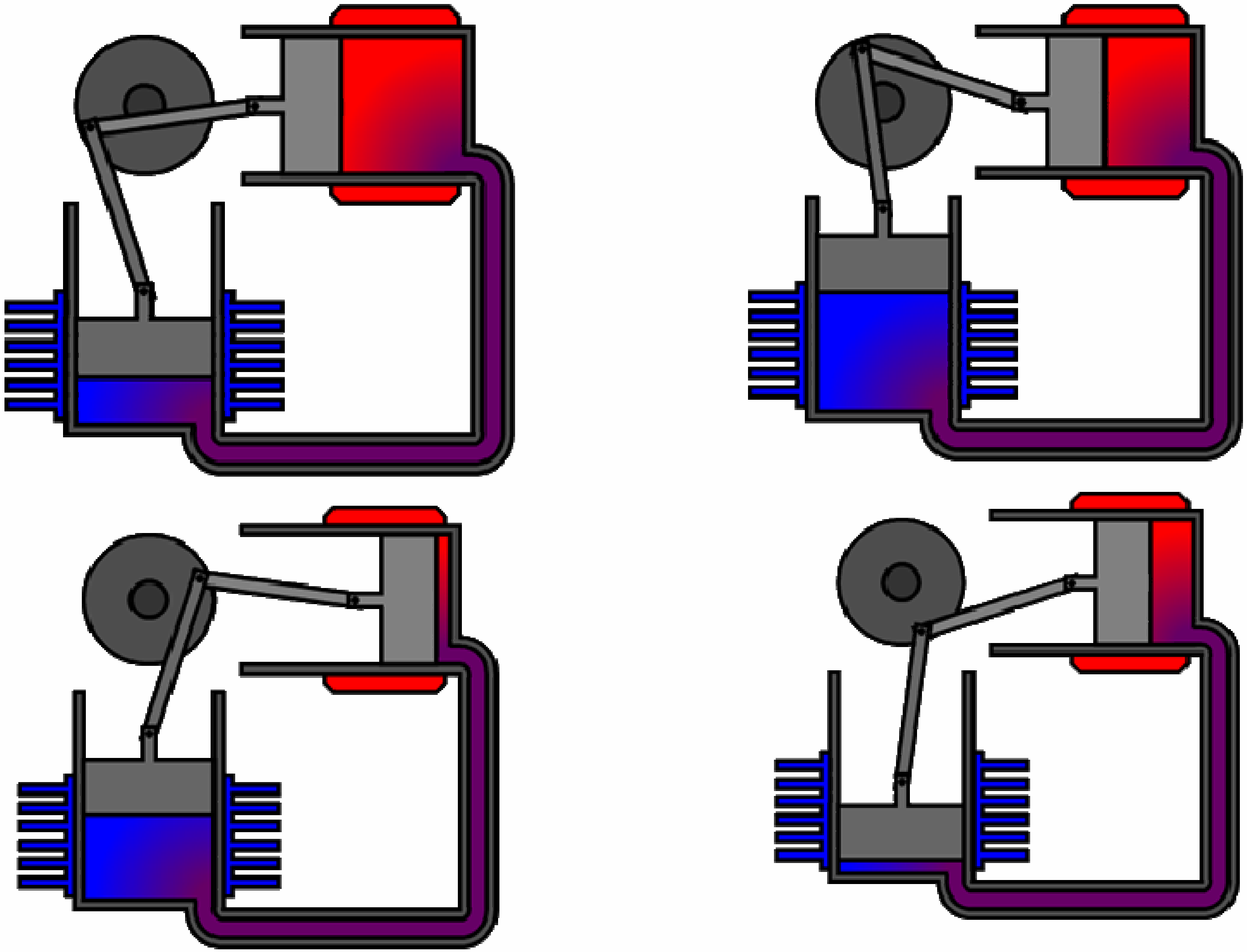
- Receiver
- Stirling Engine
- Electricity Generator



Receiver

- The heat from the collector is transferred to th network of tubes that heats the working gas in the cylinder chambers. The cylinders contains a fixed volume working gas (hydrogen).

Stirling Engine Basics – External Combustion Engine



Source: Wikipedia

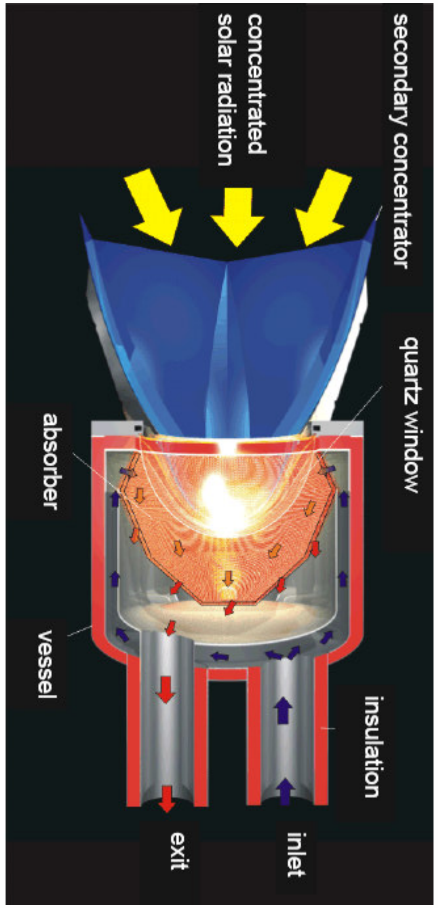
Central Receiver Technology

Central Receiver Technology - Basics

- This technology uses a field of large sun-tracking mirrors (called heliostats) that reflect the sunlight to a receiver mounted on a central tower in the middle of the mirror field.
- Air, water or a heat transfer medium is heated within the receiver and is used directly, or through a heat exchanger, to power a turbine and generator.
- Three different receiver configurations are being proposed: Molten salt, Direct steam and Volumetric Air.
- Common plant components, across all three options, include the heliostats, steam system, turbine, generator and cooling plant.

Receiver Developments

Saturated Steam	Molten Salt	Volumetric Air



Steam conditions:
250℃, 40bar

550℃, 125 bar

485℃, 27 bar

Heliostat Fields

360deg field - surround receiver

Single sided field – cavity receiver

Heliostats


ge - Abenoa


Image - Brightsource

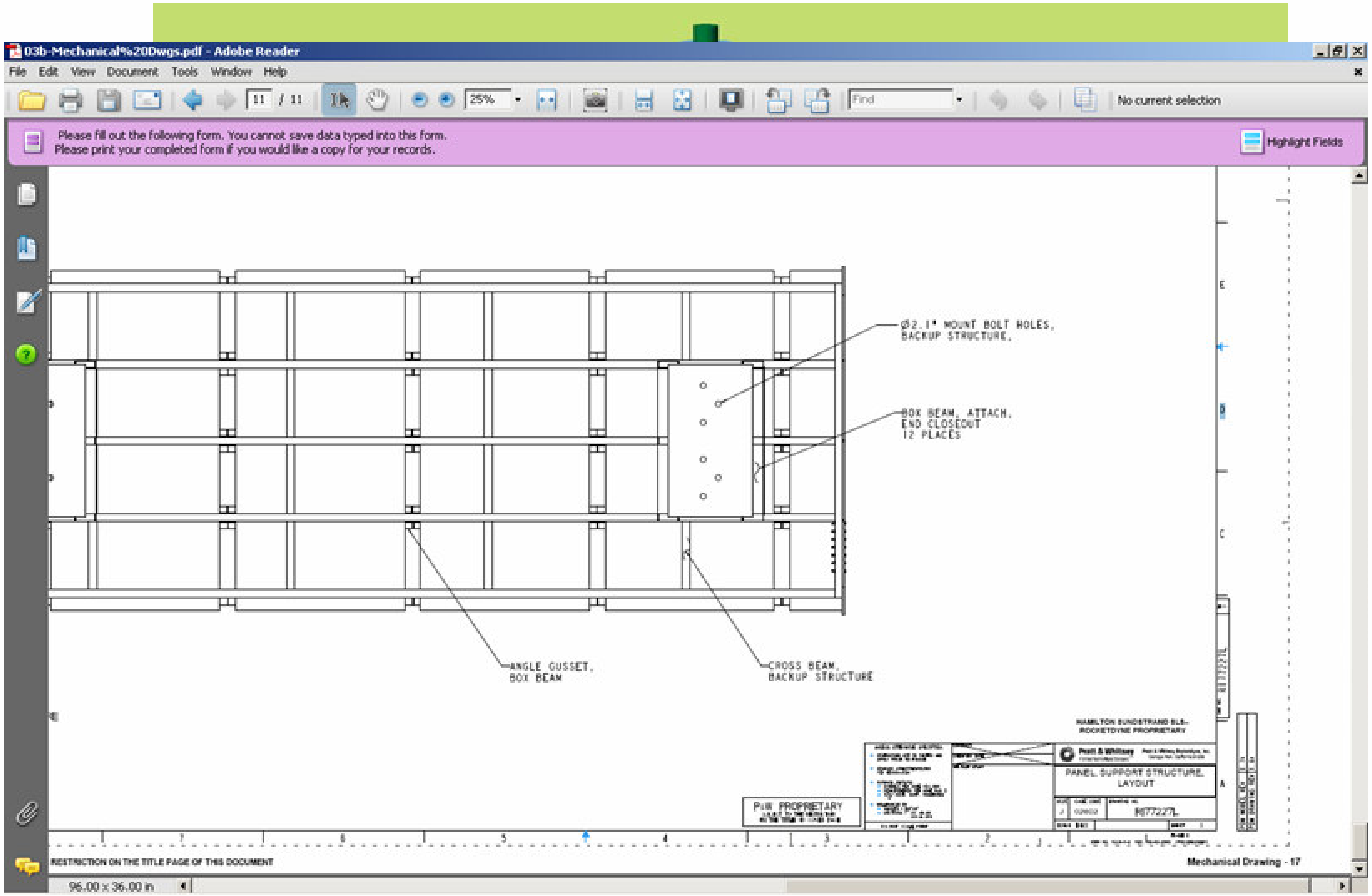

Image - eSolar

Central Receiver Technology - History

Project	Sponsoring Country	Power Output (MWe)	Heat Transfer Fluid	Storage Medium	Operation Began
SSPS	Spain	0.5	Liquid Sodium	Sodium	1981
EURELIOS	Italy	1.0	Steam	Nitrate Salt/Water	1981
SUNSHINE	Japan	1.0	Steam	Nitrate Salt/Water	1981
Solar One	United States	10.0	Steam	Oil/Rock	1982
CESA-1	Spain	1.0	Steam	Nitrate Salt	1983
MSEE/Cat B	United States	1.0	Molten Nitrate Salt	Nitrate Salt	1984
THEMIS	France	2.5	Hi-Tec Salt	Hi-Tec Salt	1984
SPP-5	Russia	5.0	Steam	Water/ Steam	1986
TSA	Europe	1.0	Air	Ceramic	1993
Solar Two	USA	10.0	Molten Nitrate Salt	Nitrate Salt	1996

The above facilities were built both to prove that solar power towers can produce electricity and to improve on the individual system components.
All the power tower projects were experimental in nature and were not intended as commercial ventures, i.e., unlike the SEGS trough plants, power was not sold from the projects.

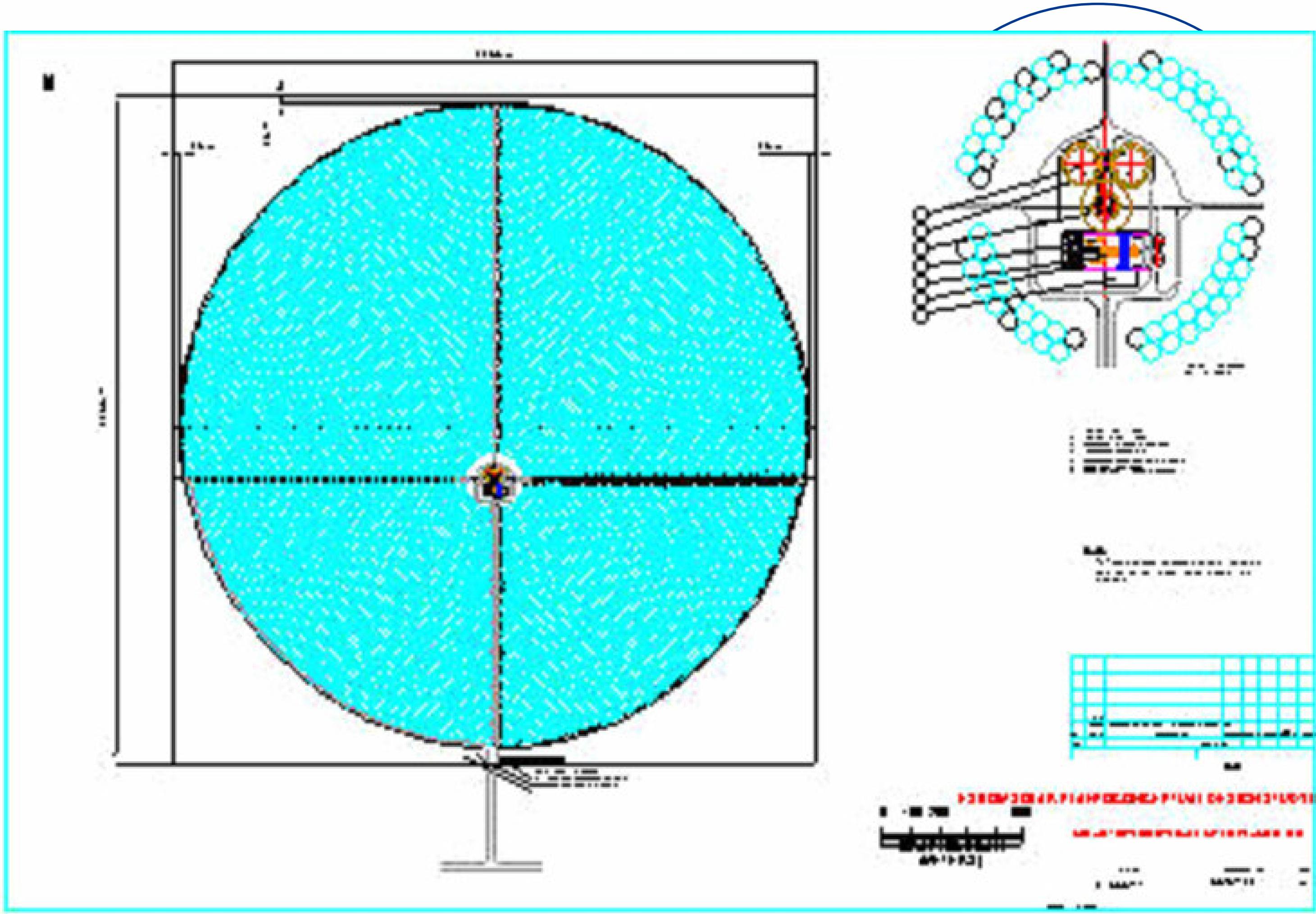
Original Eskom Plant Design



Plant Configuration

- Receiver – 540MW(t),
- Energy storage – app 14 hours,
- Salt volume of approximately 25,000ton
- Water requirements: 300,000m^3/annum
- Salt - 60% Sodium Nitrate ($NaNO_3$) and 40% Potassium Nitrate (KNO_3)
- Plant capacity – 100MW(e), generating 24 hours over summer solstice.
- Avg expected load factor – app 68%.

Plant Design – Field Layout



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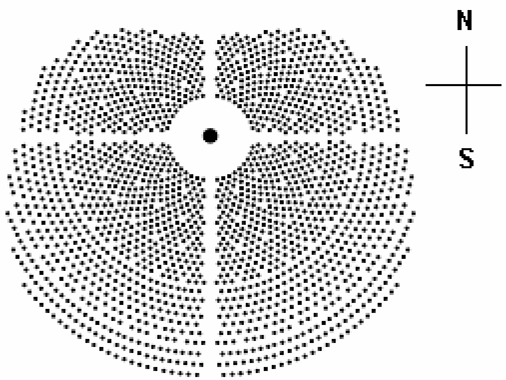
Heliostats (General)



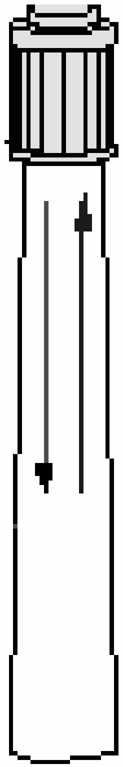
- Constitutes app 40% of direct plant costs.
- Custom heliostat designs considered for Upington project.
- Heliostat size: app 125m^2
- No. of heliostats required app 8000.
- South-biased field.
- Key components: Drives and low-iron glass.

Tower

The central tower is a concrete tower, steel structure can be used on smaller units.

The tower dimensions are approximately:

- Height: 190m
- Foundation: 45m in diameter, 4.5m thick.
- Tower @ base: 24m in diameter, 750mm thick.
- Tower @ top: 17m in diameter, 300mm thick.
- Steam Generator System located in the base of the tower.



Receiver


Image - Rocketdyne

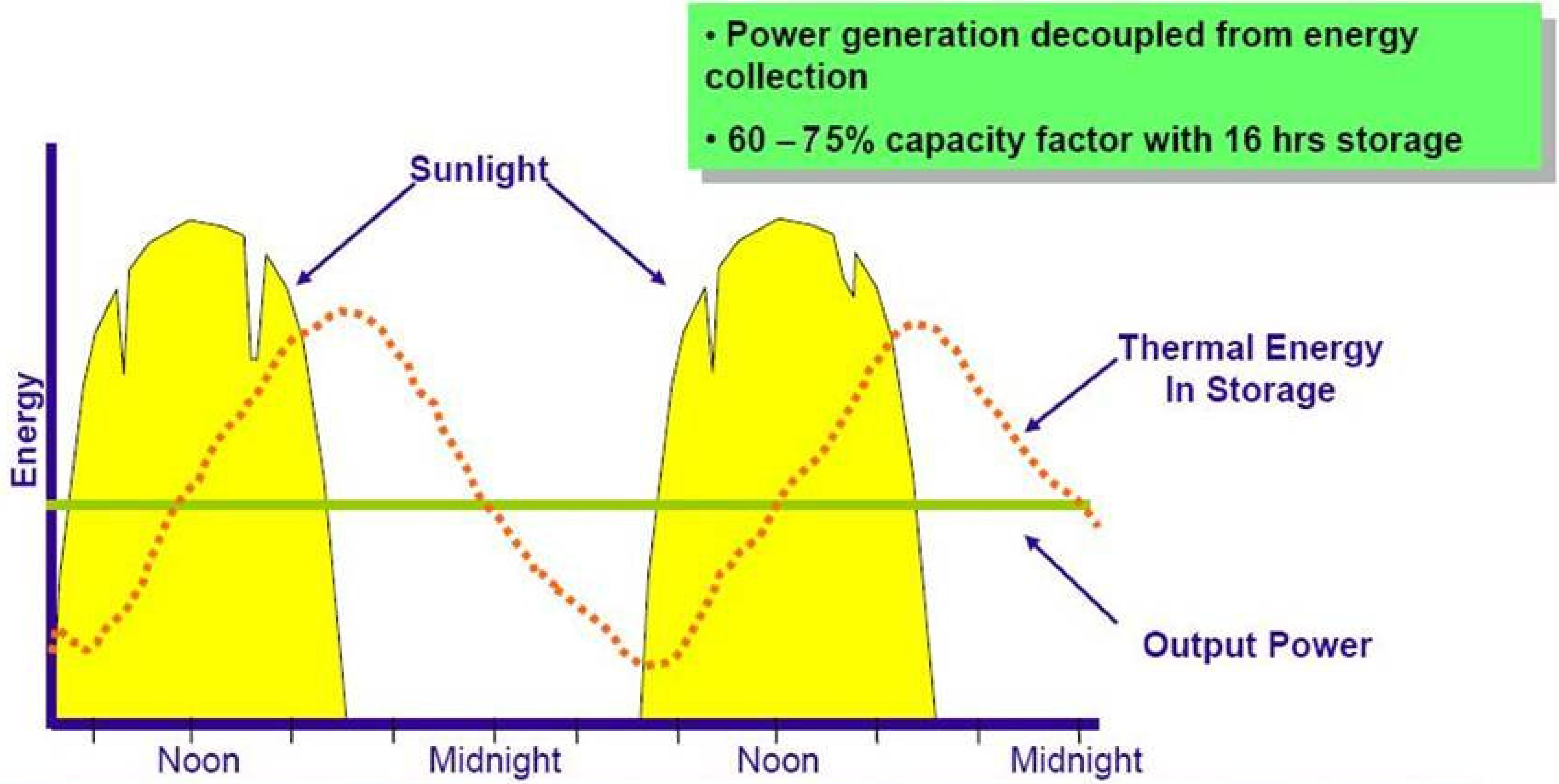
- Critical plant component.
- Material composition:

  Tubes made from a high nickel alloy (i.e. Inconel 625LCF).
- Approximate dimensions:

  Diameter - 15m

  Height - 20.5m.
- The cylindrical receiver is divided into panels, app 2m wide.

Plant Operation & Storage Impact



Molten salt enables efficient energy storage & truly dispatchable green power

Image - Rocketd

Salt Tanks & TG

- Two storage tanks required, one for the “hot” salt and the other for the “cold”.
- Material requirements:

  Hot salt tank - TP321H or TP347H stainless steel and

  Cold salt tank - Carbon steel.
- Insulation material:

  Mineral wool, ASTM C612-93, Type 4.

- 100MW Reheat steam turbine
- Live steam pressure: 125 bar, temperature: 550℃
- Reheat steam pressure: 30 bar, temperature: 550℃
- Proposed configuration of the turbine for this project is combined HP + IP and double flow LP.
- The condenser pressure being optimised.

Storage

5. Financing options

World Bank, CTF and DFI funding

2 Dec 2009 Eskom Board approved the acceptance of the following loans:

- WB (IBRD) loan for a value of up to USD 3.75 billion or its currency equivalent to fund Medupi infrastructure, renewables (Wind and CSP), Majuba Rail and Plant efficiency improvements.
- Clean Technology Fund (CTF) loan for a value of up to USD 350 million to fund low carbon initiatives.
- DFI's support in principle the project and the gap financing requirements. African Development Bank PDA completed, EIB, Kfw support the project.
- Bound by WB procurement guidelines

Table 69: Project Components co-financed by CTF

Project Component	Indicative Financing Plan (US$ millions)					Total Cost (US$ millions)
	IBRD	CTF via IBRD	CTF via AfDB	AFD	Other Lenders and Eskom	
Upington CSP Project	150.00	200.00	50.00	0.00	382.68	782.68
Sere Wind Project	110.00	50.00	50.00	100.00	105.43	415.43
Total:	260.00	250.00	100.00	100.00	488.11	1,198.11

Country and Sector Context

Potential DFI funding

AfDB: $ 200mil: EiB: $ 50mil: Kfw: $ 100mil..etc

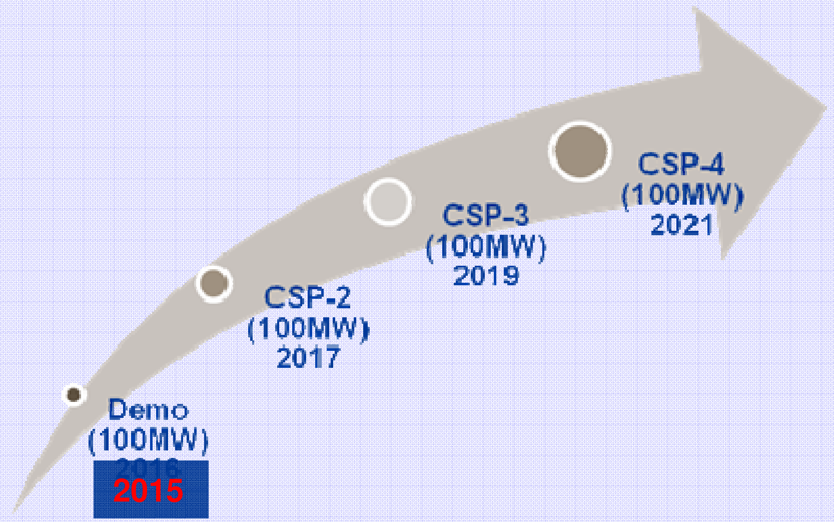
Funding is subject to final plant specifications

Project Enablers

- IRP1 (for Eskom CSP & Sere Projects)
- MYPD2- Pilots & Demo budget
- Country Plan; 300MW of CSP
- Will form a major contributor in IRP2

6. Project High Level Schedule

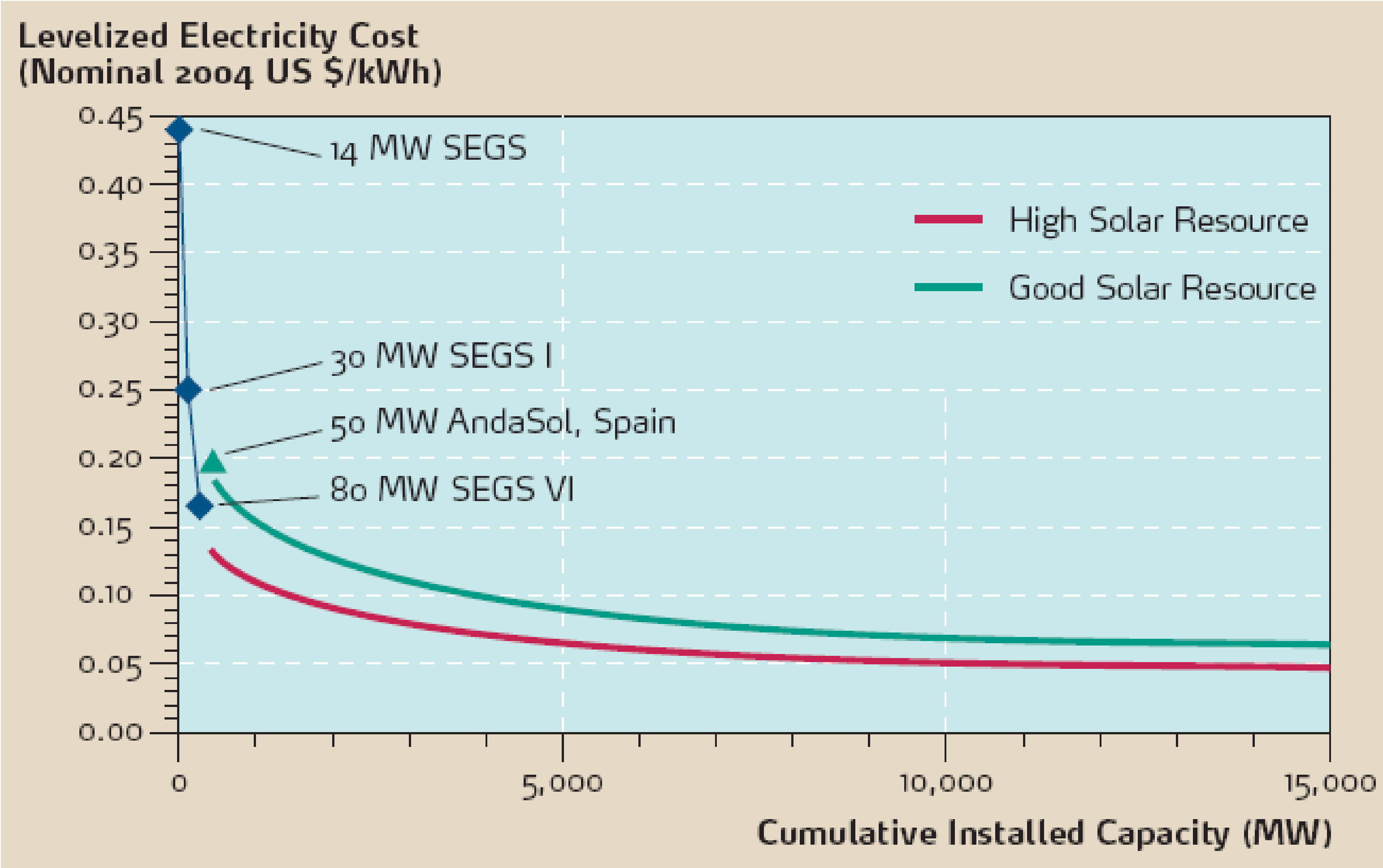
Month- Year	Dec-10	May-11	Dec-11	June-12	Jun-13	Dec14	Jan 15	Marc15
Technology Assessment	6 mths							
Appoint Owners Engineer: Plant Specs		5 mths						
Business Case and Feasibility studies			7 mths					
Procurement: Planning & Design: EPC/BoP			18 mths					
Procurement: key components				18 mths				
Construction					2.5 yrs			
Commissioning							2 mths	
Research & Optimisation								2 yrs
Other	Land Procurement	Land Re-zoning	Water supply, Transmission and Distribution integration studies and related construction					



The country plan has 300MW of CSP. Eskom will plan for 300MW and will be guided by IRP2.

(Construction Start dates indicated)

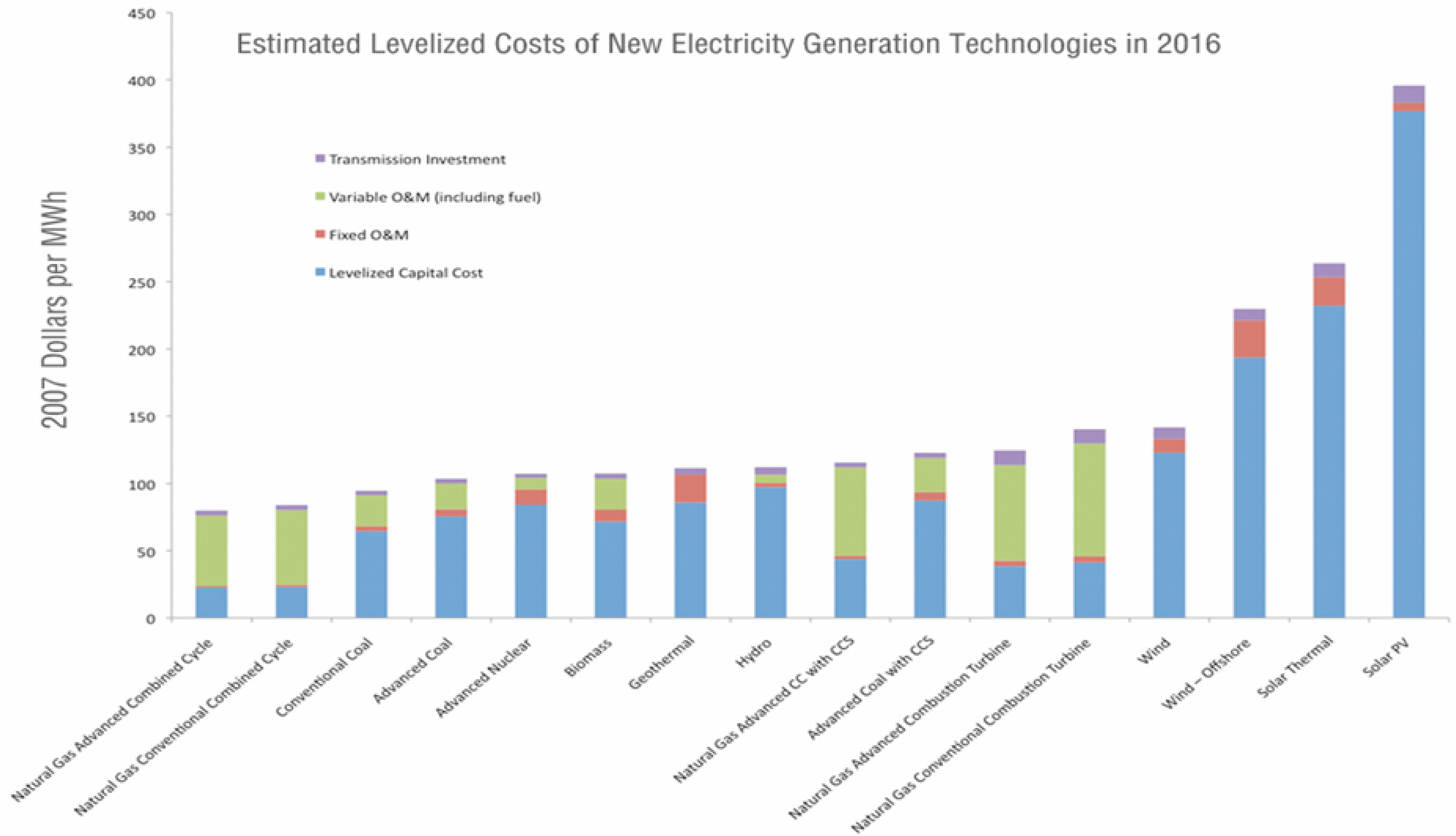
Indicative Costs



Eskom

Ref: CSP Global Market Initiative

Cost is the big challenge – but we are winning



Average National Levelized Costs of Generating Technologies in the Updated 2009 Annual Energy Outlook (AEO)
Energy Information Administration, April 2009, SR-OIAF/2009-03, http://www.eia.doe.gov/oiaf/servicerpt/stimulus/index.html
Explanation of data at http://www.instituteforenergyresearch.org/2009/05/12/levelized-cost-of-new-generating-technologies

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9. Conclusions

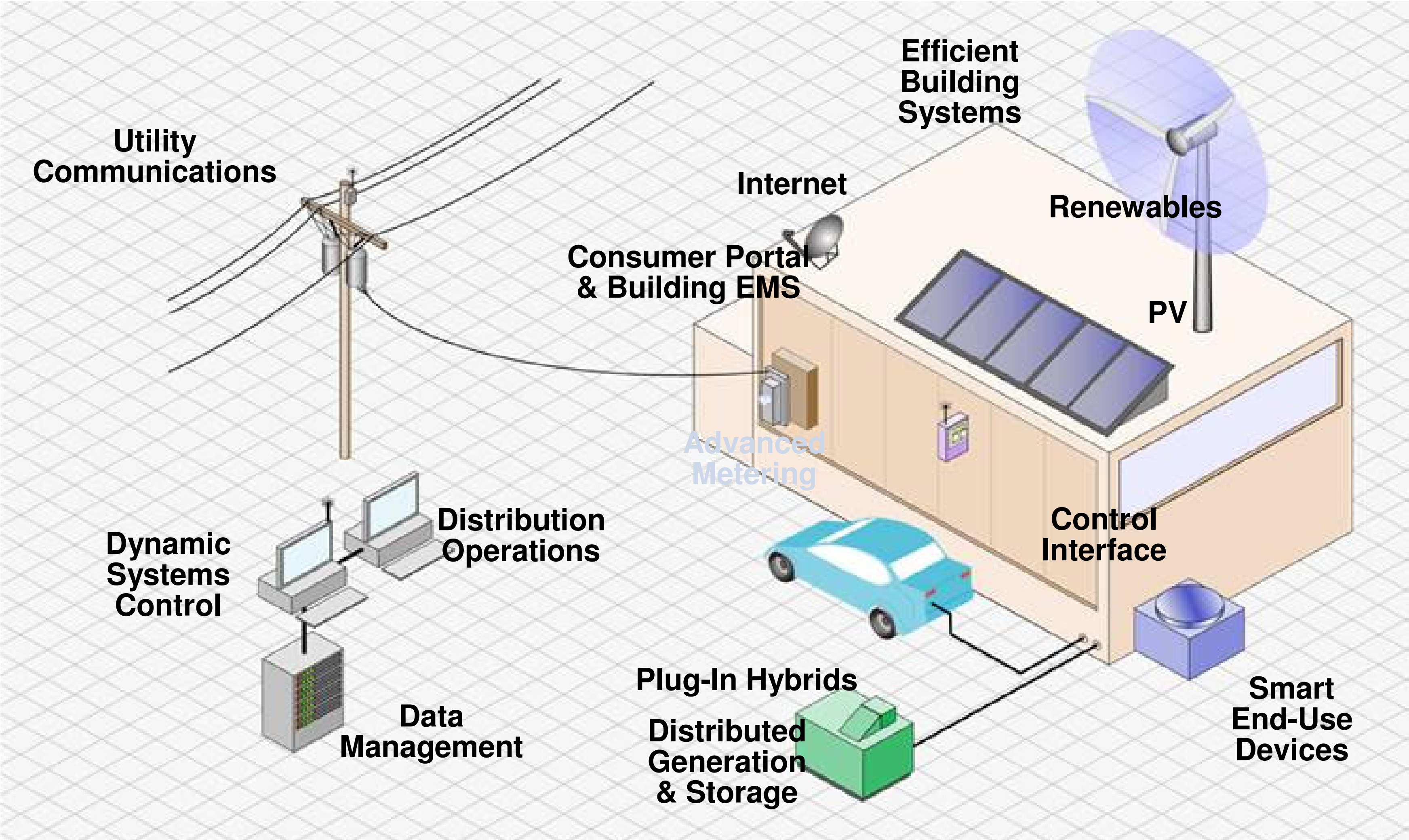
- CSP is a Renewable Energy Option for large scale grid connected Solar power that can compliment coal base load power generation
- CSP is a techno-economically feasible option for of large scale role-out within the generation mix
- The potential supply of dispatchable power in future in the Northern Cape and Northwest Provinces is in the GW range.
- CSP is the only large-scale renewable technology with proven energy storage.
- CSP will offset CO_2 emissions from Eskom's Base Load generation fleet.
- CSP will offer Eskom and SA an opportunity be a world player in the concentrated solar power industry with positive impacts on local industry and GDP growth.
- This technology will pose certain challenges but project technology risks have been identified and will be mitigated through binding performance contracts with suppliers on proven building blocks

Demand Side?

The PV Vision - Integrated PV and End Use

PV can be used as a supply side option…..

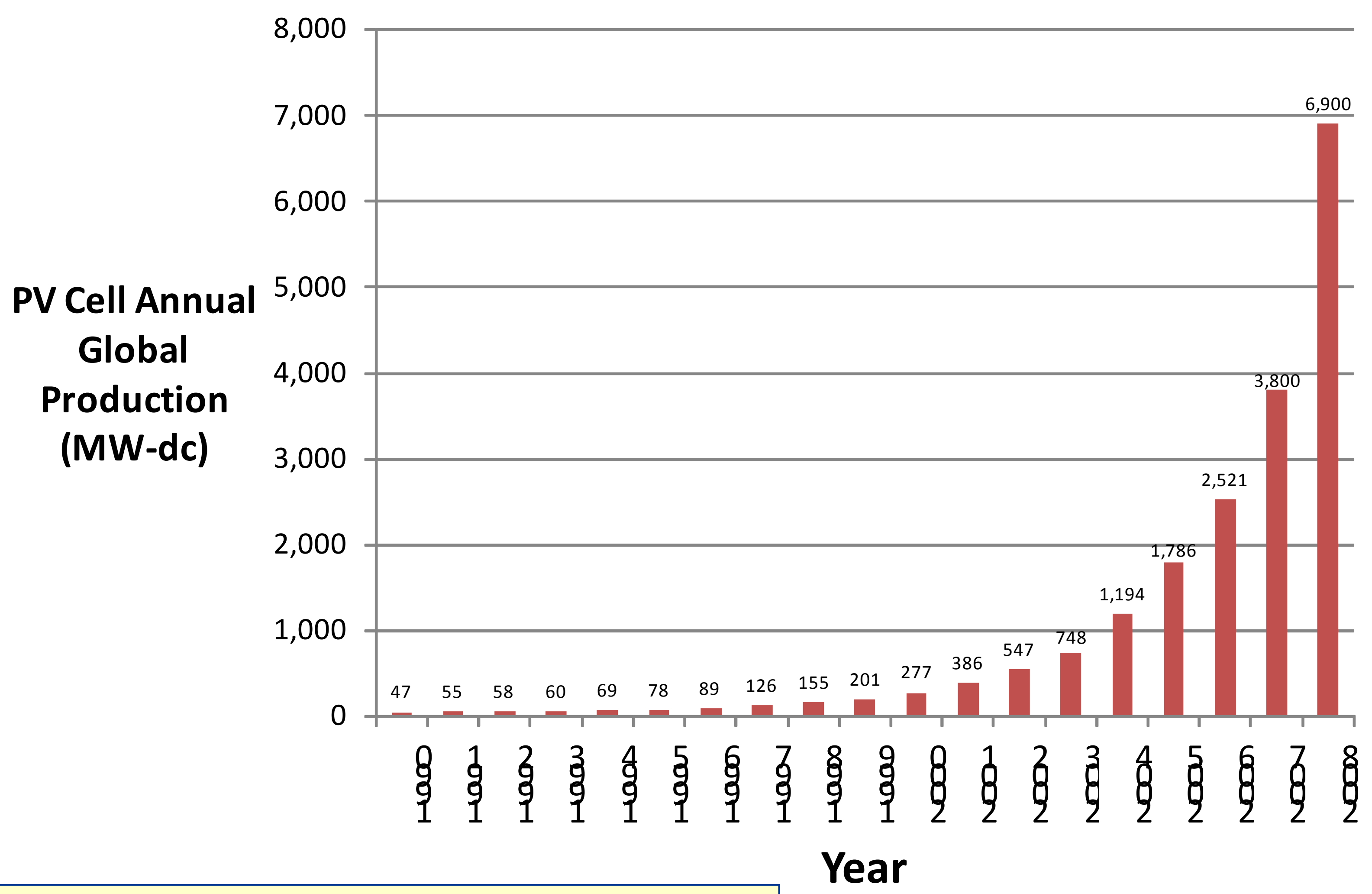
Smart Grid - The "Save a Watt" Power Plant



Smart Metering, Two Way Communication & Real Time Pricing
A Valuable Resource in a Carbon Constrained World

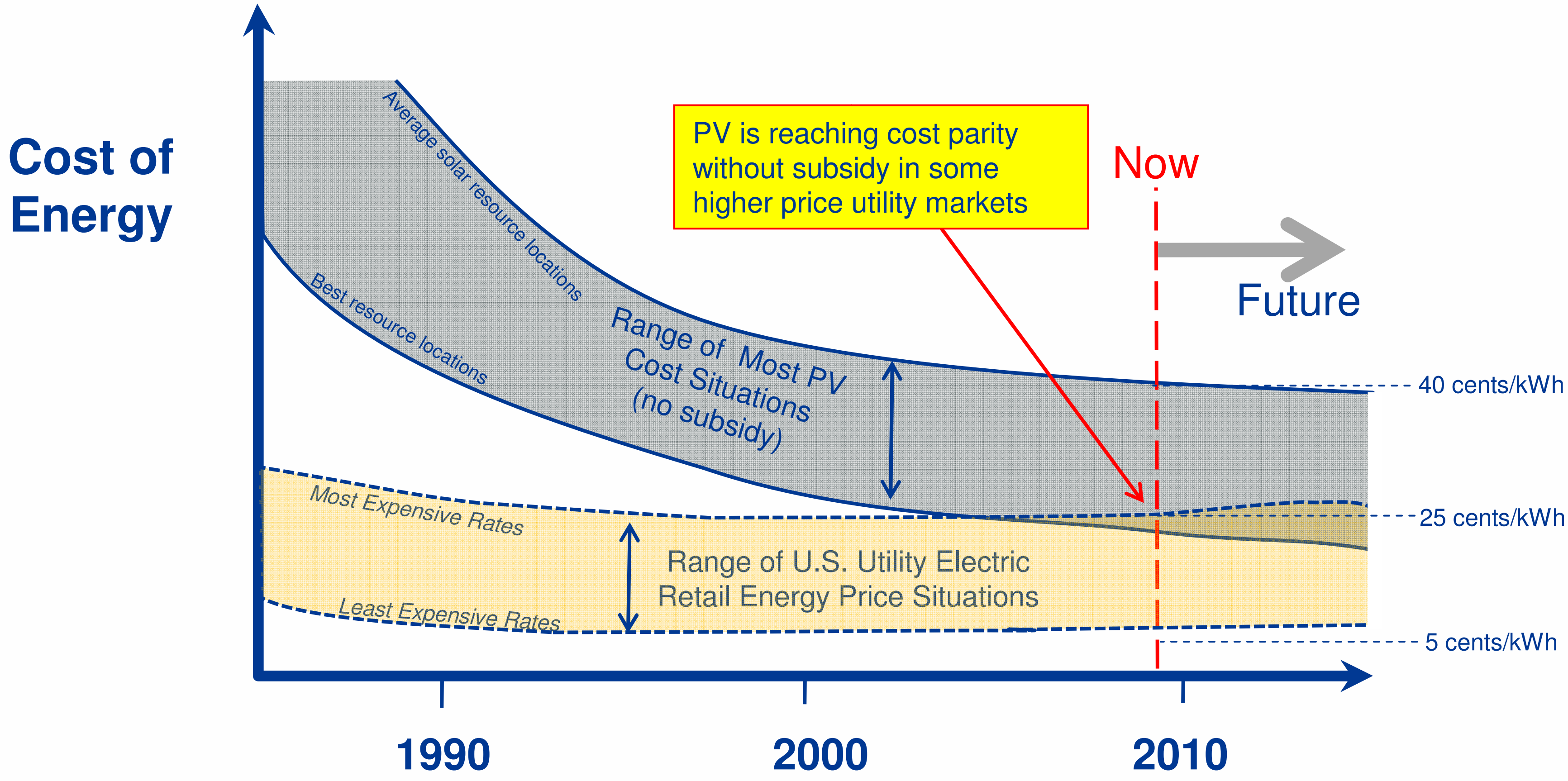
Renewable Energy Subdivision

Global PV Cell Production Growth ✓



Quantity of new PV cells produced by solar cell factories each year. This Global solar cell production data originates from Prometheus Institute/Paul Maycock

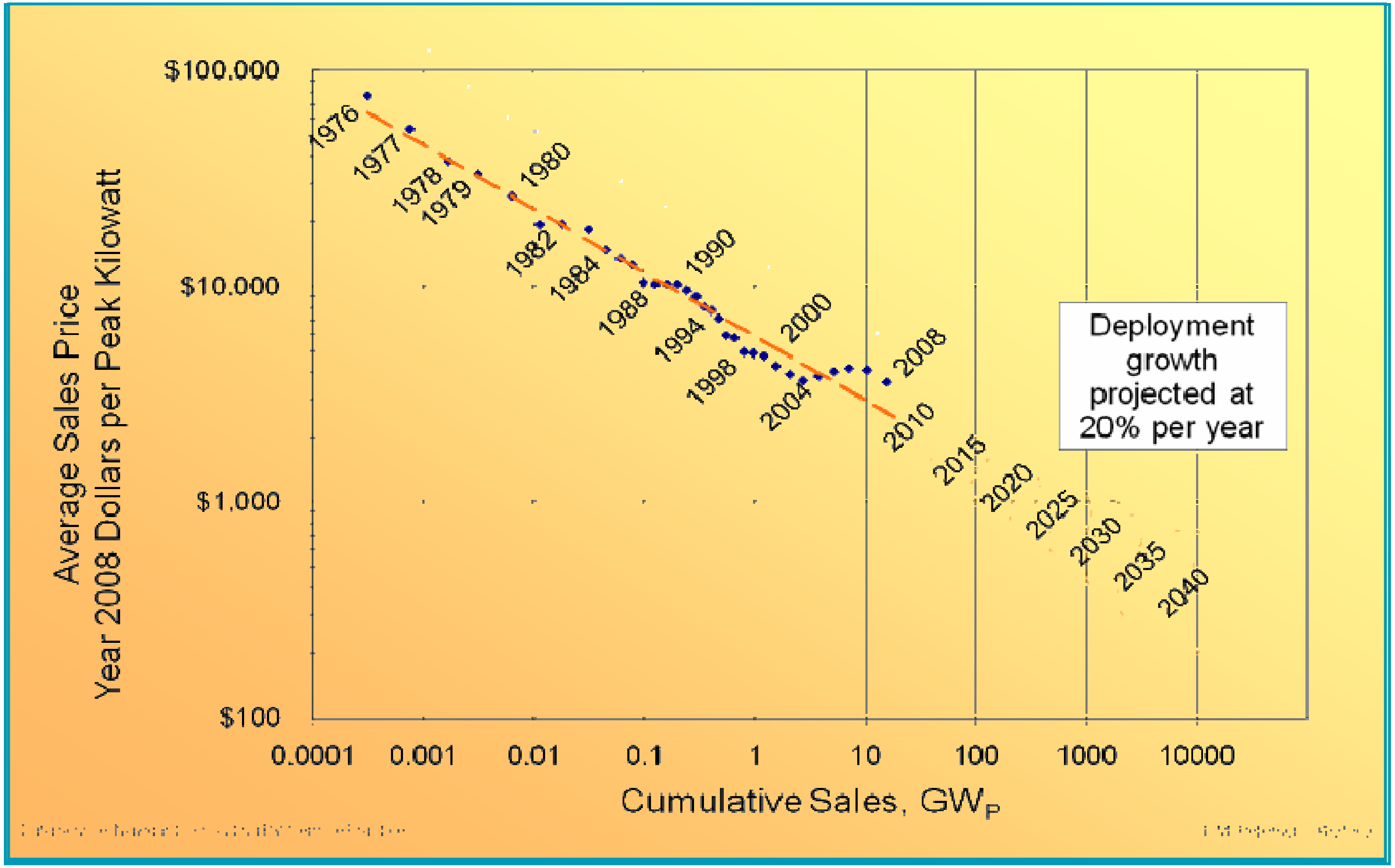
Downward Trend in PV System Energy Cost ✓



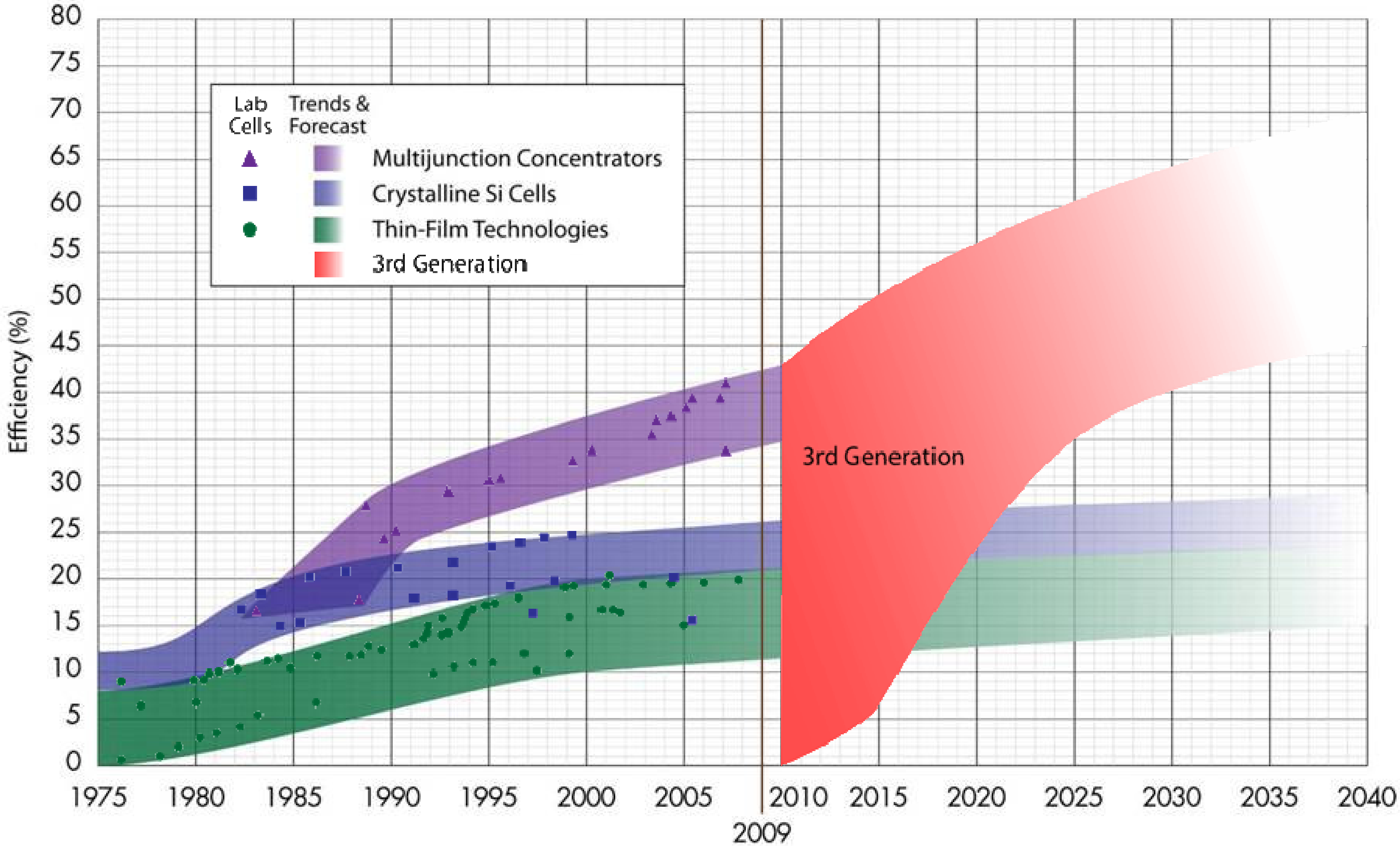
When will PV reach the "ignition" cost point? Sooner or later utility industry will need to be proactive on PV opportunities, and to avoid risk of losing market share.

Eskom

Reducing PV Module GW shipments and prices ✓

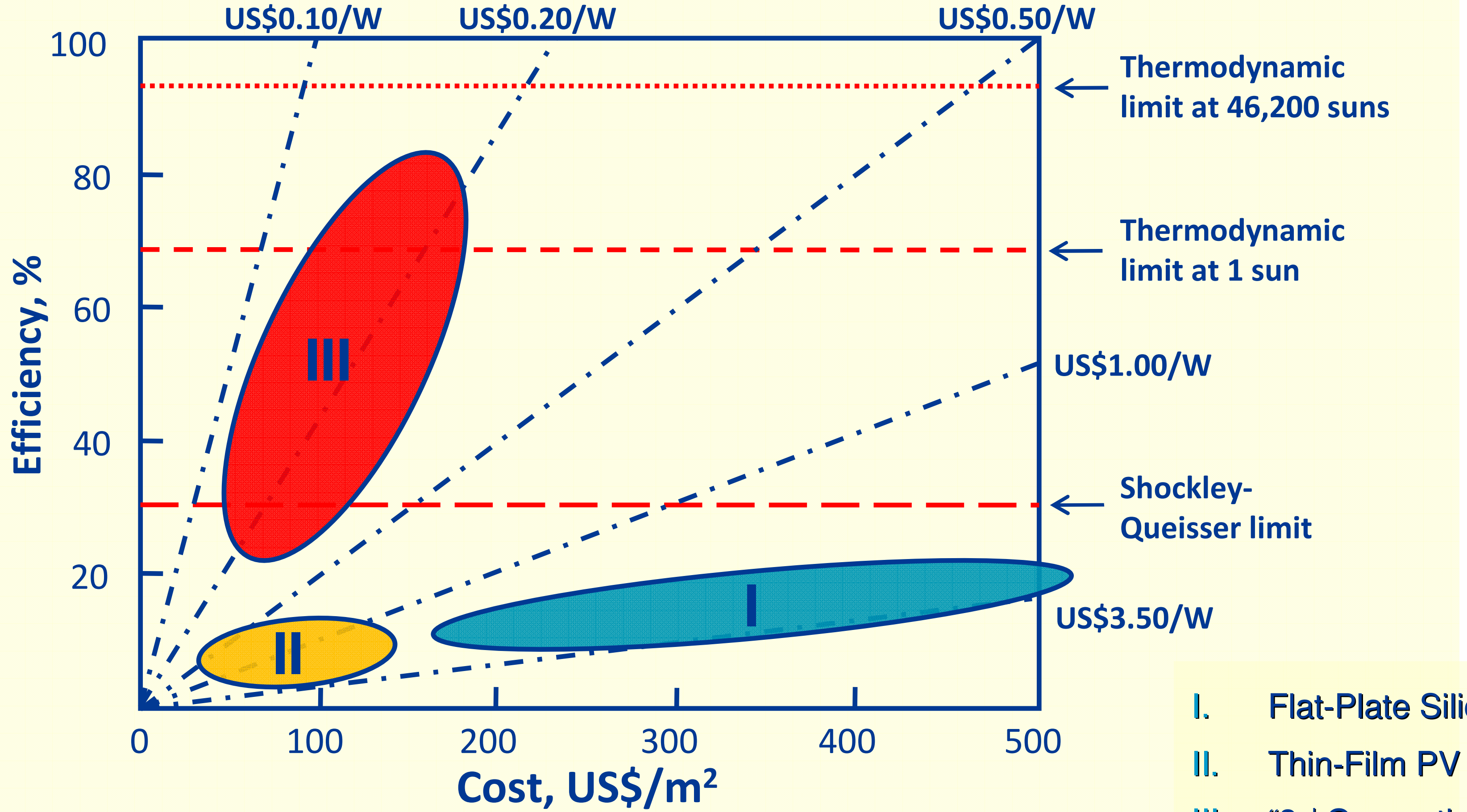


Cell Efficiency Improving ✓



Source: EPRI

Efficiency vs. Cost - Defines PV Technology Taxonomy

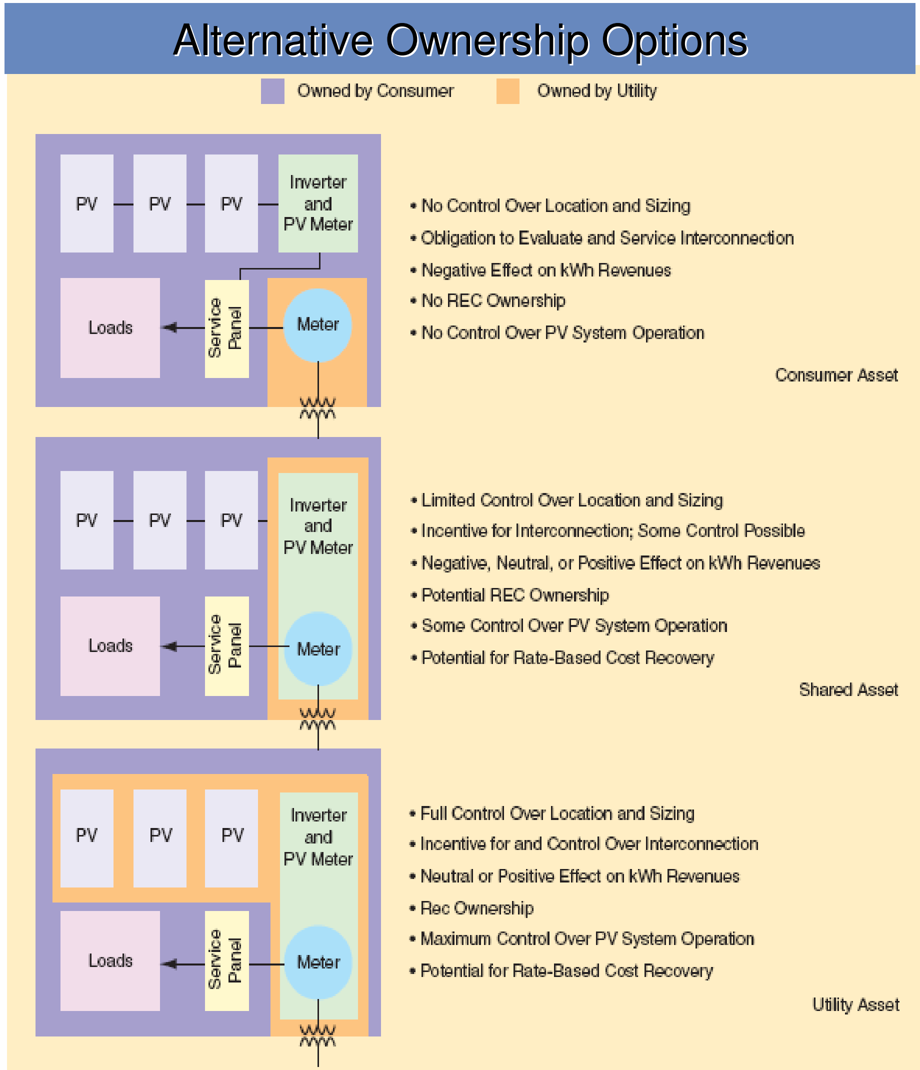


I. Flat-Plate Silicon
II. Thin-Film PV
III. "3rd Generation" Concepts

Source: M. Green, Univ. New South Wales

Purchase/Own Decision….and ability to:

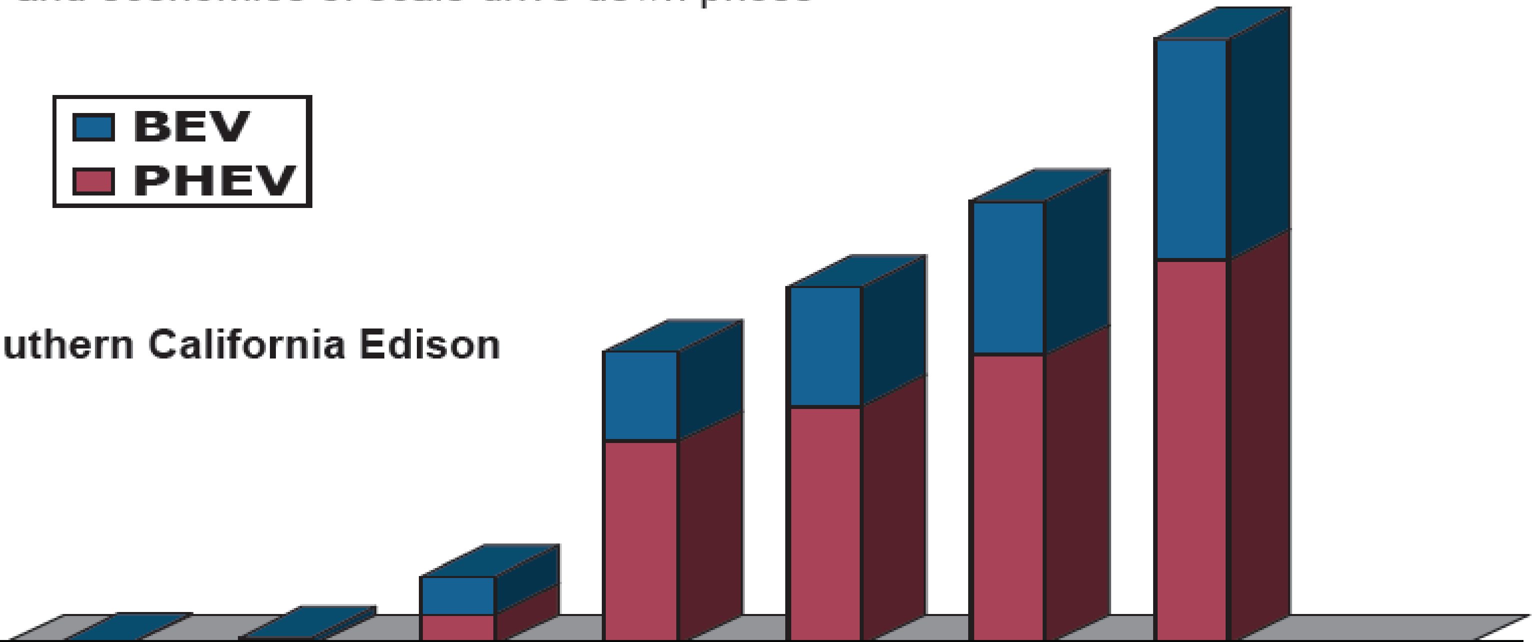
- Factor in existing customer relationships
- Build, maintain and service more complex infrastructure ….. achieving economy of scale
- Leverage other business interests – demand response, efficiency, design and inter- connection, metering and wholesale
- Finance Long-term PV asset investments
- Target deployment levels and siting to reduce losses, reduce peak load and enhance reliability



Plug-In Vehicles Enter Market in Late 2010
What is the Near-Term Achievable Market Penetration?

Market penetration grows as vehicle production numbers increase, new models are introduced, and economies of scale drive down prices

Source: Southern California Edison



	2009	2010	2011	2012	2013	2014	2015	Total
BEV	500	5,800	31,850	73,967	97,500	126,550	181,800	517,967
PHEV	150	250	25,000	167,100	196,700	238,000	316,000	943,200

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Transportation Electrification Overview

Two funding opportunities, both awarded August 5th.

1. FOA-26 – Electric Drive Vehicle Battery And Component Manufacturing Initiative
   - Manufacturing incentives
   - $2 billion
2. FOA-28 – Transportation Electrification
   - Vehicle and infrastructure demonstrations
   - $400 million

FOA – US Federal Govt. Funding Opportunity Announcement

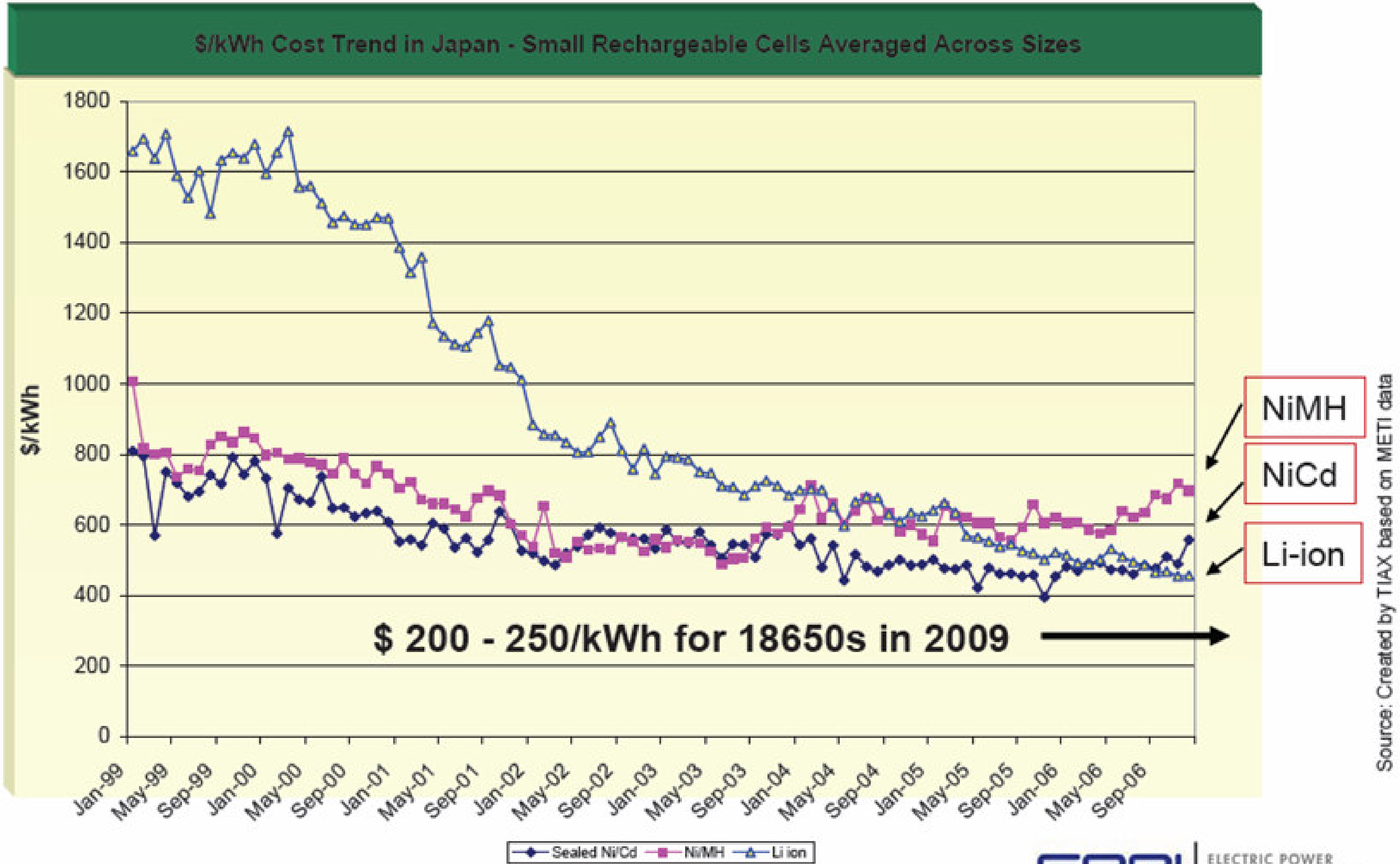
The Lithium Ion Battery is Evolving Rapidly

Current Status

Lithium Ion is the critical battery technology for PHEVs and EVs

- Cost reductions are continuing
  - 18650s (consumer Li Ion cells) now at $200 – 250/kWh
  - Large cells are quickly dropping in price
  - Prices are now approaching lead-acid territory!
- Automotive production capacity quickly developing
  - Over $1 billion in stimulus awards to U.S. companies
- PHEV and EV production will drive Li Ion volume
- The potential secondary use market for used automotive is very interesting

Lithium Ion Battery Cost



PHEV Batteries in Secondary Use

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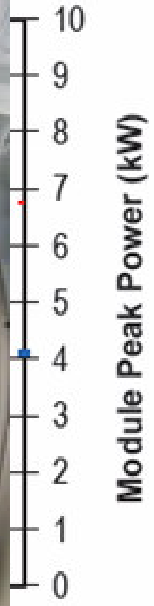


Need for Utility-Automotive-Battery Industry Collaboration to Answer These Questions

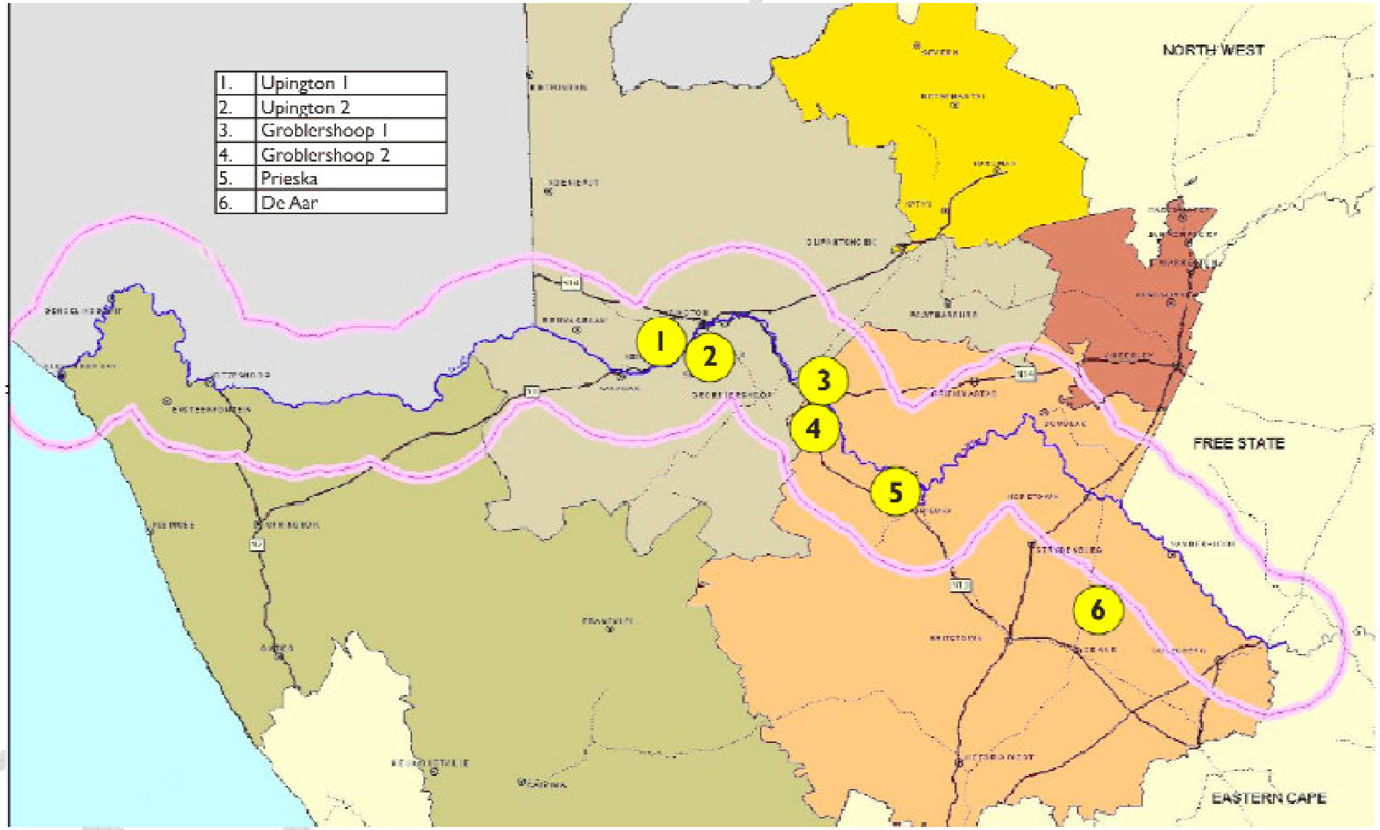
The Future

Clinton Climate Initiative

Eskom

CLINTON FOUNDATION | CLINTON CLIMATE INITIATIVE

FIGURE 51: NORTHERN CAPE, POTENTIAL SOLAR PARK TARGET AREAS



Source: NCPG and CCI, 2010

DoE driving solar park initiative

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2 - AUG 2010
Chief Executive

MINISTER
ENERGY
REPUBLIC OF SOUTH AFRICA

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2010 -08- 02
CHAIRMAN

Brian Dames
FYA (S)

04th Floor 2A, Travenna Campus, 75 Mentjies Street, Pretoria, 0007, Private Bag X19, Pretoria, 0007, Tel:012-444 4267, Fax: 012-444 4505
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cc Steve Lennon
Chose Chuene
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Enquiries: Ms M Mathekgana
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Email: mokgadi.mathekgana@energy.gov.za

Mr Mpho Makwana
Chairperson: ESKOM
P.O.Box 1091
JOHANNESBURG
2000

Tel: (011) 800 2030
Fax: (011) 800 5803

Steve
(1) prepare a response for Chairman's signature.
(2) Briefing note for our information.
Thanks.
B
3/8

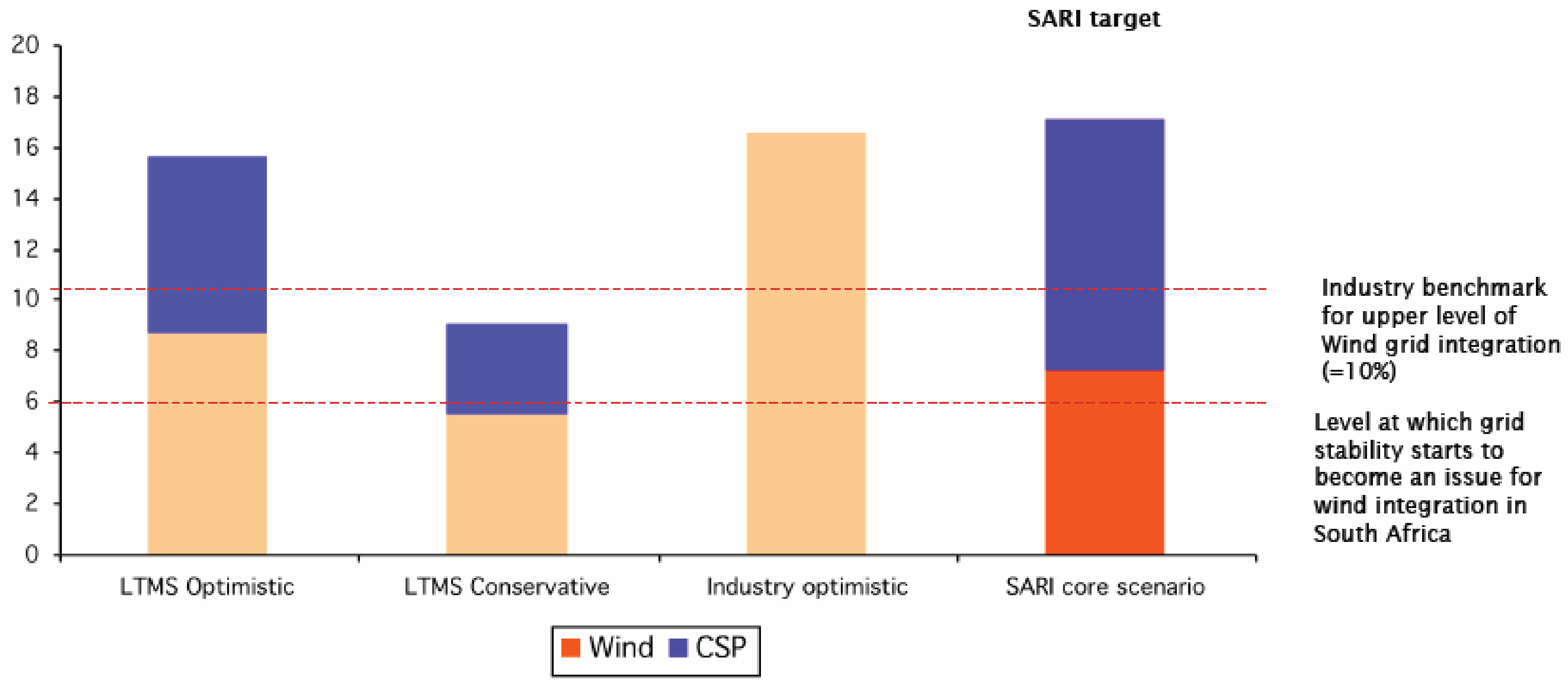
Dear Colleague

PROGRESS MADE ON THE ESTABLISHMENT OF A SOLAR PARK INITIATIVE AND YOUR DEPARTMENT'S PARTCIPATION IN THE PROJECT

The White Paper on Renewable Energy Policy was published in 2003. This policy sets a target of 10 000 GWh to be produced from renewable energy technologies by 2013. The Department is committed to meeting this target through proven renewable energy technologies like wind, biomass, solar and small-scale hydro.

SARI's projections are based on a cautious target of 15% renewables by 2020, with wind and CSP dominating the mix

Commissioned renewables capacity by 2020
GW



Public Enterprises
Trade and Industry

Source: LTMS Scenarios, WWF(2009) Costing a 15% target for renwables for South Afric, GTZ (2009) Grid Integration of Wind Energy in the Western Cape, Industry interviews, SARI team analysis

SARi
SOUTH AFRICAN RENEWABLES INITIATIVE

CSP localization potential (parabolic trough)

Percentage Value	Category	Example
29	Globally leading	Curved mirrors Receiver tubes Turbines
8	Advanced	Drives Valves
14	Intermediate	Control Pumps
49	Shallow	Metal structures Heat exchanger Foundations Civils

Public Enterprises
Trade and Industry

Typical 50 MW Parablic Trough with Thermal oil as Heat Transfer and
7 h Molten salt storage
Source: Industry Inputs, Sari analysis

SARi SOUTH AFRICAN RENEWABLES INITIATIVE

Integrated Resource Plan will provide direction

Eskom

FIGURE 8: IRP 1 PLANNED CAPACITY ADDITIONS

Current Programs	2009	2010	2011	2012	2013	Total
Return to Service [1]	772	683	404	-	-	**1,859**
Medupi (coal)	-	-	-	738	738	**1,476**
Kusile (coal)	-	-	-	-	723	**723**
Ingula (pumped hydro)	-	-	-	-	666	**666**
OGCT IPP (gas)	-	-	1,020	-	-	**1,020**
MTPPP (co-gen), REFIT [2]	-	343	518	284	-	**1,145**
Eskom Wind, CSP	-	150	-	-	-	**150**
Other	-	30	55	-	-	**85**
Total Capacity Added (MW):	**772**	**1,206**	**1,997**	**1,022**	**2,127**	**7,124**
System Capacity (MW)[3]:	**44,157**	**45,363**	**47,360**	**48,382**	**50,509**	**50,509**

[1] Represents the scheduled return to service of existing coal generation assets temporarily taken offline for maintenance and refurbishment

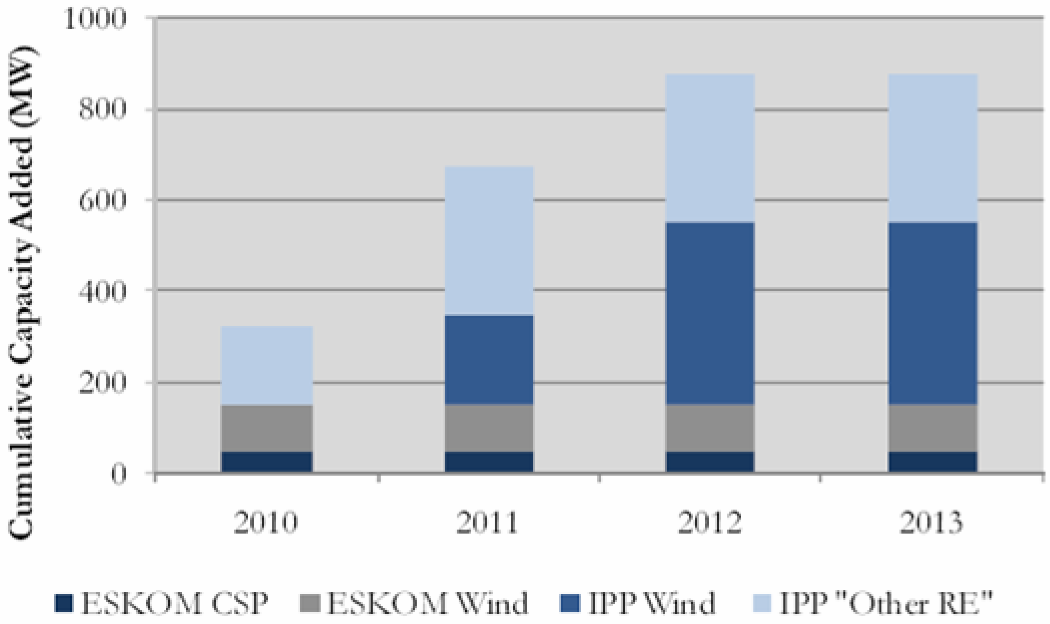
[3] "MTPPP" represents capacity additions under the "Medium Term Power Purchase Program" for co-generation power; "REFIT" represents capacity additions under the "Renewable Energy Feed-in Tariff" Program

[3] IRP 1 projected an EOY 2009 capacity of 44,157 MW, whereas ESKOM documents suggest 2009 capacity totaled 44,132 MW, a difference of 25 MW. Starting from ESKOM's 2009 capacity baseline, capacity online by 2013 would total 50,484 MW

Source: South African DOE, December 2009

NERSA's role

FIGURE 20: CUMULATIVE SOUTH AFRICAN RENEWABLE CAPACITY (PROJECTED)

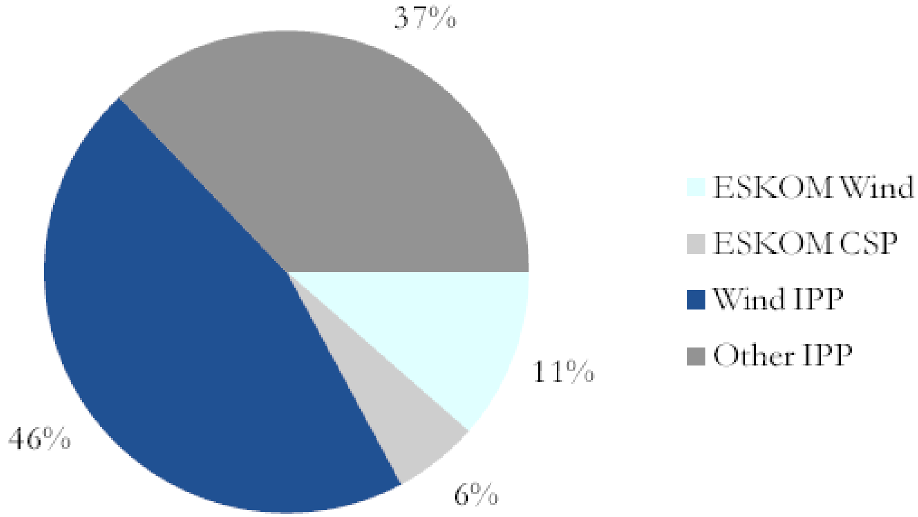


Source: NERSA 2010

IRP 1 makes clear that the government intends for the majority of new renewable capacity to come from IPPs. According to the numbers above, IRP 1 plans for 83% of the renewable capacity for 2013 to come from IPPs, and for 17% to come from ESKOM.

50% wind, 50% solar of ~ 17GW

FIGURE 21: BREAKDOWN OF PLANNED 2013 RENEWABLE CAPACITY



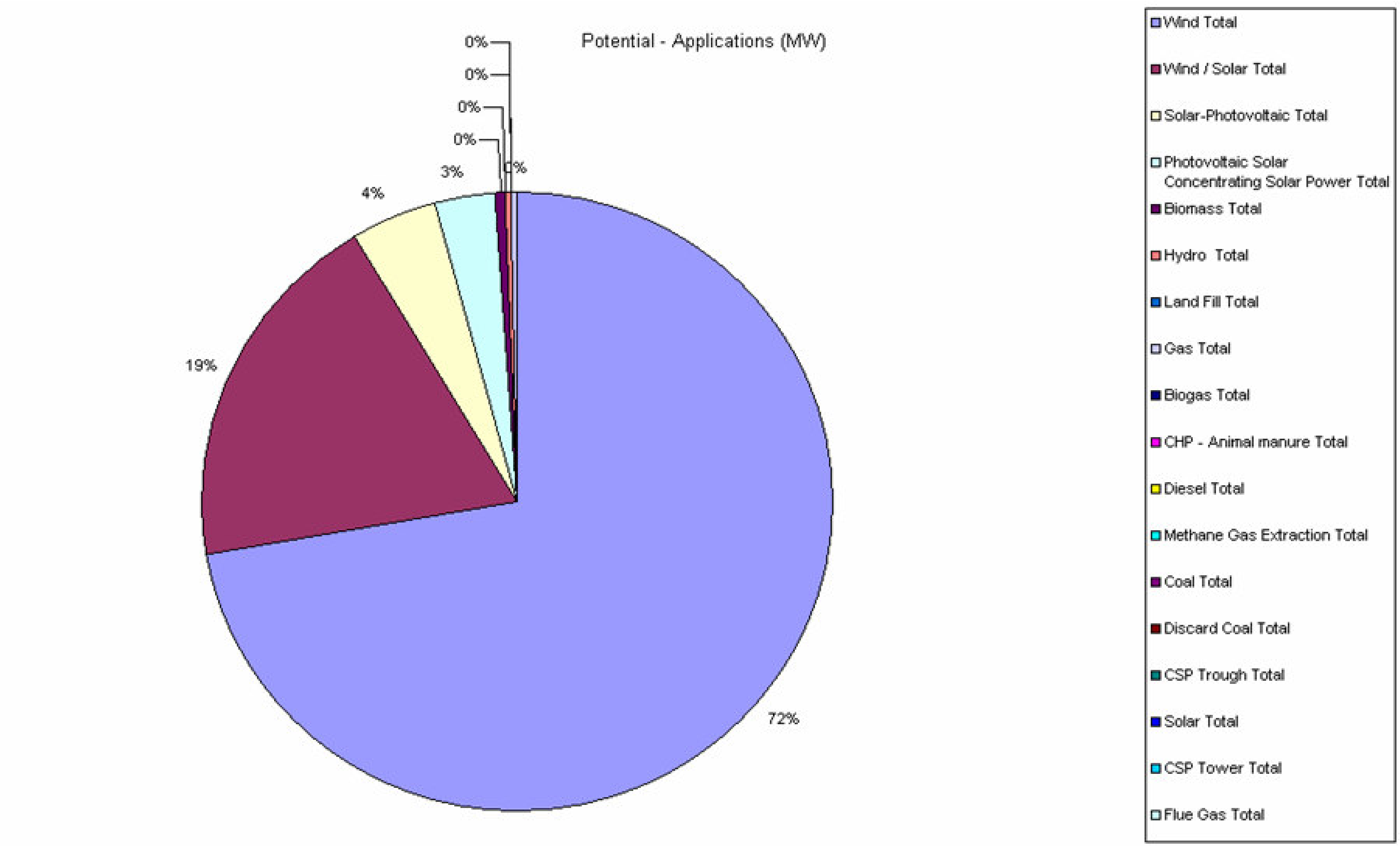
Source: NERSA 2010

The role of Independent Power Producers?

I can't say it better than the (ex) chairman – Bobby Godsell

- **"By the way, Eskom's average tariff is 33 c/kWh and the way the system works at the moment, Eskom has to pay the difference . . . so, we shouldn't then be surprised that private players haven't come in."**
- **"We are encouraging the private producers to put their own case to Nersa, with their own facts and indicating their own prices . . . and to paddle their own canoe, so to speak. Eskom should absolutely get out of their way, we need private producers. Eskom can't do it all," he added.**

13,7GW of IPP *Expressed Interest* (low certainty)



Conclusions

- South Africa needs certainty regarding targets – strong reliance on IRP2 and RE White Paper to provide this. Eskom contribution needs to be clearly stated as does IPPs.
- NERSA needs to follow through on REFIT for IPPs and funding for Eskom RE build. A funding solution is imperative.
- A technical working group needs to be established around each technology and break it down into component parts. These then are multiplied by the target growth numbers to produce a bill of quantities which then can be released as market information. A high level of certainty needs to be attributed to the numbers to attract investment.
- DST must work closely with DoE on IRP2 and RE white paper and Clinton Foundation Park initiative, also with DPE on SARi

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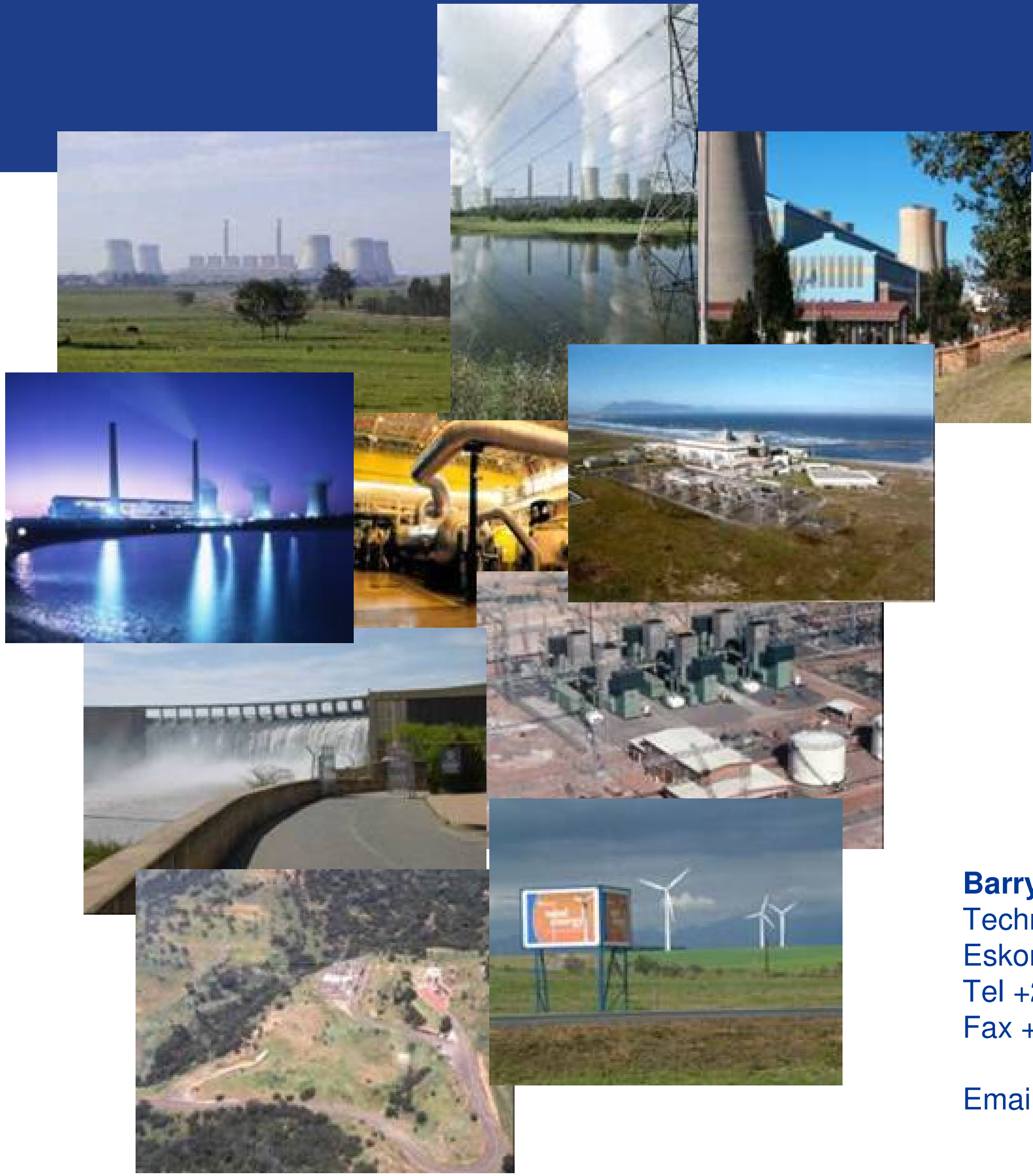

THANK YOU

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