Wheeled wind energy to resolve constraints under the ECS or as the lowest cost generation option under carbon taxes

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South African Wind Energy Association
www.sawea.org.za

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Conclusion

Installed

- Wind Energy has been pursued in SA since 1998
- Very considerable regulatory and price barriers
- At present 8 turbines installed (DWF 4, Eskom Klipheuwel 3, Kouga 1)
- Installed capacity about 10 MW (Germany perhaps 15,000 turbines, 20,000 MW+ installed)

Under development

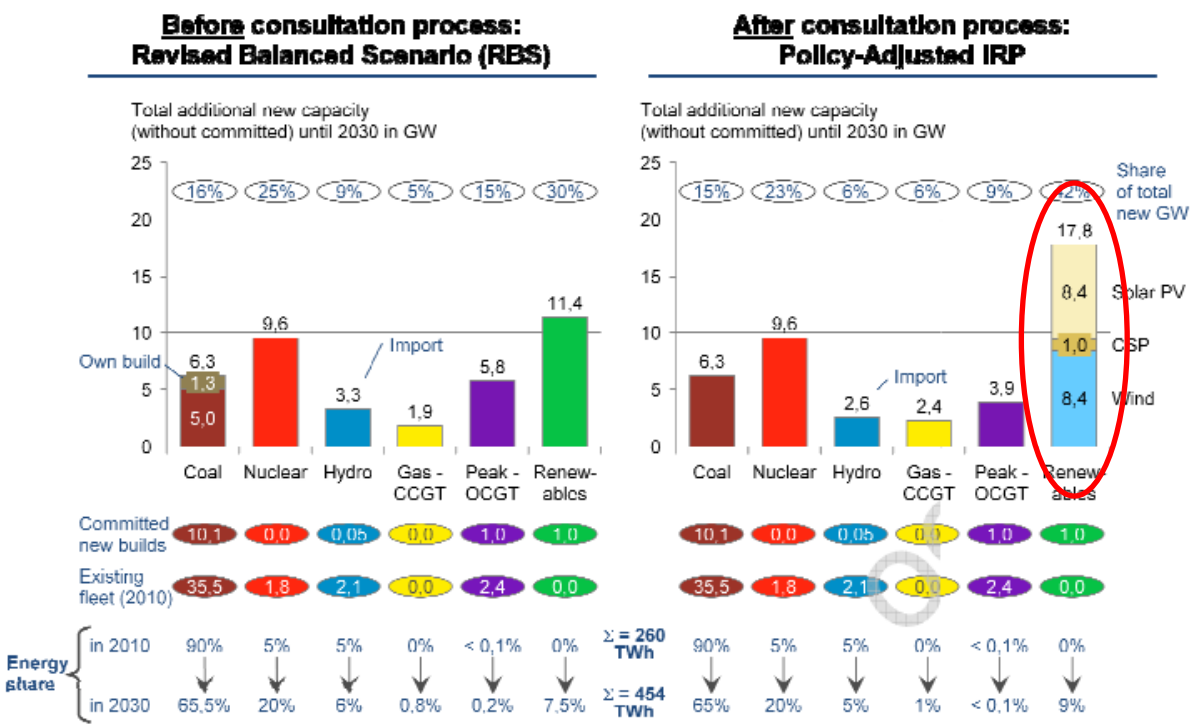
- As at Sept 2011, 143 EIA's totalling 12,500MW
- This typically includes wind measurement and basic fatal flaw studies
- More MW's behind
- Some will not fly due to various fatal flaws
- Some are mutually destructive (grid etc)
- More behind in the pipeline

Resource

- WASA (Wind Atlas for Southern Africa) is showing very promising results
- Distributed over a large land mass
- Good capacity credit
- Individual developers have measured good to excellent wind (8.5 m/s +)
- Most informed estimates of the total capacity available for development in SA will say 10,000 – 20,000 MW installed or more
- About 5,000 MW will be available within 12 – 18 months with a commissioning timeframe of another 12 – 14 months after financial close

The IRP 2010

- Integrated Resource Plan 2010 (***www.doe-irp.co.za/content/IRP2010_2030_Final_Report_20110325***)
- It is the 20 year blueprint/masterplan for energy in the country
- Extensively workshopped and modelled
- Adjusted from lowest cost model for various factors including policy
- Readjusted every 2 years due to changed circumstances



IRP – medium term roll-out of wind

	Committed build											New build options								
	RTS Capacity (coal)	Medupi (coal)	Kusile (coal)	Ingula (pumped storage)	DOE OCGT IPP (diesel)	Co-generation, own build	Wind	CSP	Landfill, hydro	Sere (wind)	Decommissioning	Coal (PF, FBC, Imports)	Co-generation, own build	Gas CCGT (natural gas)	OCGT (diesel)	Import Hydro	Wind	Solar PV, CSP	Renewables (Wind, Solar CSP, Solar PV, Landfill, Biomass, etc.)	Nuclear Fleet
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
2010	380	0	0	0	0	260	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	679	0	0	0	0	130	200	0	0	0	0	0	103	0	0	0	0	0	0	0
2012	303	0	0	0	0	0	200	0	100	100	0	0	0	0	0	0	0	0	0	0
2013	101	722	0	333	1020	0	300	0	25	0	0	0	124	0	0	0	0	0	0	0
2014	0	722	0	999	0	0	0	100	0	0	0	0	426	0	0	0	200	0	0	0
2015	0	1444	0	0	0	0	0	100	0	0	-180	0	600	0	0	0	400	0	0	0
2016	0	722	0	0	0	0	0	0	0	0	-90	0	0	0	0	0	800	100	0	0
2017	0	722	1446	0	0	0	0	0	0	0	0	0	0	0	0	0	800	100	0	0
2018	0	0	723	0	0	0	0	0	0	0	0	0	0	0	0	0	800	100	0	0
2019	0	0	1446	0	0	0	0	0	0	0	0	0	0	474	0	0	800	100	0	0

Procurement of wind power

- DOE as procurer and Eskom as buyer is presently procuring 2,100 MW of wind power
- This represents the IRP allocation until 2016
- Procurement takes place in 5 windows about 4 – 5 months apart or until allocation is filled
- First window closed on 4 November 2011 and received about 1050 MW of wind bids
- Each bid required about 24,000 pages of documentation to comply
- Bidding cost was ZAR 2 – 3 million per bid
- The bid bond was ZAR 100,000 per MW bid and thus more than ZAR 100 million must have been posted as wind bid bonds
- The above proves how sophisticated, determined and well-resourced wind IPP's are

Supply and demand of wind power – medium term estimate

Year	Demand from government procurement (MW)	"Permitted" supply available to be built – MW (estimate)	"Wind surplus supply" - MW
2012	2,100	3,000	900
2013	2,100	5,000	2,900
2014	2,100	5,500	3,400
2015	2,100	6,000	3,900
2016	2,100	6,500	4,400

SA: Electricity supply and demand

- The problems of 2008 have not gone away
- Economic stagnation merely hid it
- 900 MW lost at Koeberg due to hydrogen leak
- First unit at Medupi delayed until Oct 2013
- The open cycle gas turbines are running far over budget at exorbitant cost
- Coal plants have not all received scheduled maintenance
- 500 MW being procured on short term basis from Municipalities and IPP's

Eskom adequacy report week 41 (2011)

Week start	MW prediction	MW available capacity	MW available capacity less Operating reserve and unplanned outage	Capacity reserve margin (%)	Operational surplus/deficit (MW)
14 Nov	32,880	38,651	32,251	-1,95	-629
21 Nov	32,830	37,588	31,188	-5,26	-1642
28 Nov	32,588	38,565	32,165	-1,32	-423
5 Dec	32,811	37,415	31,015	-4,82	-1496
12 Dec	32,073	37,680	31,280	-2,54	-795
19 Dec	30,296	36,720	30,320	0,08	24
26 Dec	28,391	36,344	29,944	5,19	1553
2 Jan	29,853	34,964	28,564	-4,51	-1289
9 Jan	31,121	34,934	28,534	-9,07	-2587
16 Jan	31,677	35,809	29,409	-7,71	-2268

Energy Conservation is the chosen strategy

– see http://us-cdn.creamermedia.co.za/assets/articles/attachments/10986_nationalresponse_sa_electricity1.pdf

DEMAND REDUCTION OPTIONS	SUPPLY CONSTRAINTS	COUNTRY IMAGE	CLIMATE CHANGE	FINANCIAL SUSTAINABILITY	SA ECONOMY	PROBABILITY OF DESIRED OUTCOME
LOAD SHEDDING	No improvement	Extremely negative impact	No impact	No impact	Extremely negative Indiscriminate allocation Impossible to plan	NOT AN OPTION
ROLLING BLACKOUTS	Some improvement	Extremely negative impact	Limited impact	Limited impact	Extremely negative Indiscriminate allocation Impossible to plan	NOT AN OPTION
PRIORITISATION OF NEW LOAD	Potentially negative	Negative Impact May be considered unfair	Limited benefit	Depends on priorities	Negative Deter investment	LOAD SHEDDING REMAINS BEST USED IN CONJUNCTION WITH POWER RATIONING
INTENSIFIED "ENERGY EFFICIENCY" DSM	Positive in long term	Slight positive impact	Positive in long term	Neutral to Eskom if funded by NERSA/customers	Positive in long term High initial cost	LOAD SHEDDING REMAINS ELEGANT SOLUTION, BUT SLOW
SEVERE NMD PENALTIES	Some improvement	Neutral	Some improvement	Limited improvement	Neutral	LIMITED IMPACT WILL NOT RELIEVE CURRENT
SUSPEND NEW APPLICATIONS	No improvement	Very negative impact	Mildly positive impact	Neutral in short term Long term risk	Constrains growth Deter investment	LOAD SHEDDING REMAINS TEMPORARY REPRIEVE NEGATIVE LONG TERM IMPACT
POWER CONSERVATION PROGRAMME	Im				Facilitate intensified DSM & co-generation Economy can grow	PROVEN SOLUTION IMMEDIATE IMPACT DELIVERS INTENSIFIED DSM

Power Conservation is the Recommended Option

Positive impact | Neutral | Negative Impact

The PCP and the ECS

- The Power Conservation Programme, large users were capped at say 92% of baseline use
- Excess use would be penalised by as much as ZAR 18/kWh
- Power could be bought in from IPP's to lower Eskom use
- System never implemented
- Now – Energy Conservation Programme ("ECS")
- Rules reworked, going to DOE
- Then to NERSA for approval
- Imminent

Wheeled wind power to supply business

- Under the PCP, if penalties or incentives are to be provided, wheeled wind power can be used to lower Eskom use
- Monthly accounting period means variability of wind would matter less
- Wind power would probably cost far less than any penalty and is far cheaper than even the open cycle gas turbine power (say ZAR 1.15/kWh against ZAR 4.00/kWh)

Challenges to a private market for wheeled power

- Long term PPA's required (about 20 years)
- Business reluctant to commit so far forward
- Banks reluctant to finance beyond say 7 years against private PPA
- How much in wheeling charges?
- How much in standby charged?
- Whose risk if the grid is down and power cannot reach its destination?
- Interplay with carbon tax may make a difference to unlocking the private wind power market

Carbon taxes

- Mooted at between ZAR 70 and ZAR 200/tonne as a strategy to price the externalities of coal fired power generation
- This equates roughly to between 7c and 20c/kWh if passed through
- New coal costs about 95c/kWh
- Wind about ZAR 1,15/kWh
- Obvious that carbon taxed will equalise the costs of wind and new coal quite quickly
- There are externalities other than carbon that are not being priced in

Externalities of coal power use – how much can it be per kWh for Kusile?

(University Pretoria)

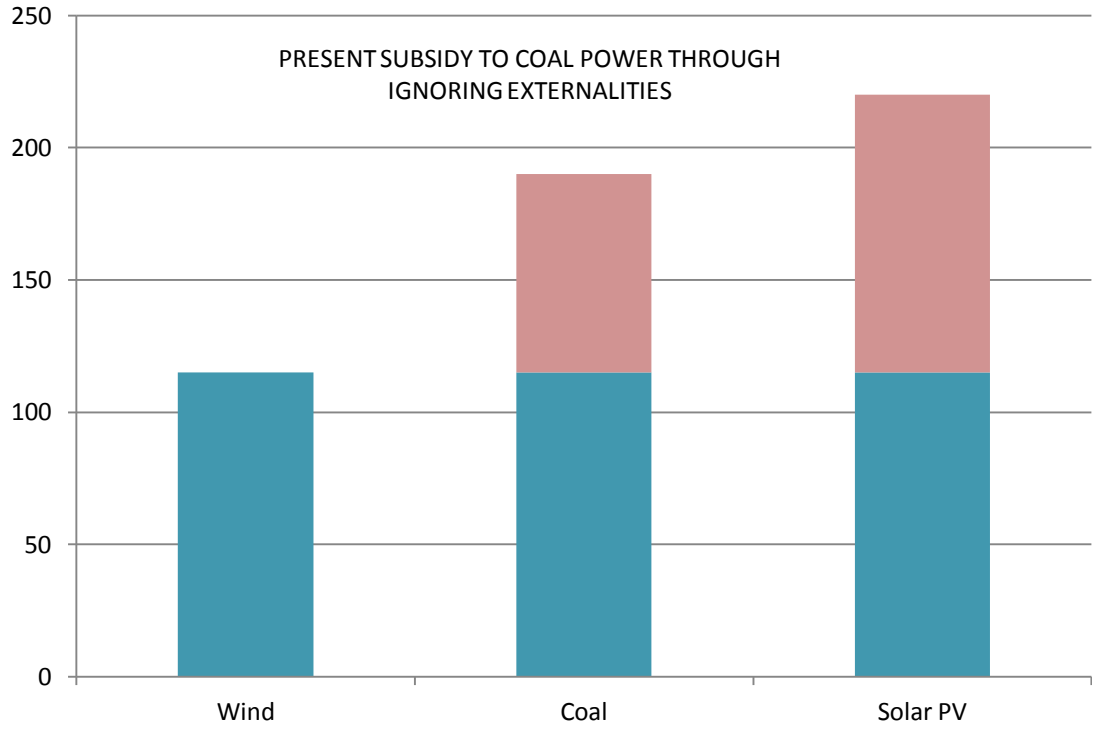
Table 1: Estimated annual externality cost of Kusile (BE at UP: p. 18)

	Net output	Externality cost			
	GWh	Low (R million)	R/kWh (Low)	High (R million)	R/kWh (High)
Health	32 301	182.8	0.006	213.3	0.007
Climate change	32 301	3 148	0.097	5 334	0.165
Water	32 301	21 305	0.660	42 357	1.311
Mining	32 301	6 538	0.202	12 690	0.393
Total		**31 174**	**0.97**	**60 594**	**1.88**
Total excluding water for generation purposes*		**9 869**	**0.31**	**18 237**	**0.56**

* For illustrative purposes only

Wind as least cost, bulk generation option with present subsidies to coal

(conservative assumptions of cost)



Wind power as lowest cost generation option

- Full pricing of externalities would mean that wind is likely to be the lowest cost, bulk generation option
- Just the carbon tax will get it very close with cross-over only a few years away
- There will be over-demand for electricity in SA for the medium term
- There will be over-supply of wind power projects
- These projects can supply power to large users to avoid ECS penalties or avoid the carbon tax
- If 1,000 MW of open cycle gas turbines run at 20% capacity factor at ZAR 4/kWh the cost is ZAR 7 billion per annum
- This can fund the levelised cost of 2,700 MW of installed wind power
- It makes sense, let's make it work!

THANK YOU

Johan van den Berg

CEO SAWEA

johan@sawea.org.za

082 925 5680