energy

Department:
Energy
REPUBLIC OF SOUTH AFRICA

IRP2 : Stakeholder Plenary Session 07 June 2010

AIIM
AFRICAN INFRASTRUCTURE INVESTMENT MANAGERS

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1 Background to Topic

Umoya Energy : Stakeholder Inputs to IRP2 - Background

- African Infrastructure Investment Managers (Pty) Ltd ("AIIM") established in 2000
- Approximately R5.1 billion (US $ 680m) of committed infrastructure equity funds under management in 4 investment funds : SAIF, AIIF, KEIF & AIIF 2
- Funds deployed as equity in core infrastructure projects in Africa covering Toll Roads, Telecoms and Power
- Umoya Energy (Pty) Ltd was established by AIIM as a Renewable Energy Developer – currently developing Hopefield Windfarm (100MW)

80m monitoring mast at Hopefield site

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Umoya Energy : Stakeholder Inputs to IRP2 - Background

- Renewable Energy hardly featured in the IRP 2009 and this trend is reflected in the IRP2 “indicative future Generation Mix” table as included in the DoE Doc ID S11 : Generation Mix (Supply Input)
- This is completely at odds with the rest of the world where renewable energy is being embraced - :
  - EU – 20% of energy generated by renewables by 2020
  - USA – > 15% of energy generated by renewables by 2020
  - UK – 15% by 2020 (up from less than 3% currently)
  - China – wind + solar energy by 2020 > 2 x nuclear
  - India – 5% by 2012 & targeting 10 – 15% by 2020
  - Australia – targeting 20% by 2020
  - Egypt – targeting 20% by 2020

- Of the renewable energy technologies suitable for RSA only wind and solar have sufficient resource for deployment at scale
- Wind is the dominant and most proven current source of renewable energy in the world (158 GW) – solar has great potential but is still maturing and is currently just too expensive

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2

Wind Energy – The Facts

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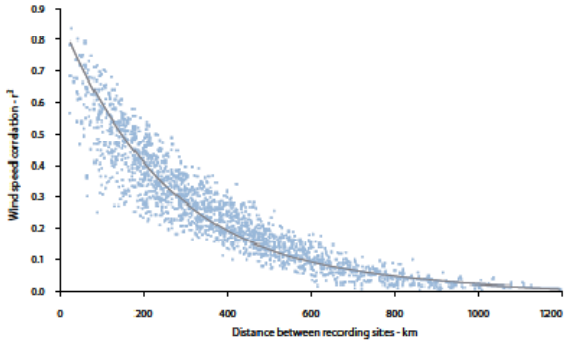
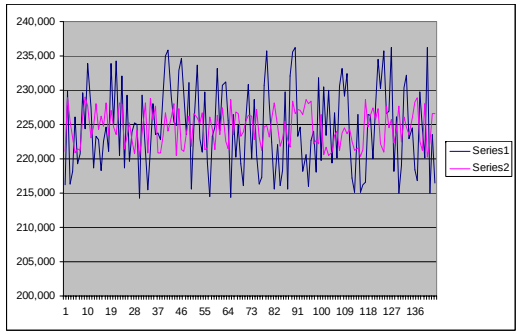
Wind Energy as a Reliable Resource - Facts

Wind Power is *Unreliable* – True or False ?

- Negative perceptions due to this issue are unfounded
- Wind is statistically predictable – with great accuracy
- Wind Energy is Variable but not Intermittent
- Intermittency is a binary concept, either On of Off, (actually a characteristic of conventional energy)
- Variability is significantly reduced by geographic dispersion & the portfolio effect
- Capacity factor is not an indicator of “% of time the wind blows” , e.g. Hopefield 30% vs 75%
- The variable output of a single turbine is irrelevant to the Grid Operator
- At 10% wind energy penetration levels the variability of wind is dwarfed by the normal variations of the load





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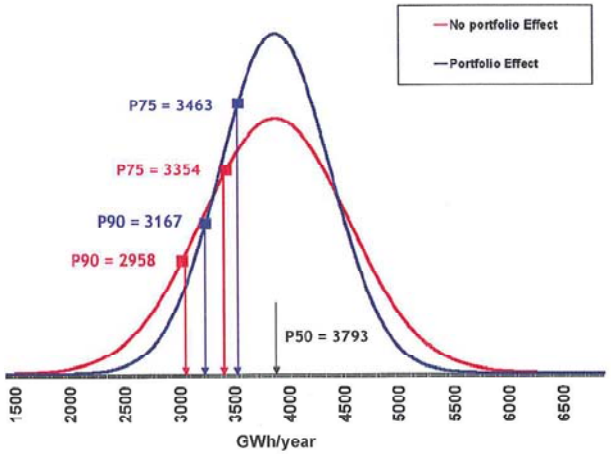
Wind Energy as a Reliable Resource – Int Refs

- **Wind Power is actually *Highly Predictable***

  - Energy prediction uncertainties are mitigated when considering a wind portfolio – 25% benefit demonstrated

  - German ISET experience since 2001 - 24hr forecasts with less than 6% error and 2 hr forecasts with less than 2.5%

  - The GH Forecaster service used extensively in the UK and parts of Europe suggest error levels of 12 – 16% at 24hrs and 6% at 1 hr in advance



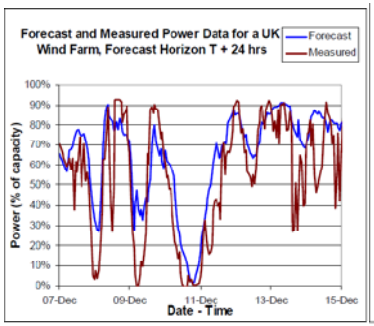


Figure 4- Time history of forecast and measured power for a single wind farm

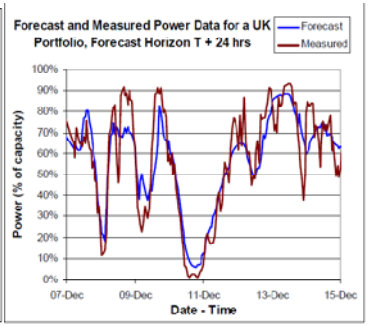


Figure 3- Time history of forecast and measured power for a portfolio

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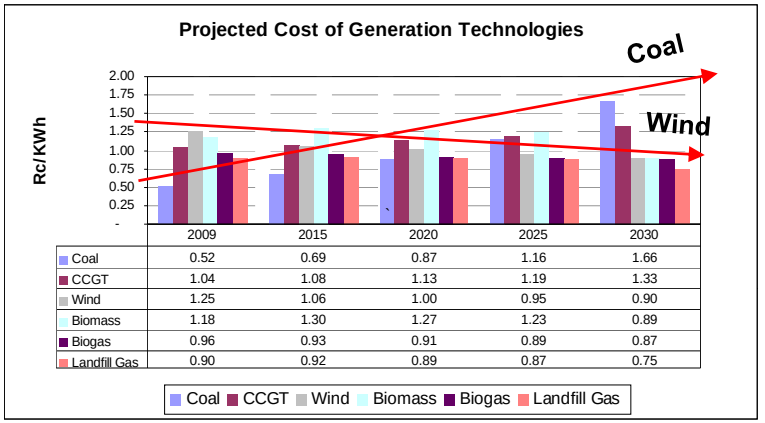
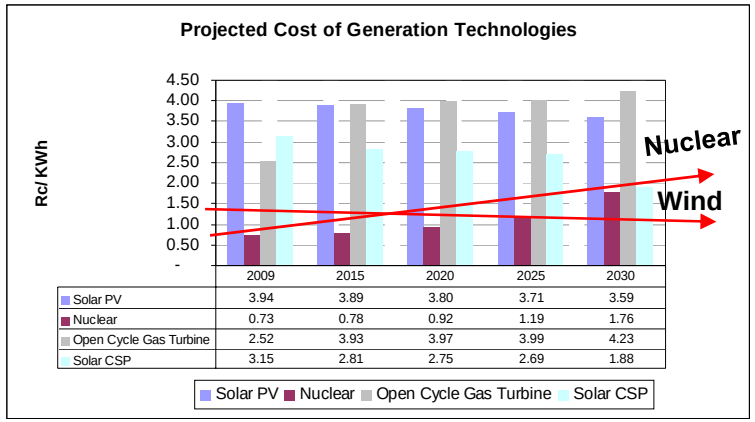
Wind Energy as a Reliable Resource - Facts

Wind Power is *Expensive* – True or False ?

- European Commission Extern.E project suggest that if externalities were included, Coal energy costs double and Gas energy costs increase by 30%
- Once externalities are included Wind Power is no more expensive than Coal or Nuclear, in fact with CO_2 @ Euro 30 / ton it is cheapest
- Wind Power costs are “certain” with 75% of energy cost upfront vs Coal & Gas with less than 50% upfront plus fuel price volatility & geo-political risk
- Over the past 20 years wind energy costs have decreased by between 9 – 17% for each doubling of installed capacity, i.e, roughly every 3 years
- RSA trends are in line with the above





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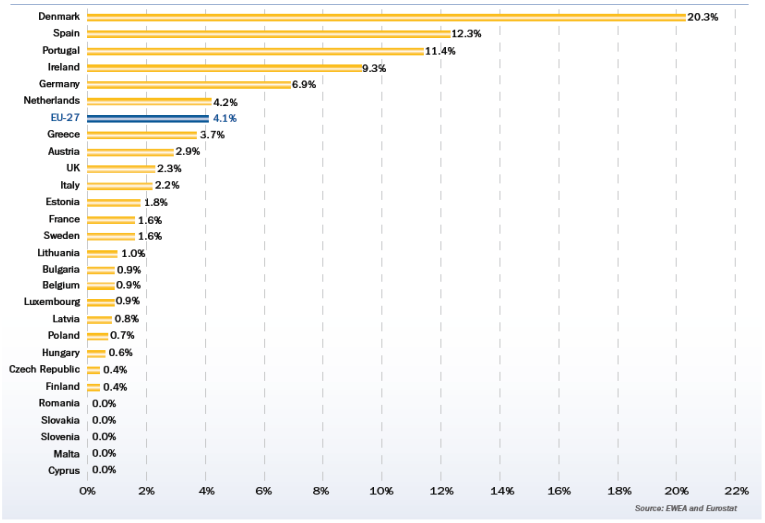
Wind Energy as a Reliable Resource - Facts

Wind Power is *Unsuitable for the Grid* – True or False ?

- At wind energy penetration levels of around 10% the impact on the grid is limited with system operation hardly affected
- European experience is that established control methods are usually adequate for wind energy penetration levels up to 20%
- In Denmark with energy penetration of around 20%, there have been times when 100% of the energy consumed is generated by wind.
- In Spain, with wind energy penetration at around 12%, more than 50% of energy consumed was recently generated by wind.
- The 2009 GTZ funded study has shown that the existing Eskom grid in the W Cape can accommodate almost 3 000 MW of Wind Power



[5] Source: Eurostat and EWEA. The national wind power shares are calculated by taking the electricity that the capacity installed by the end of 2008 will produce in a normal wind year and dividing it by the actual 2007 electricity demand, which is the latest available figure from Eurostat. Average capacity factors are assumed by EWEA for each country. The statistical methodology used differs from the methodology otherwise used throughout this report. The figures may differ from the shares reported by national wind energy associations due to differences in methodology.

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Wind Energy as a Reliable Resource – Int Refs

Wind Power Grid Intergration

- UK System Operator National Grid's 2009 report " Operating the Electricity Transmission Networks in 2020" covers, *inter alia,* the impact of wind energy penetration rising from around 3% as at present to a target of 20% by 2020 and concludes that this is workable from the Operator's perspective
- Poyry Consulting's 2009 report "Impact of Intermittency" suggests that the real challenge relating to the addition of large quantums of wind energy to the grid is the impact on market economics (short term spot pricing) rather than technical issues
- European Super Grid – Senior Scientific Advisor to the German Government, Dr Gregor Czisch, in studies relating to grid integration and increased renewable energy penetration, suggests "you should focus on the best (renewable) energy resources and that means mainly wind energy…short term fluctuations (in wind energy output) are easy to deal with if you are drawing energy from enough different sites…"
- Technology Consultant David Milborrow's 2009 report "Managing Variability" advises that the UK Grid can handle 20% wind energy penetration with only modest impacts and then further suggests "the breakdowns of thermal plants, in particular large coal and nuclear generation, pose more of a threat to network stability than the variability in wind output"

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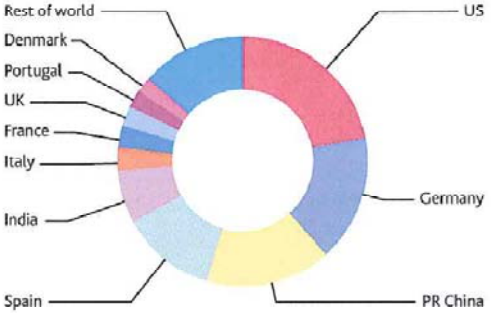
Wind Energy as a Reliable Resource - Facts

➢ Wind Power needs *Additional Backup* – True or False ?

- False when placed in the correct context, i.e. a small diversified portfolio within the total system
- At energy penetration levels of around 10% the impact of wind energy on reserves and balancing is minimal
- At higher levels of penetration (20%) balancing costs have been found to increase by circa 10% of the wholesale price of wind generated energy

TOP 10 CUMULATIVE INSTALLED CAPACITY 2009



	MW	%
US	35,064	22.1
PR China	25,805	16.3
Germany	25,777	16.3
Spain	19,149	12.1
India	10,926	6.9
Italy	4,850	3.1
France	4,492	2.8
UK	4,051	2.6
Portugal	3,535	2.2
Denmark	3,465	2.2
Rest of world	21,391	13.5
Total top 10	**137,114**	**86.5**
World total	**158,505**	**100.0**

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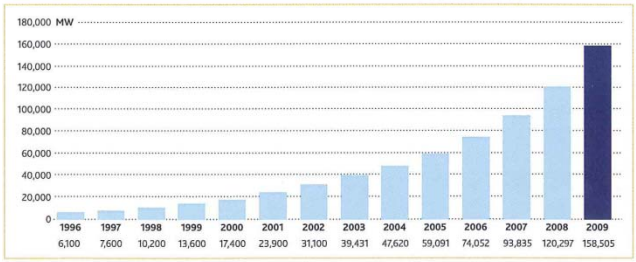
3 RSA Scenario

Wind Energy as a Reliable Resource – Int Refs

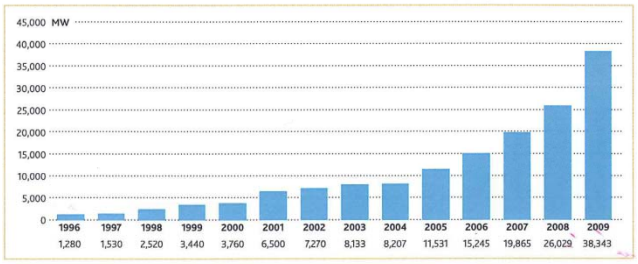
158 GW of Wind Power Installed World Wide

- The world has embraced Wind Power with installed capacity doubling every 3 years since 1990
- In both industrial & developing countries Wind Power is the dominant re-newable technology
- China has doubled installed capacity every year since 2004, and has set 2020 targets of 150 GW Wind vs 20 GW Solar and 80 GW Nuclear
- Wind Power is more and more frequently being selected for reasons other than “environmental”, e.g. speed, price certainty, no geo-political risk, stimulate regional economic development etc
- Wind energy penetration levels of as high as 20% are not uncommon as targets set for 2020 by leading industrialised and developing countries

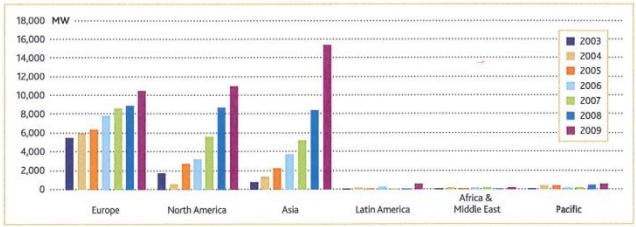
GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2009



GLOBAL ANNUAL INSTALLED CAPACITY 1996-2009



ANNUAL INSTALLED CAPACITY BY REGION 2003-2009



Should RSA be different ?

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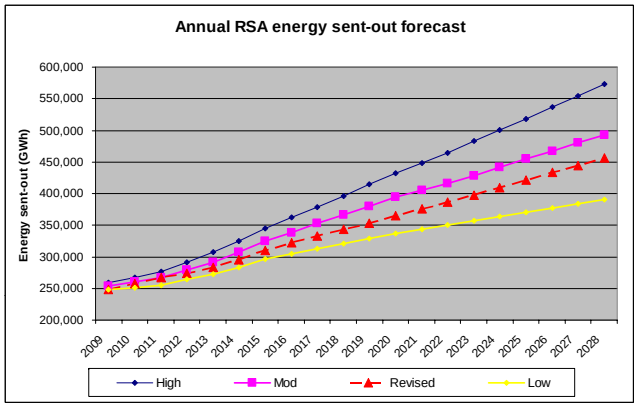
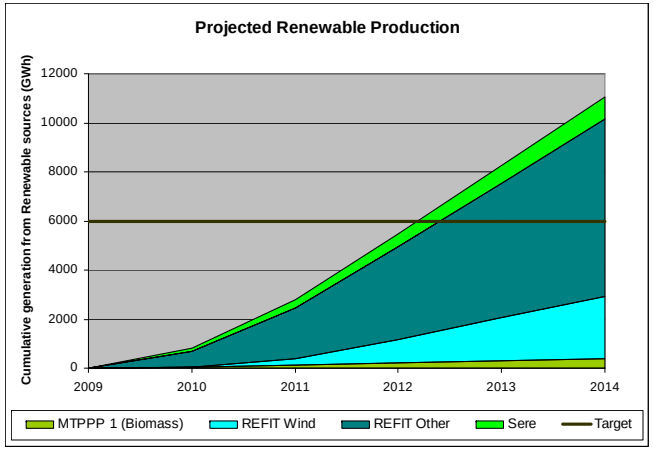
Wind Energy as a Reliable Resource – RSA

Wind Power in the RSA Energy Mix - Current

- Integrated Resource Plan (2009) suggests that by 2013 the RSA System Capacity will be circa 50 400 MW with energy demand circa 283 200 GWh
- Wind energy penetration of 10% equates to 28 320 GWh which at a capacity factor of 25% implies some 12 930 MW of installed capacity in 2013
- By 2020 a 10% wind energy penetration implies some 16 500 MW of installed capacity
- However REFIT / IRP (2009) currently only targets 500 MW of wind by 2013, i.e. some 1 095 GWh which implies a wind energy penetration of less than 0.5%





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Wind Energy as a Reliable Resource – RSA

- **Wind Power in the RSA Energy Mix - Suggested**
  - The RSA potential wind resource is under study by DoE, but is expected to be shown to be comfortably above 20 000 MW
  - The 2009 GTZ Grid Integration Study has shown that the W Cape grid can immediately accommodate almost 3 000 MW without material impacts
  - We need to determine this value for the E Cape and other RSA high wind resource areas, but it is unlikely to be less than a further 3 000 MW
- **RSA should be targeting 6 000 MW of wind now, with a 2020 target of 16 500 MW**

"A green, renewable energy economy isn't some pie-in-the-sky, far-off future – **it is now**.

It is creating jobs – **now**.

It is providing cheap alternatives to $140-per-barrel-oil – **now**.

And it can create millions of additional jobs, an entire new industry, if we act – **now**."

Barack Obama

June 24, 2008

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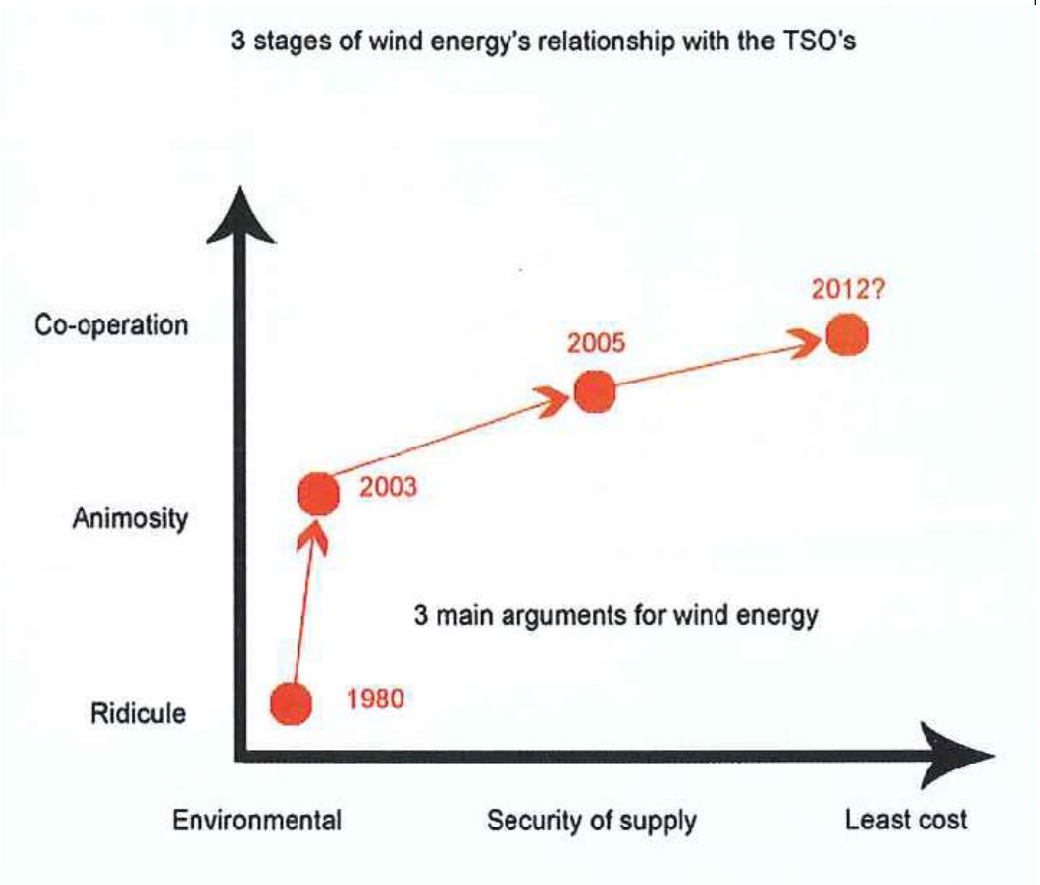
4 Conclusion

Wind Energy as a Reliable Resource

- Wind Energy "Myths" of being *unreliable, expensive, needing back-up and grid enhancement* are unfounded
- Wind Energy is reliable, predictable, fairly priced, and at the penetration levels envisaged in RSA needs no unusual backup or grid enhancement
- RSA Authorities should confidently be planning for wind penetration at 10% of the energy mix by 2020 which implies some 16 500 MW of installed capacity, with 6 000 MW to be introduced ASAP



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Thank You

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