PB Power

Wind Power for Australia

Taraz Saba
Senior Wind Power Engineer
PB Power - Asia Pacific

26 October 2006

Overview

PB Power

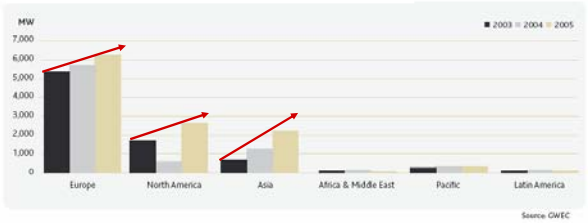
- Global Wind Power;
- Wind Power opportunities in Australia;
- Why Wind Power for Australia?
- Wind Power environmental impacts;
- Wind Power compared with other energy sources;
- How Wind Power can reduce GHG emissions.

sabat@pbworld.com

World's Installed Wind Power (MW)

PB Power

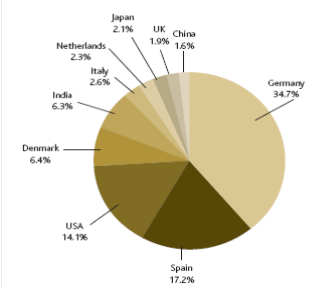
59,247 MW installed worldwide by early 2006



sabat@pbworld.com

Top Ten Wind Power Markets in 2004

PB Power



Country	Total capacity End 2004 (MW)
Germany	16,649
Spain	8,263
USA	6,750
Denmark	3,083
India	3,000
Italy	1,261
Netherlands	1,081
Japan	991
UK	889
China	769
Total	42,735

Source : GWEC

sabat@pbworld.com

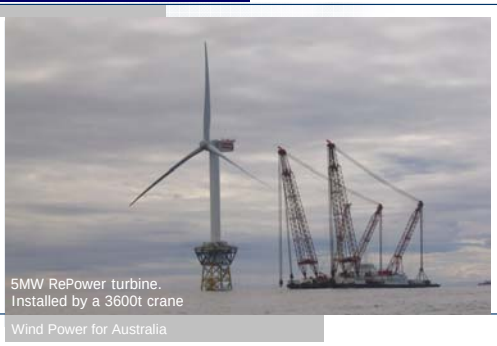
WTG Technology

PB Power

sabat@pbworld.com

Large Turbines

PB Power



5MW RePower turbine.
Installed by a 3600t crane

sabat@pbworld.com

Basic Facts

PB Power

- Installed cost of wind project currently averages $1,800 to $2,000 per kW (for projects 75 + MW);
- Cost of wind generated wind power in Australia is 7-8 c/kWh
- Turbines have increasing reliability (98%+ availability)
  - Vestas, GE, Siemens, Enercon, Gamesa, Suzlon, and others
- In good wind regimes, net capacity factors can range from 30 to 40%
- Average wind turbine size is 1.5-2MW (60-80m hub height)
- 15 to 20 year PPAs can be priced with little or no escalation;

sabat@pbworld.com

Wind Power in Australia – Current Status

PB Power

- Currently over 800MW installed, enough to power 314,000 homes or 80% of Adelaide domestic consumption
  - QL – 12MW (proposed 175)
  - NSW – 17MW (proposed 1193)
  - VIC – 134MW (proposed 1944MW)
  - TAS – 67MW (proposed 555MW)
  - SA - 388MW (proposed 1849MW)
  - WA – 199MW (proposed 241MW)
  - NT – 0

sabat@pbworld.com

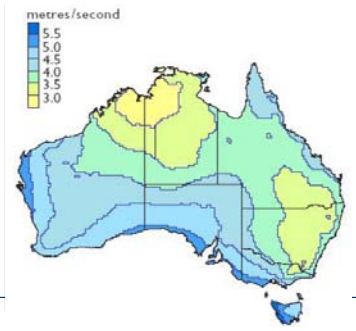
	PROJECT & LOCATION	YEAR	WTG Model	WTG Size	NUMBER	TOTAL SIZE	State
1	Ten Mile Lagoon	1992	Vestas	225kW	9	2.0	WA
2	Crookwell	1998	Vestas	600kW	8	4.8	NSW
3	Windy Hill	2000	Enercon	600kW	20	12.0	QLD
4	Blayney	2000	Vestas	660kW	15	9.9	NSW
5	Hampton	2001	Vestas	660kW	2	1.3	NSW
6	Codrington	2001	Bonus	1.3MW	14	18.2	VIC
7	Albany	2001	Enercon	1.8MW	12	21.6	WA
8	Toora	2002	Vestas	1.75MW	12	21.0	VIC
9	Woolnorth Stage 1	2002	Vestas	1.75MW	6	10.5	TAS
10	Starfish Hill	2003	N Micon	1.5MW	23	34.5	SA
11	Challicum Hills	2003	N Micon	1.5MW	35	52.5	VIC
12	9 Mile Beach	2003	Enercon	600kW	6	4.0	WA
13	Khancoban	2003	Vestas	850kw	2	1.7	QLD
14	Bluff Point (Woolnorth Stage 2)	2004	Vestas	1.75MW	31	54.3	TAS
15	Lake Bonney Stage 1	2004	Vestas	1.75MW	46	80.5	SA
16	Canunda	2004	Vestas	2MW	23	46.0	SA
17	Cathedral Rocks	2005	Vestas	2MW	33	66.0	SA
18	Yambuk	2006	N Micon	1.5MW	20	30.0	VIC
19	Walkaway	2005	Vestas	1.65MW	54	89.1	WA
20	Emu Downs	2006	vestas	1.65MW	48	79.2	WA
21	Wattle Point	2005	Vestas	1.65MW	55	90.8	SA
22	Wonthaggi	2006	REpower	2MW	6	12.0	VIC
23	Mount Millar (Yabmana)	2005	Enercon	2MW	35	70.0	SA

Under Construction	TOTAL	State
Lake Bonney Stage 2	160	SA
Studland Bay	75	TAS
Waubra	192	VIC
Hallett	95	SA

sabat@pbworld.com

Australian Wind Resource Map (indicative)

PB Power



30-Oct-06sabat@pbworld.com

Windy Hill Australia (QLD-12MW)

PB Power

30-Oct-06sabat@pbworld.com

Emu Downs Wind Farm (WA-80MW)

PB Power

30-Oct-06sabat@pbworld.com

Albany Wind Farm – WA (22MW)

PB Power

Wind Power for Australia

30-Oct-
06sabat@pbworld.com

Challicum Hill Wind Farm (VIC-53MW)

PB Power

Wind Power for Australia

30-Oct-
06sabat@pbworld.com

Starfish Wind Farm (SA-35MW)

PB Power

Wind Power for Australia

30-Oct-
06sabat@pbworld.com

Crookwell Wind Farm (NSW-4.8MW)

PB Power

Wind Power for Australia

30-Oct-
06sabat@pbworld.com

Why Wind Power for Australia

PB Power

- Produces virtually no pollution of air, water or soil;
- Saving Water - Wind Power doesn't use any water during its life time operation;
- Utilises Australia's abundant wind resource;
- Pattern of wind generated electricity matches with typical load;
- Substitutes for base-load (mostly coal power) in mainland Australia;
- Generates energy used in its construction in just 3 months of operation, with operational lifetime is 20-25 years.
- occupies less land area per kilowatt-hour (kWh) of electricity generated than any other energy conversion system (except rooftop solar PV);
- It is compatible with grazing and agricultural activities;
- WTGs are very economical to produce - cost per kW reduced from 30cents during early 80s to 6 cents today;
- the price of wind power is not affected by fuel price increases or supply disruptions
- Wind farms are modular - additional turbines can be added if the need arises,
- Short construction time is much shorter than a typical fossil fuel power plant – e.g. a 100MW wind farm could be commissioned in 12 months.
- Generate additional revenue for farmers, many of whom have been affected by the draughts
- Promotes employment opportunities;

Wind Power for Australia

sabat@pbworld.com

Wind Power Impacts

PB Power

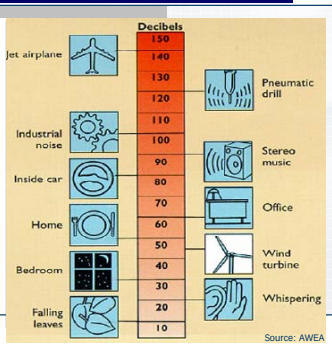
1. Visual Amenity;
2. Wind Farm Noise
3. Bird Strikes
4. Fluctuation in Power Generation;
5. Inconsistency in Planning Guidelines;

Wind Power for Australia

sabat@pbworld.com

Noise from a different sources

PB Power

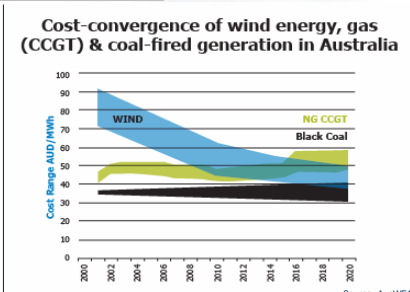


Source: AWEA

sabat@pbworld.com

Cost of Generating Electricity in Australia

PB Power



Source: AusWEA

Wind Power for Australia

sabat@pbworld.com

Environmental Schemes in Australia

PB Power

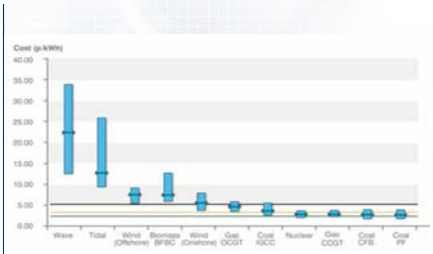
- **National Renewable Obligation (MRET)**
  - launched in 2001
  - Renewable generation to contribute 9.5 TWh by 2010
- **Victoria State Renewable Obligation**
  - Starts mid 2008
  - 10% of State demand to be met through renewables by end of 2010
- **SA State Renewable Bill**
  - Currently a bill
  - 10% of State demand to be met through renewables by end of 2014
- **New South Wales CO2 Abatement Scheme**
  - active since Jan 2002
- **Eastern States emission trading scheme (post 2010)**
  - discussion paper issued 16 August
  - opposed by Federal Government

Wind Power for Australia

sabat@pbworld.com

Relative cost of wind power and other generations

PB Power



Source: UK Study

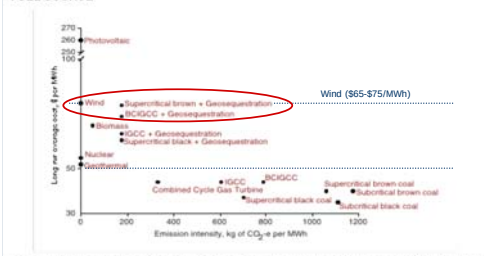
Wind Power for Australia

sabat@pbworld.com

Electricity Generation Costs & Emission Intensity

PB Power

ELECTRICITY GENERATION: INDICATIVE COSTS AND EMISSION INTENSITY BY FUEL SOURCE

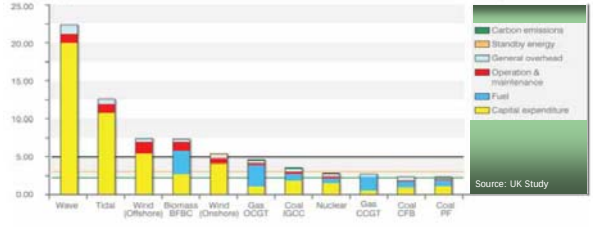


Sources: MMA; The Allen Consulting Group; and The Australian Government, 2004, *Securing Australia's Future* (White Paper). Note: Based on assumed cost of geosequestration of $50 per tonne of CO_2-e. Key: BCIGCC = Brown Coal Integrated Gasified Combined Cycle; IGCC = Integrated Gasified Combined Cycle; CCGT = Combined Cycle Gas Turbine.

sabat@pbworld.com

Generation Costs Breakdown (UK Study)

PB Power



Source: UK Study

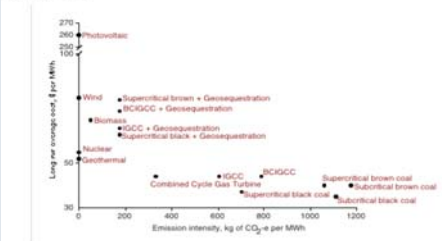
Wind Power for Australia

sabat@pbworld.com

How Can Wind Power Reduce GH Gas Emissions

PB Power

ELECTRICITY GENERATION: INDICATIVE COSTS AND EMISSION INTENSITY BY FUEL SOURCE



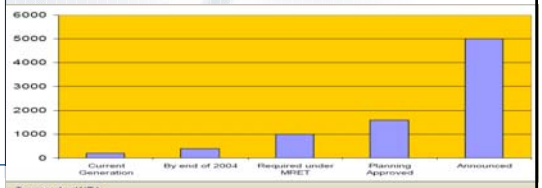
Sources: MMA; The Allen Consulting Group; and The Australian Government, 2004, *Securing Australia's Future* (White Paper). Note: Based on assumed cost of geosequestration of $50 per tonne of CO_2-e. Key: BCIGCC = Brown Coal Integrated Gasified Combined Cycle; IGCC = Integrated Gasified Combined Cycle; CCGT = Combined Cycle Gas Turbine.

sabat@pbworld.com

Reducing Green House Gas Emissions

PB Power

- How wind farms reduce GH Emissions?
- Offsetting Fossil Fuels
  - Currently – about 3.3m tonnes of CO_2 per year
  - Assuming 5000MW By 2020 – 23m tonnes of CO_2 per year

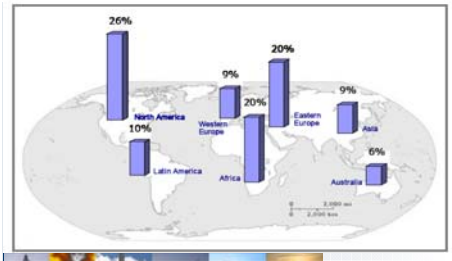


Source: AusWEA

sabat@pbworld.com

Utilising Australian Rich Wind Resource

PB Power



Wind Power for Australia

sabat@pbworld.com

PB Power / Parsons Brinckerhoff

PB Power

- PB Power is the Energy Division of PB
- Parsons Brinckerhoff - 10,000 staff in 250 offices
- PB is heavily involved in infrastructure projects - locally & globally
- Engineering Services in Energy, Infrastructure, & Environment
- Wind Power involvement since 1991
- Covering all relevant engineering disciplines
- Active in Asia-Pacific, Europe, and America

Wind Power for Australia

sabat@pbworld.com

PB Power

Thank you ☺

Wind Power for Australia

Taraz Saba
Senior Wind Power Engineer
PB Power - Asia Pacific

26 October 2006