Australian Institute of Energy National Conference 2006

The Wind Energy Market in Australia

Present Status and Future Prospects

Graham White

November 2006

GARRAD HASSAN

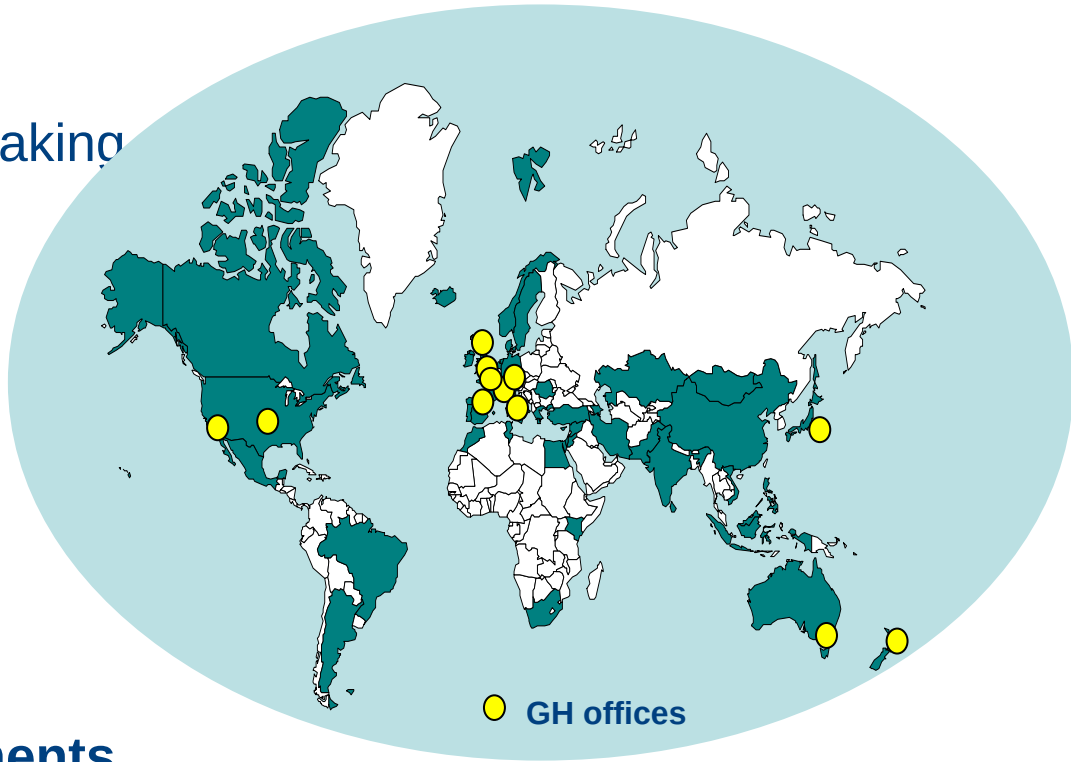
Presentation Overview

- World market profile
- Global growth and statistics
- Manufacturing
- Australian Market Drivers
- Government policies
- MRET
- Green Power
- VRET, NRET
- RECs Market
- Australian wind farms
- Competitiveness
- Future for wind energy

GARRAD HASSAN

Garrad Hassan

- **Independent** wind energy consultancy
- 200 professionals in 14 countries worldwide
- Established in 1984
- Focus on wind energy
- Maintains independence by taking no equity stake in any development or technology.
- Our client list includes all the major developers, banks, lenders and wind turbine manufacturers.



Wind Farm Energy Assessments

- 50,000 MW in 60 countries
- 14,000 MW constructed

GARRAD HASSAN

World Market Profile

- Industry is now over 25 years old
- Early turbine manufacturers Danish
- Soon followed by US, Dutch, English, German
- Now manufacturers in Spain, India, Japan and China
- Manufacturing industry consolidation over past 10 years
- Some new entrants
- Industry has been ‘globalised’
- Adoption of wind energy is policy dependent
- Some countries have tied growth to local manufacturing
- This has occurred in China, Canada, Spain, India
- Climate Change issues becoming a driver

GARRAD HASSAN

Market Drivers

- Adoption of new technologies including wind energy is policy dependent
- All energy technologies receive subsidies of some form
- Subsidies almost always required for new entrants to compete with incumbents
- MRET and VRET have created markets for RE
- Such mechanisms will be required in the future
- 45 countries to date have RE market incentives
- If CO2 emissions are to be cut, then future investment needs to be increased in RE technologies
- Business as usual will amplify the problems of CO2 emissions
- Climate change perception is growing

GARRAD HASSAN

Globalisation of the wind industry

3 giant international corporations now manufacturing turbines

- General Electric, Siemens, Mitsubishi

3 large Spanish companies involved:

- Gamesa, Acciona, Ecotechnica

Manufacturers' HQs in:

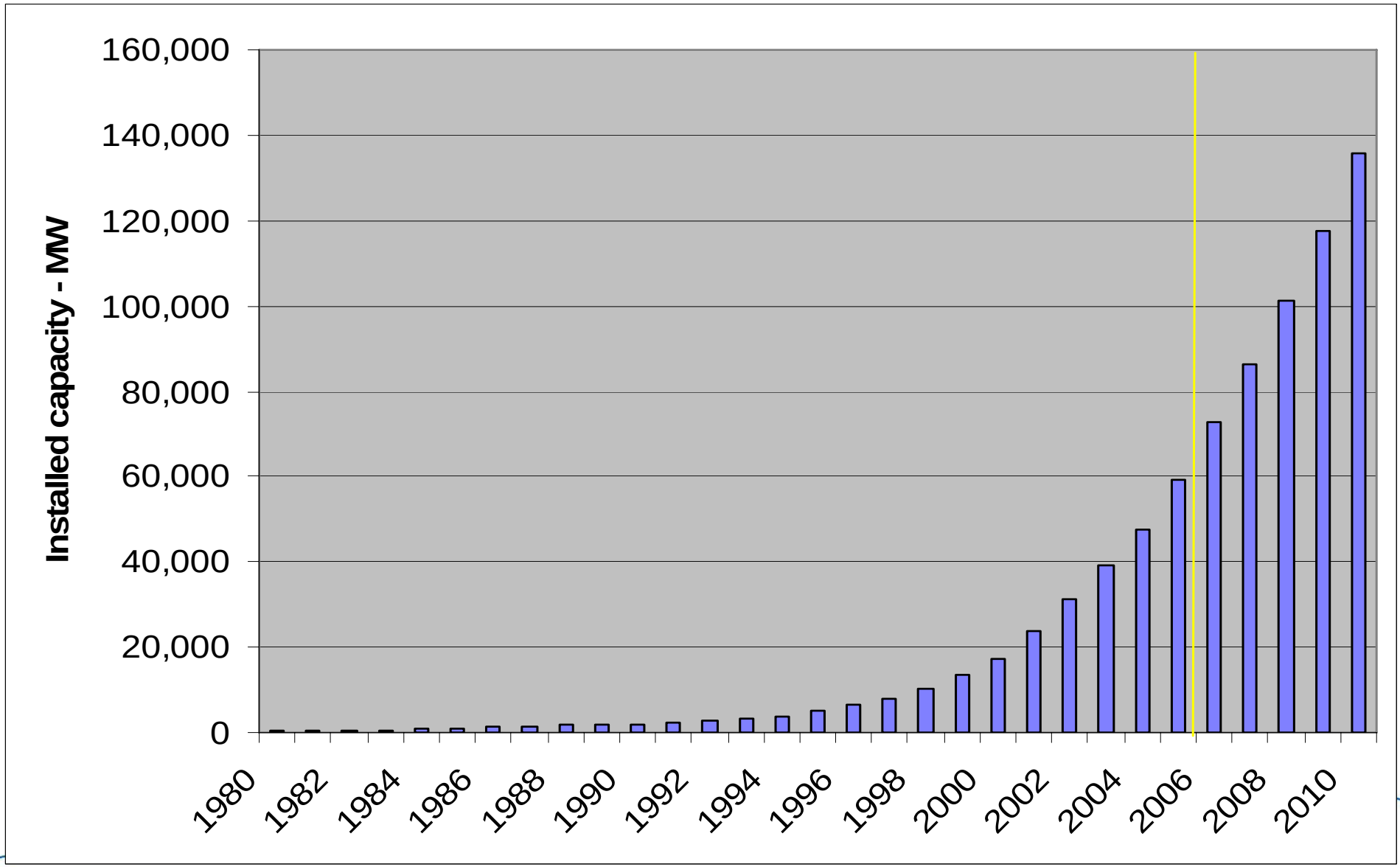
- Denmark, Spain, Germany, US, Japan, India

Subsidiaries now in most major markets including:

- Brazil, USA, UK, Canada, China, Australia, India

GARRAD HASSAN

Worldwide wind capacity growth to 2010

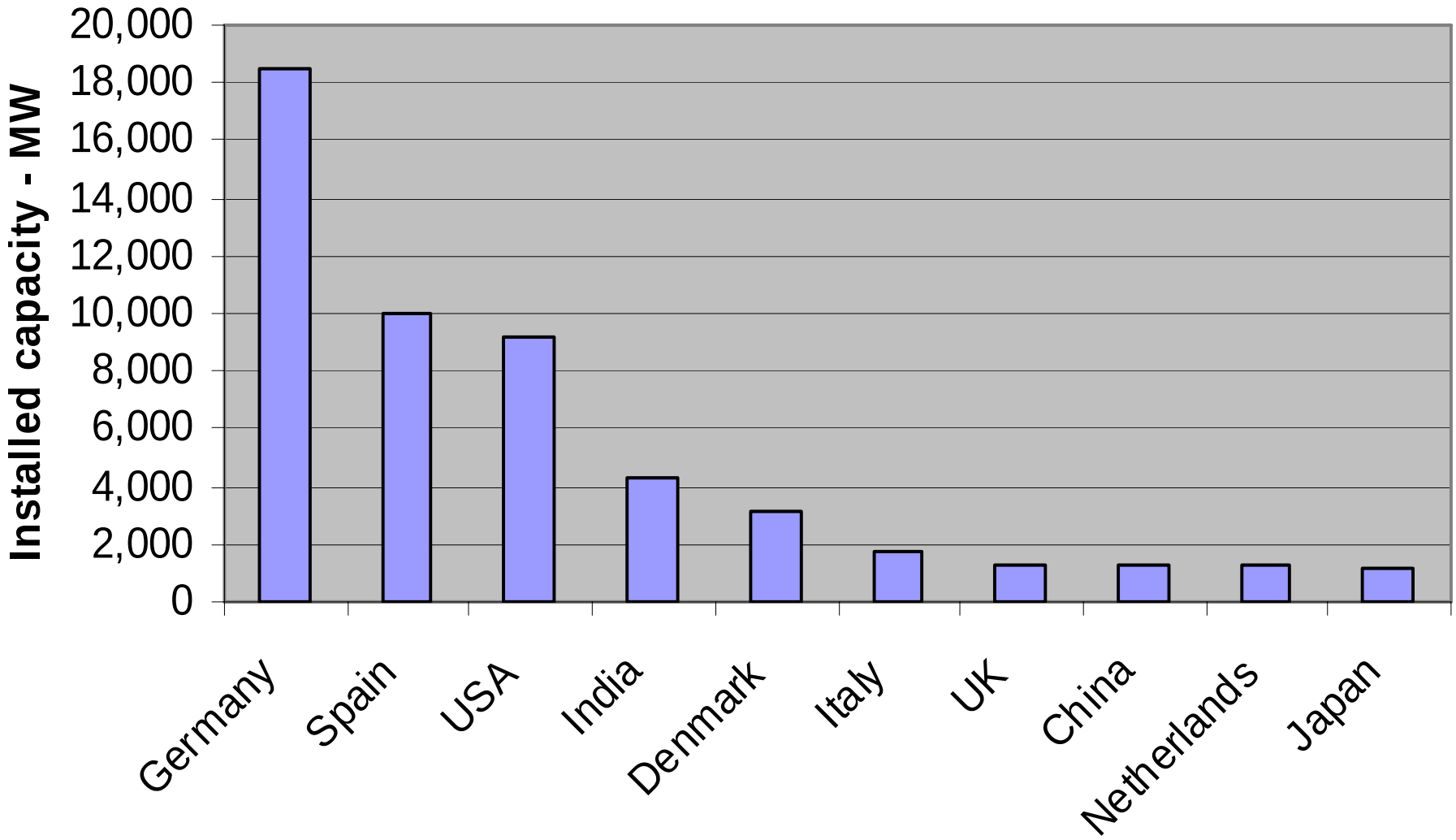


World wind energy market

- worldwide capacity of wind generation growing at ≈ 25%/year
- Annual growth 10 GW (≈ 7,000 turbines in 2005)
- presently 70,000 MW of wind energy capacity installed
- for perspective, Australia has ≈ 50,000 MW of total electricity generation capacity
- by 2010 world wind capacity predicted to be 130,000 MW
- 2005 investment in wind energy ≈ $20 Billion per annum
- by 2010 predicted to be $35 Billion per annum
- 10 major turbine manufacturers
- some countries have significant targets for wind energy
- China has targets of 5,000 MW by 2010 & 30,000 MW by 2020
- Spain has target of 20,000 MW by 2010 (double present capacity)
- 45 countries now have policy targets for renewable energy

GARRAD HASSAN

Installed wind farm capacity – top 10 markets



Manufacturing

- Denmark - Vestas, Siemens, Nordex, Wincon, LM Glasfiber
- Germany - Enercon, REpower, Ventis, DeWind, Nordex, Fuhrländer, + LM Glasfiber
- US - GE Wind, REpower, + LM Glasfiber
- China - 8 local manufacturers - 7 JVs - 5 subsidiary plants
- Spain – 6 manufacturers
- India - 8 manufacturers
- Japan – 1 manufacturer
- New Zealand – 1 manufacturer
- Canada – 4 subsidiary plants
- Australia – 2 subsidiary plants

GARRAD HASSAN

Turbine Manufacturers in China

Goldwind	Private
Zhejiang Yunda	SOE
Dalian Heavy Machinery	SOE
Donfang Electric Group	SOE
SEC	SOE
Mingyang	SOE
Baoding Huitang	SOE
Xiangtan	SOE
Acciona/CASC/Inceisa	JV
Nordex	5 JVs
GE/NGC	JV
GE	Subsidiary
Suzlon	Subsidiary
Vestas	Subsidiary
Gamesa	Subsidiary
LM Glasfiber	Subsidiary

GARRAD HASSAN

Australian Market

Wind energy market driven by 3 primary mechanisms

- Federal policies – MRET, pro & anti-wind lobbies, climate change, drought, Kyoto, AP6
- State policies – VRET, NRET, elections
- Market – green energy, climate perceptions

Industry

- 1 blade manufacturing plant (Portland)
- 1 nacelle manufacturing (Wynyard)
- 3 tower manufactures (Launceston, Portland, Adelaide)
- O&M personnel at 30 wind farms across Australia
- Parts suppliers
- Contractors, Consultants
- Present employment in the order of 3,000 jobs in Australia
- Engineering, Manufacturing, Installation, O&M, Finance, Legal

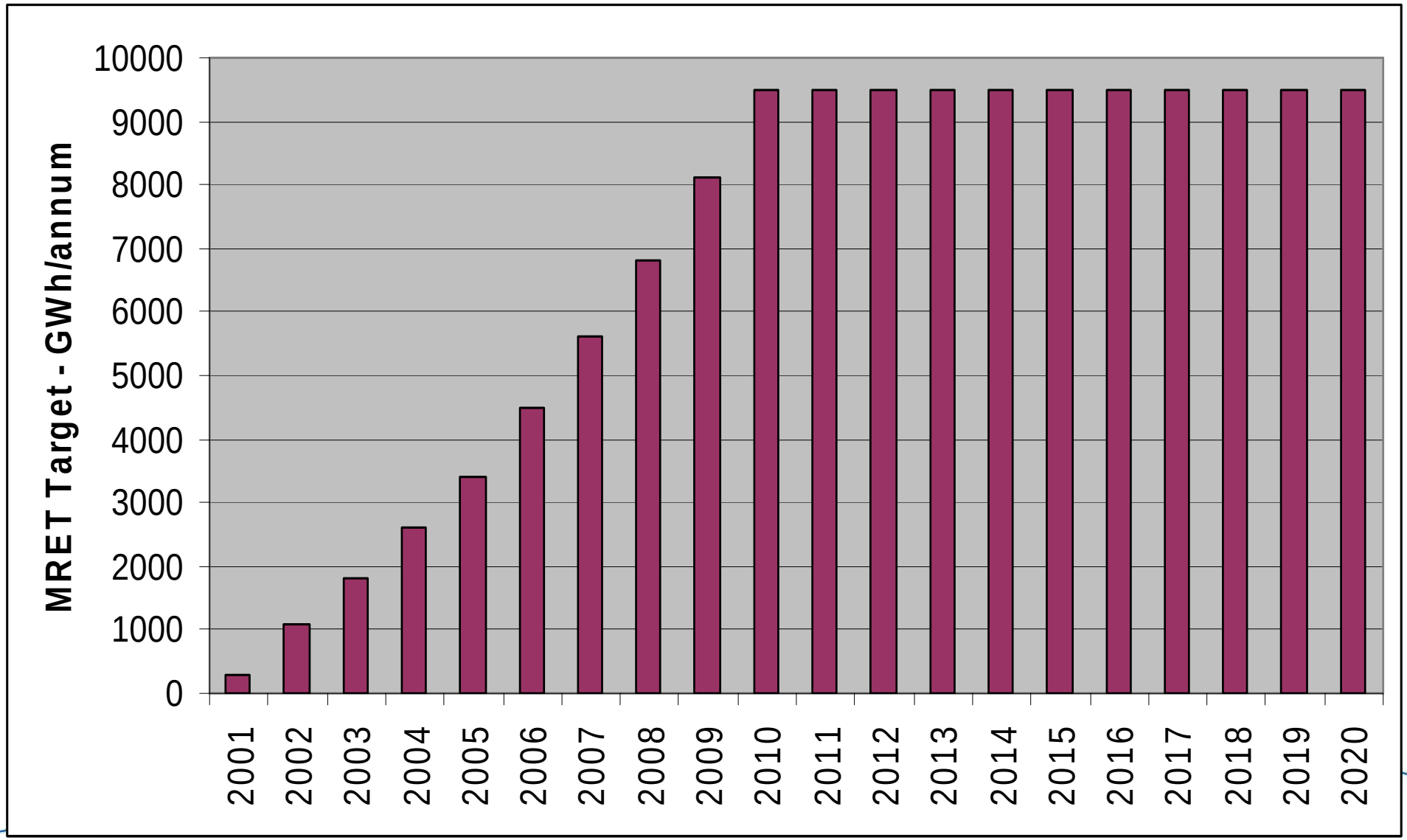
GARRAD HASSAN

Government policies and incentives for RE

- The Federal & State Govts - significant support for RE
- Policies driven by environmental issues including global warming, drought
- Commitments made by Federal Govt to the Kyoto Protocol
- last 6 years - substantial investment in wind farms
- main driver Federal Govt's MRET - introduced 2001
- requires electricity retailers proportionately utilise RE
- MRET target of 9,500 GWh of renewable energy by 2010
- target applies nationally
- eligible sources: solar, wind, ocean, wave & tidal, hydro, geothermal, biofuels (landfill gas, biogas, biomass), specified waste, solar water heating, pump storage hydro, RAPS, cofiring with renewables

GARRAD HASSAN

MRET Targets



Breakdown of energy sources for MRET

Energy Source	REC Contribution 2001 - 2004	(ORER) Estimated REC Contribution 2001 - 2020
Wind	13%	31%
Hydro	40%	27%
Solar water heaters	20%	16%
Other biofuels	15%	11%
Bagasse	11%	13%

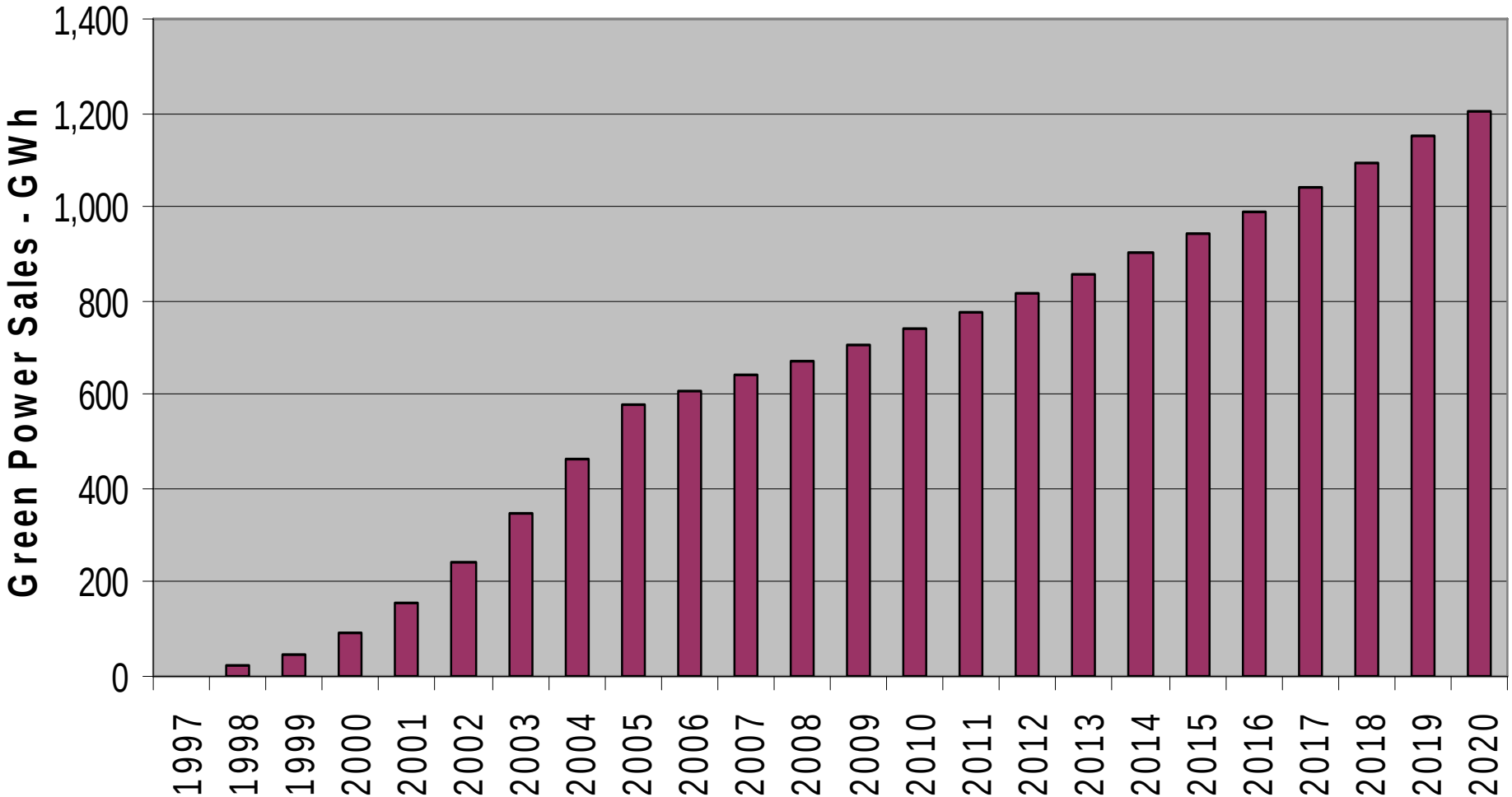
GARRAD HASSAN

Green Power

- Launched in 1997
- Eligible technologies similar to MRET
- 200,000 customers now in 2006
- 6000 business customers
- 2005 sales of 580 GWh
- Equivalent to about 200 MW of RE capacity at 33% CF
- Green Power sales presently showing high growth
- In 2005, was 17% of MRET
- While presently small, is still an important potential for RE growth

GARRAD HASSAN

Possible Green Power RECs to 2020



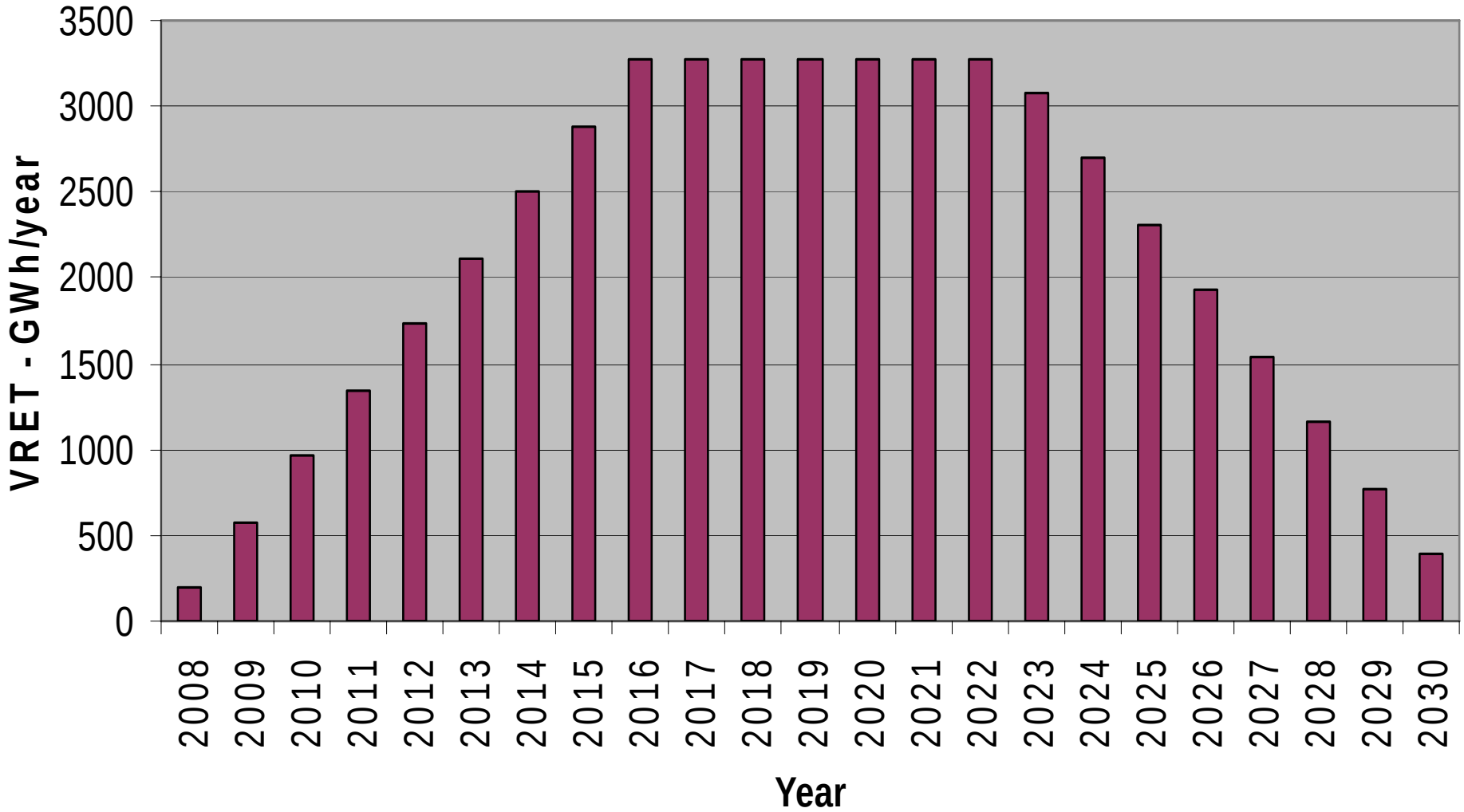
HASSAN

Victorian Renewable Energy Target

- intended to increase State's RE from 4% to 10% by 2016
- market incentivised by a mandatory scheme
- scheme will commence 1 January, 2008
- VRET scheme over and above existing RE generation
- only facilities in Victoria eligible
- VRET target is 3,274 GWh per annum in 2016
- VRET similar to the MRET but important differences
- No old hydro, no solar hot water heaters
- VRET expected to result in 1,000 MW RE capacity
- investment of AUD $2 Billion and
- create approximately 2,200 jobs
- wind energy expected to be a main player
- 140MW Kiewa Hydro expansion eligible (≈ 5% of VRET RECs)

GARRAD HASSAN

VRET Targets

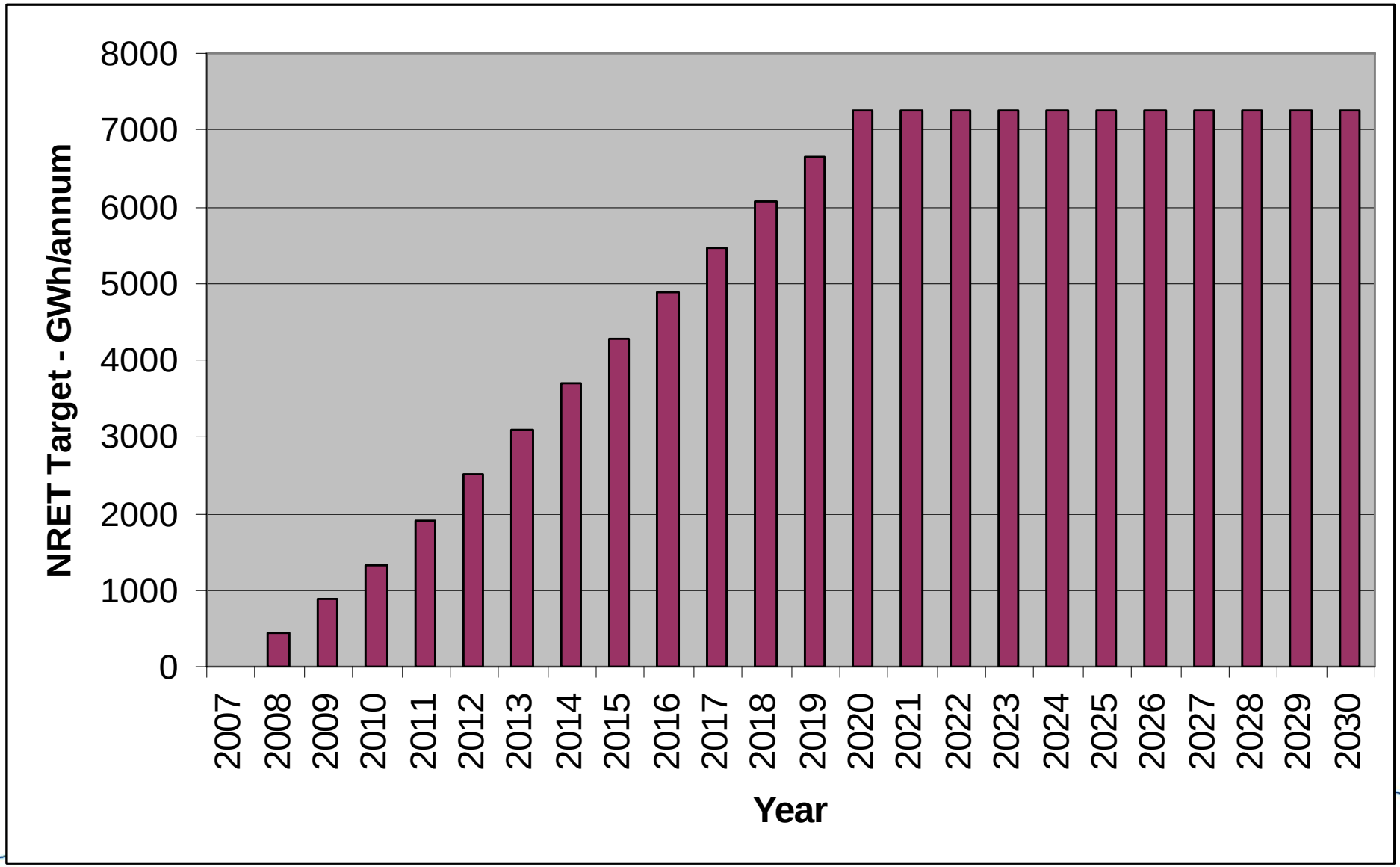


NSW Renewable Energy Target

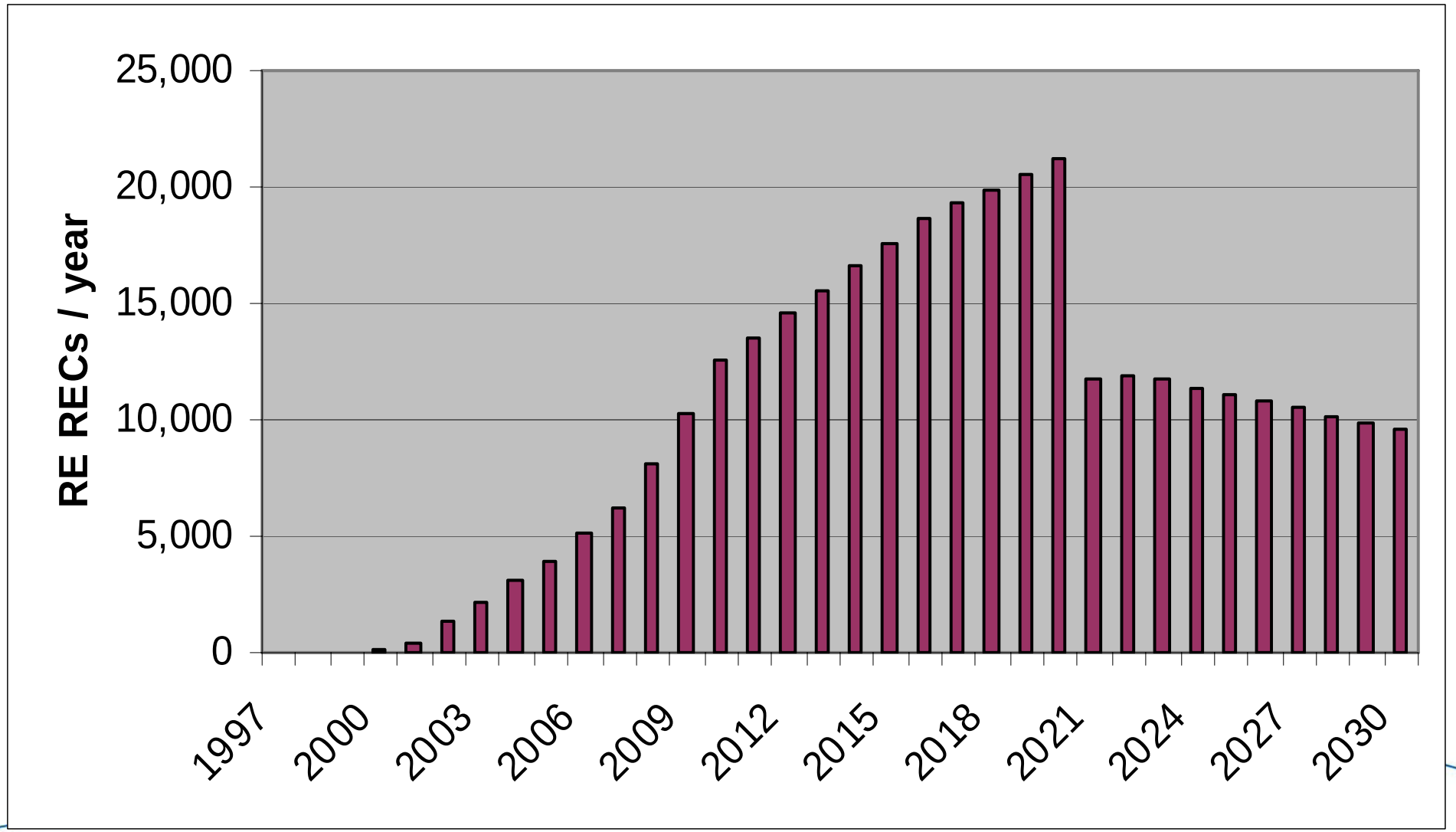
- Aims to increase NSW RE from 6% to 15% by 2020
- NRET target is 1,317 GWh by 2010 (10%) increasing to 7,250 GWh by 2020 (15%)
- Differs from VRET in that RE can be sourced from generation anywhere in the NEM
- Will run in conjunction with Greenhouse Gas Abatement Scheme
- Excludes demand management and solar hot water heaters
- Will drive an estimated AUD $5 Billion in investment
- To be administered in similar manner to VRET
- Legislation is planned to be in place and scheme commencing 2007, first target level to be met in 2008
- Review to be undertaken at halfway point of 2013

GARRAD HASSAN

NRET Targets



Total REC demand to 2020
MRET, VRET, NRET & Green Power Schemes

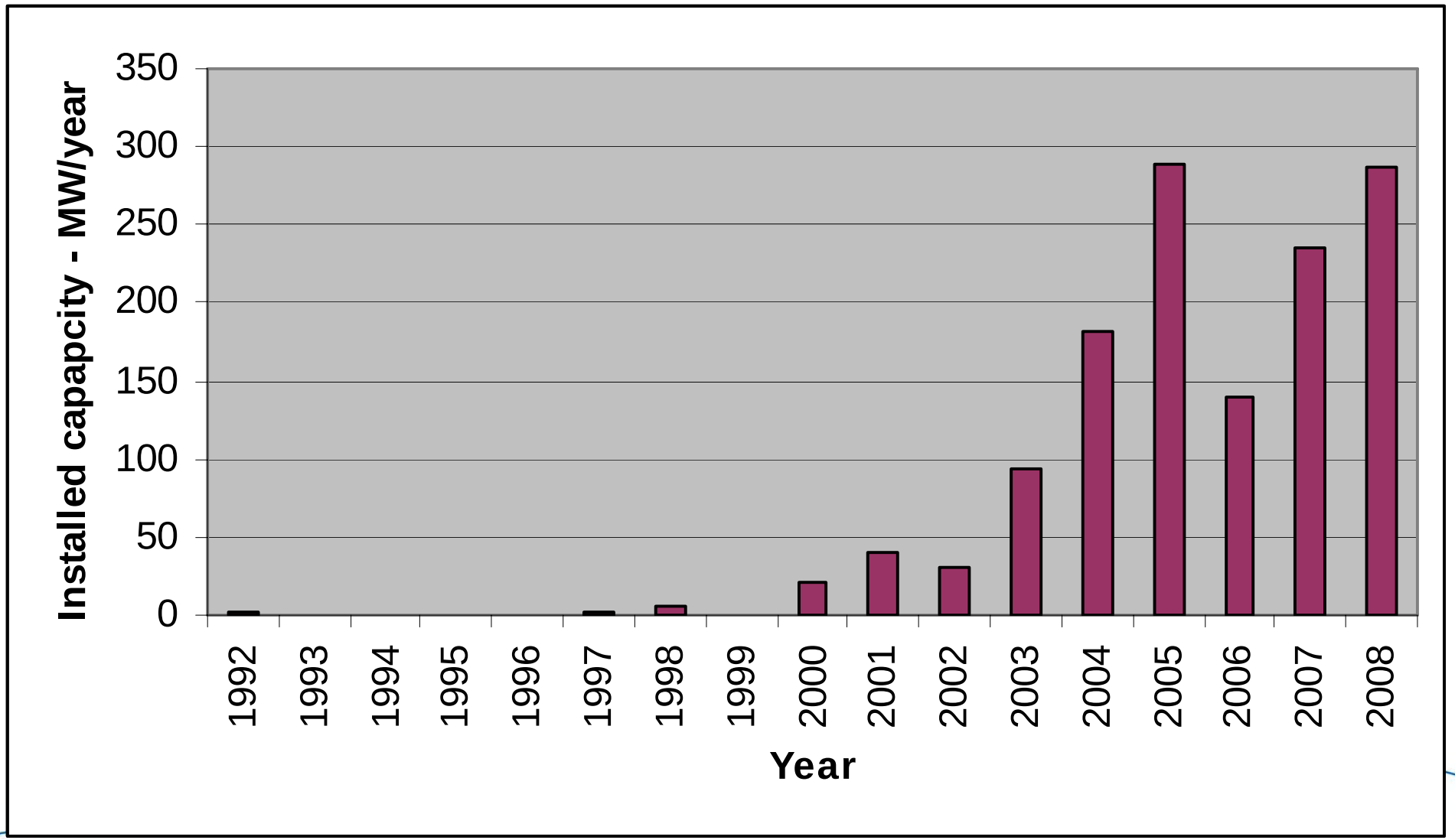


Australian wind farms

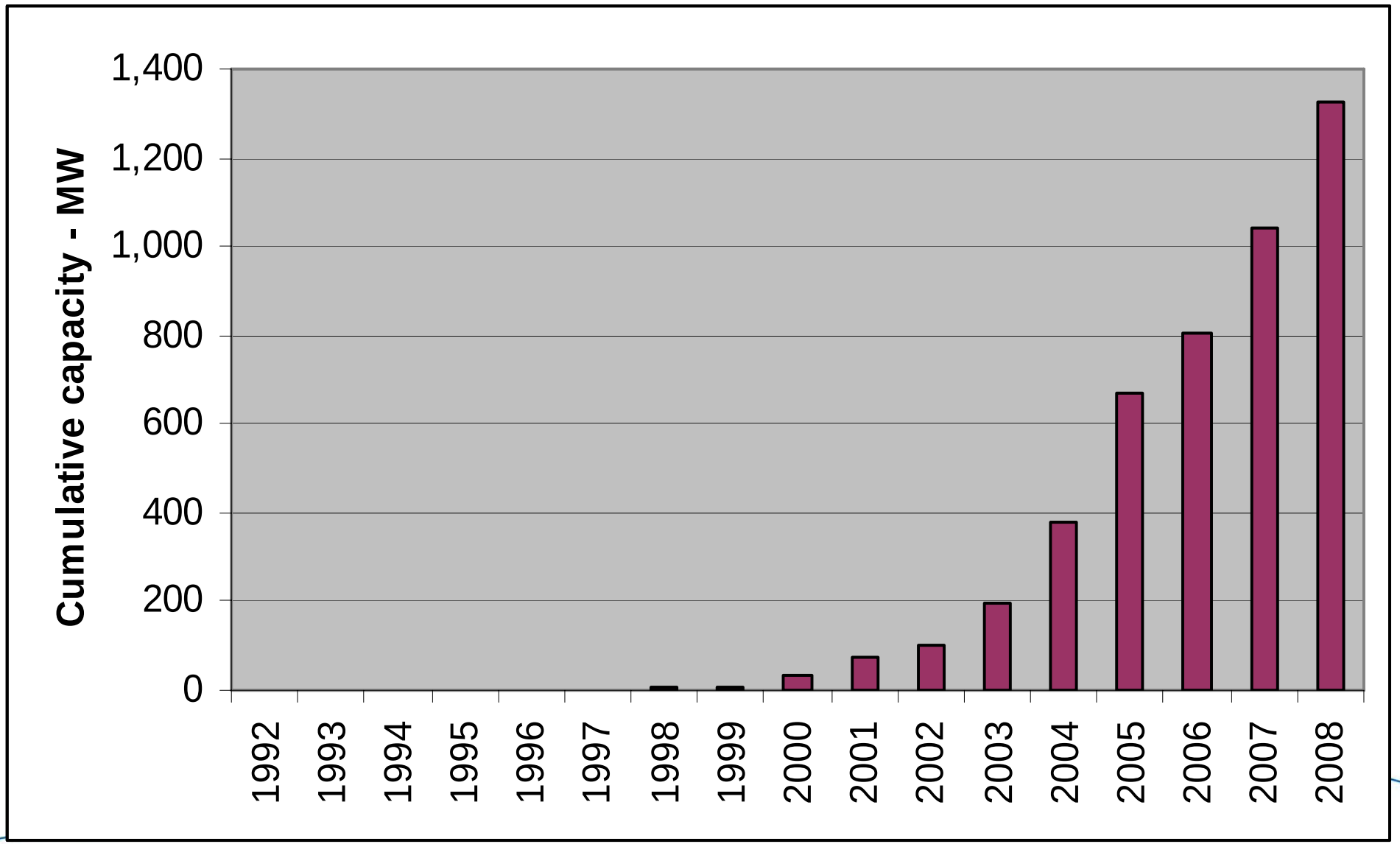
- start of MRET scheme in 2001 start of major RE projects
- dominant players - incumbent generators & local and overseas developers
- To date 22 wind projects have been built – 805 MW
- 4 projects under construction in SA, Vic & Tas ≈ 500 MW
- total installed/being constructed capacity of 1,300 MW
- to date ≈ AUD $2.5 Billion spent & committed to wind farms in Australia
- Australia ranked 14th in world in cumulative wind capacity - 2006
- Further 6,000 MW in feasibility and planning stages
- Operating & committed RE projects will fully subscribe MRET

GARRAD HASSAN

Annual wind farm installation to 2008



Australian wind farm capacity to 2008



State breakdown of wind farm projects to 2008

State	No of farms	MW	%
SA	8	633	48
Vic	6	325	25
WA	5	197	15
Tas	4	142	11
NSW	3	17	1
QLD	2	13	1
Totals	**28**	**1,327**	**100**

GARRAD HASSAN

Victorian Market

- RECs shortfall penalty of $43 provides a market value
- policy driver for VRET is Victoria's reliance on coal
- brown coal fired stations among highest emitters of CO2
- both MRET & VRET designed to decrease CO2 emissions
- VRET expected to reduce CO2 emissions by 27 million tonnes
- VRET eligible technologies:
  - wind, solar PV, hydro, wave, biomass and geothermal
  - only new facilities eligible
  - no old hydro
  - no solar hot water systems
- main driver in uptake of any energy source is cost

GARRAD HASSAN

Comparison of energy costs

Energy Cost per MWh	
Solar hot water	$20 - $40 *1
Coal	$35
Natural Gas	$35 - $45
Geothermal	$40 - $70
Wind	$55 - $80
Biomass	$50 - $100 *2
Solar PV	$75 - $125
Clean Coal (Geosequestration)	$100
Nuclear	$100 - $150

*1 cost of energy from solar hot water is very site specific. As an example, Darwin solar hot water costs are much lower than Hobart.

*2 cost of energy from biomass covers a large range and is both technology and source specific

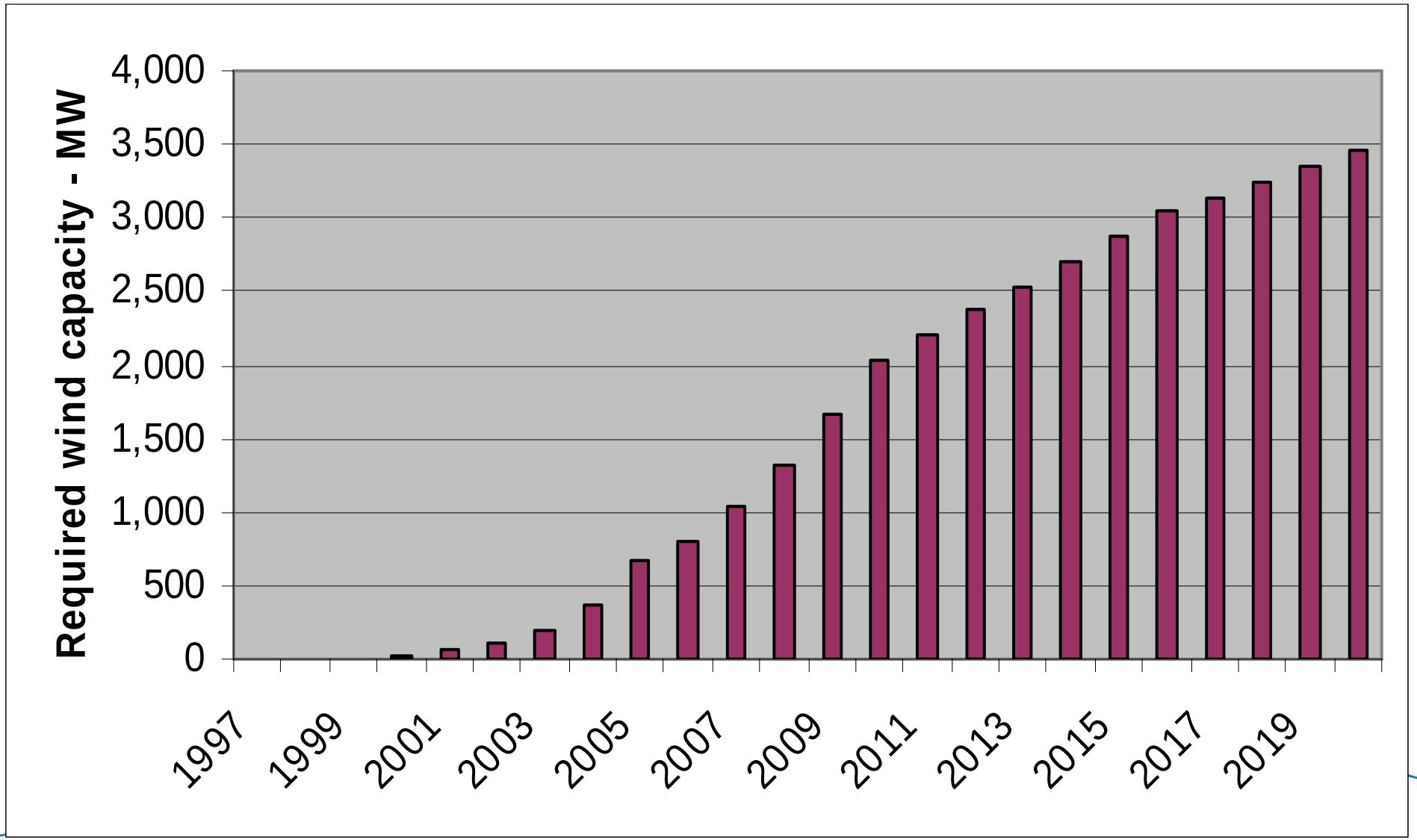
GARRAD HASSAN

Most developed potential wind farms in Victoria

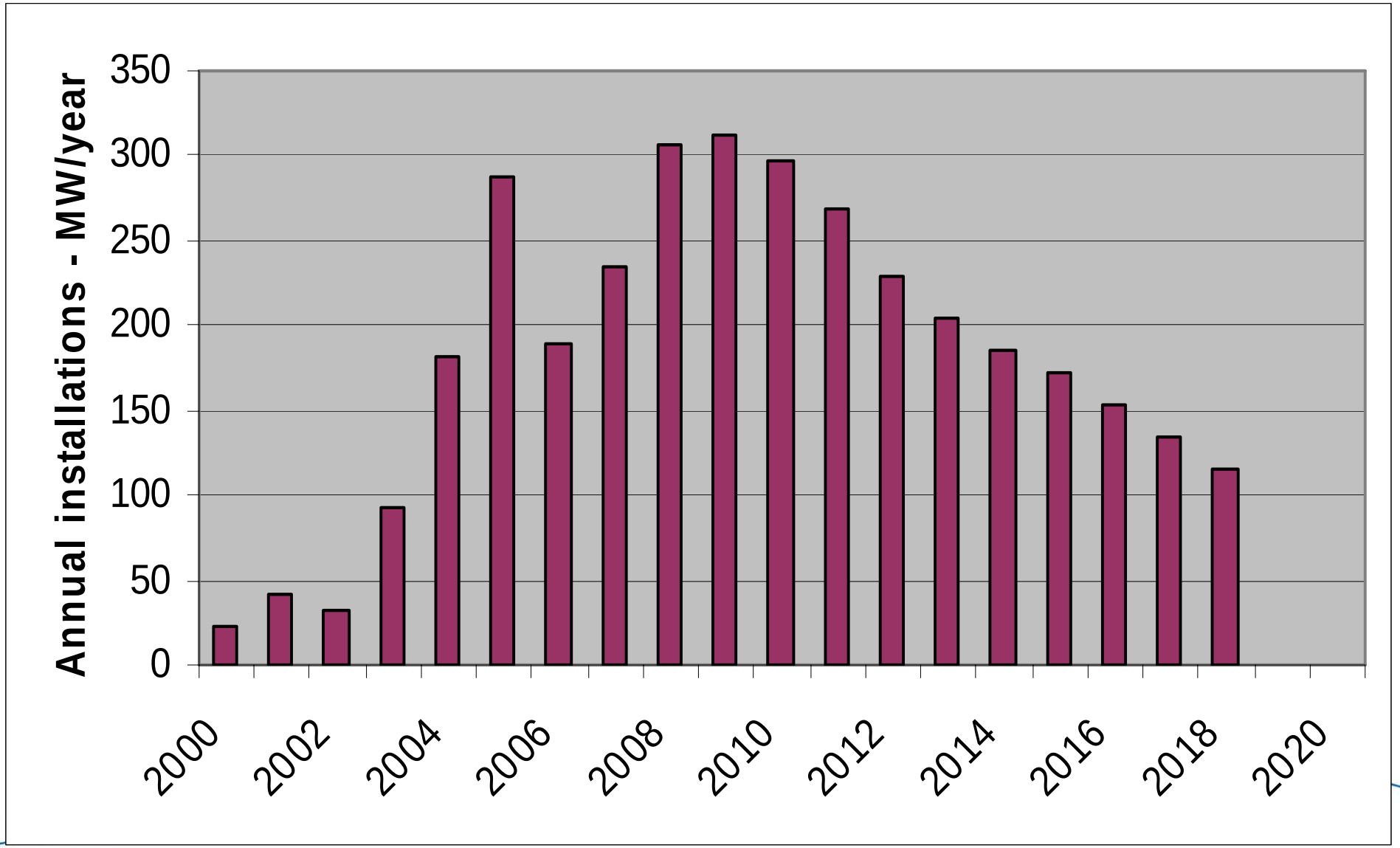
Project	Developer	MW
Mt Gellibrand	Pro Ventum	232
Cape Bridgewater	Pacific Hydro	30
Bald Hills	Wind Power	109
Naroghid	Wind Farm Developments	40
Macarthur	AGL	329
Cape Nelson/Sir William Grant	Pacific Hydro	165
Berrimal	Acciona	18
Newfield	Acciona	22
Dollar	AGL	80
Woorndoo	NewEN Australia	26
Yarrum	Synergy Wind	18
Sidonia Hills	Hydro Tasmania	120
Hepburn	Future Energy	4
Total		**≈ 1,200**

GARRAD HASSAN

Possible required wind capacity scenario based on total RECs demand



Annual wind energy installations scenario – MW/year



Future for wind energy

- wind energy does well with sustainable incentive schemes because:
  - is competitive with other RE options
  - is competitive with nuclear & clean coal
  - uses proven technology
  - has relatively short implementation timelines and
  - is an abundant resource
- wind reduces fuel price risks
- provide diversity in supply
- environmental impact is low
- is distributed
- provides jobs in rural areas
- additional cash flow to farmers

GARRAD HASSAN

Future for wind energy - Global

Worldwide, by 2020 wind is expected to:

- grow to 500 GW
- supply 6% of the world's electricity
- $100 Billion annual business
- Chinese market to surpass European markets
- Indian market to also grow substantially
- More Govts to encourage RE sources
- Global warming, energy security & price risk to drive the uptake of wind energy

GARRAD HASSAN

Future for wind energy - Australia

- 2 projects in SA to be finished over next 18 months based on MRET
- 4 – 6 projects in Vic over next 4 years based on VRET
- New projects in NSW, Vic, Tas and SA due to NRET
- In total 150 – 250 MW per annum to 2015
- Installed capacity will top 3,000 MW by 2020
- More incentives are possible under Federal support under climate change programs
- Market is now more optimistic than any previous time

GARRAD HASSAN

Garrad Hassan Contacts

Garrad Hassan - China
Room 1806, Union Plaza
20 Chaowai Street, Chaoyang District, Beijing
China 100020
Tel: +86-10-6588-7055, Fax: +86-10-6588-2909
Contact: Weiping (David) Pan
<Email: weiping.pan@garradhassan.com

Garrad Hassan and Partners Ltd (HQ)
St Vincent's Works, Silverthorne Lane
Bristol BS2 0QD, England, UK
Tel: +44 117 972-9900, Fax: +44 117 972-9901
Contact: Dr Andrew Garrad
<garrad@garradhassan.com>

Garrad Hassan Pacific Pty Ltd - Australia
PO Box 1005, Moonee Ponds
Melbourne, Victoria 3039, Australia
Tel: +61 3 9370-2500, Fax: +61 3 9370-2100
Contact: Mr Graham White
<white@garradhassan.com.au>

Garrad Hassan Pacific Ltd – New Zealand
PO Box 54-002, Mana
Wellington, New Zealand
Tel: +64 4 233-9870, Fax: +64 4 233-9871
Contact: Mr William Thorp
<thorp@garradhassan.co.nz>

Garrad Hassan Japan Limited
Sasazuka Sun Heights #211
1-53-7 Sasazuka Shibuya
Tokyo, Japan 151-0073
Tel : +81 3 3299 0720, Fax : +81 3 3299 0730
Contact: Yukinobu Uchida
<yukinobu.uchida@garradhassan.com>

Garrad Hassan and Partners Ltd - Scotland
2064 Maryhill Road, Glasgow G20 0AB
Scotland, UK
Tel: +44 141 945 4774, Fax: +44 141 945 5076
Contact: Dr Paul Gardner <gardner@garradhassan.com>

Garrad Hassan and Partners Ltd - Germany
Katharinenstr. 18, 26121 Oldenburg,
Deutschland
Tel +49 (0)441 957 2387, Fax +49 (0)441 957 2388
Contact: Mr Wolfgang Schlez
<schlez@garradhassan.de>

Garrad Hassan Denmark ApS
Pakhusvej 3, 8382 Hinnerup
Denmark
Tel: +45 87 65 61 11, Fax: +45 87 65 61 13
Contact:<@garradhassan.com>

Garrad Hassan Contacts

Garrad Hassan and Partners Ltd - Netherlands
Singel 8, 9244AA Beetsterzwaag
The Netherlands
Tel: +31 512 381661, Fax: +31 512 382722
Contact: Mr Gerrit Jan van Zinderen <
zinderen@garradhassan.com>

Garrad Hassan and Partners Ltd - Spain
Edificio Aida 7 5A, Calle Madre Rafols 2
50004 Zaragoza, Aragón Spain
Tel/Fax: +34 976 43 51 55, Mobile: +34 619 89 45 35
Contact: Dr Lucy Craig <craig@garradhassan.co.uk>

Garrad Hassan and Partners Ltd - Italy
Via XX Settembre 10,
I-40026-Imola, Italy
Tel/Fax: + 39 054 22 1859
Mobile: +39 348 672 4771
Contact: Mr Christof Stork
<stork@garradhassan.co.uk>

Garrad Hassan and Partners Ltd - France
54-56 Avenue Hoche 75008
Paris France
Tél: +33(0) 1 56 60 50 53
Fax: +33(0) 1 56 60 56 00
Contact: Jean-Pierre Callens
<callens@garradhassan.com

Garrad Hassan America – USA
Suite 209 11770 Bernardo Plaza Court
San Diego, CA ,92128 USA
Tel/Fax: +1 858 451 7013
Contact: Mr Bernie Holst <holst@garradhassan.co.uk>

Garrad Hassan and Partners Ltd - Canada
130 Albert Street, Suite 516
Ottawa, Ontario, K1P 5G4 Canada
Tel: +1 613 230-3787, Fax: +1 613 230-1742
Contact: Marc LeBlanc
<marc.leblanc@garradhassan.com