Renewable Energy Policy in Australia

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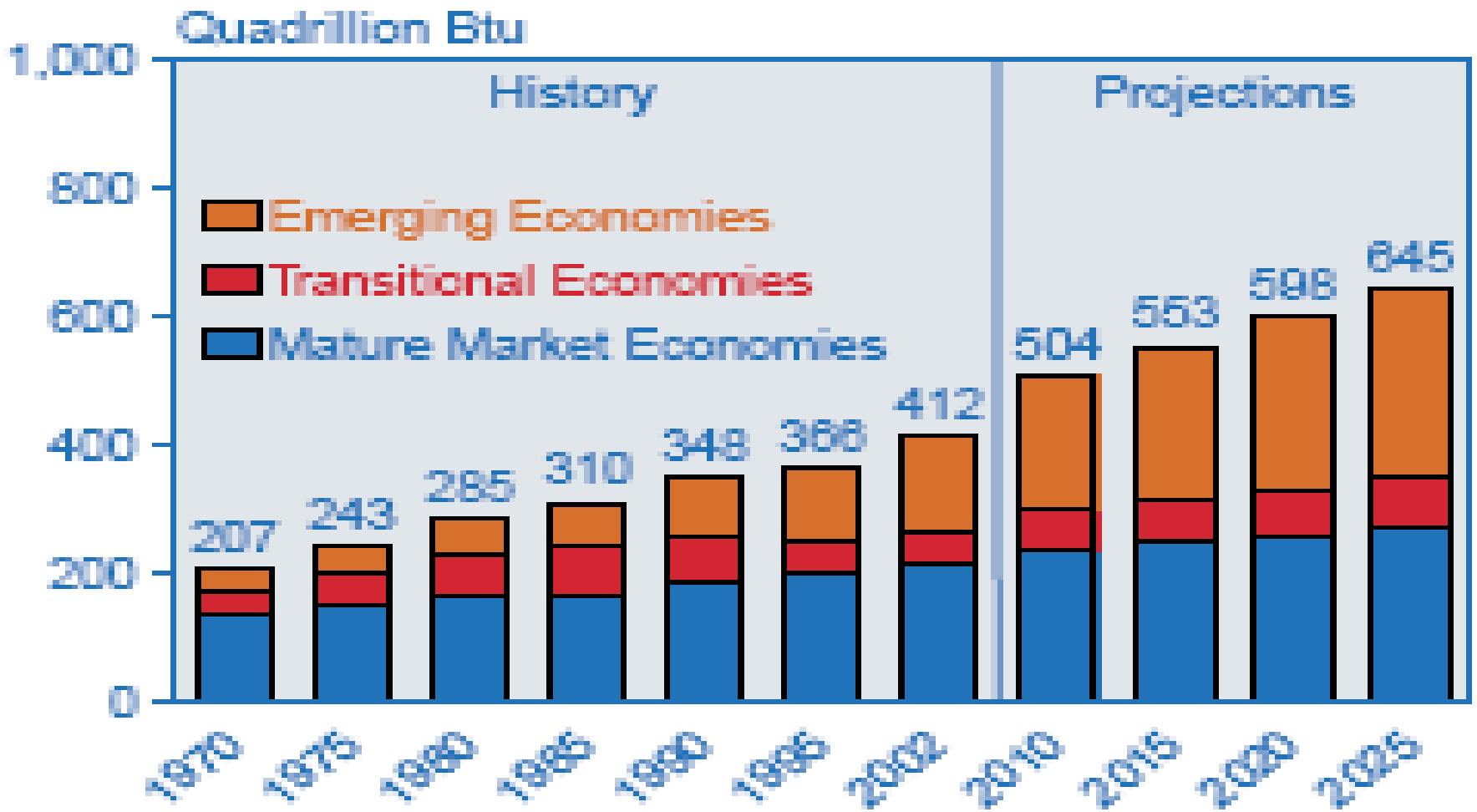
Outline

- World energy trends
- Australian energy situation
- Australia strategies
- Current status of renewables in Australia

World energy demand growth

(International Energy Agency, 2005)



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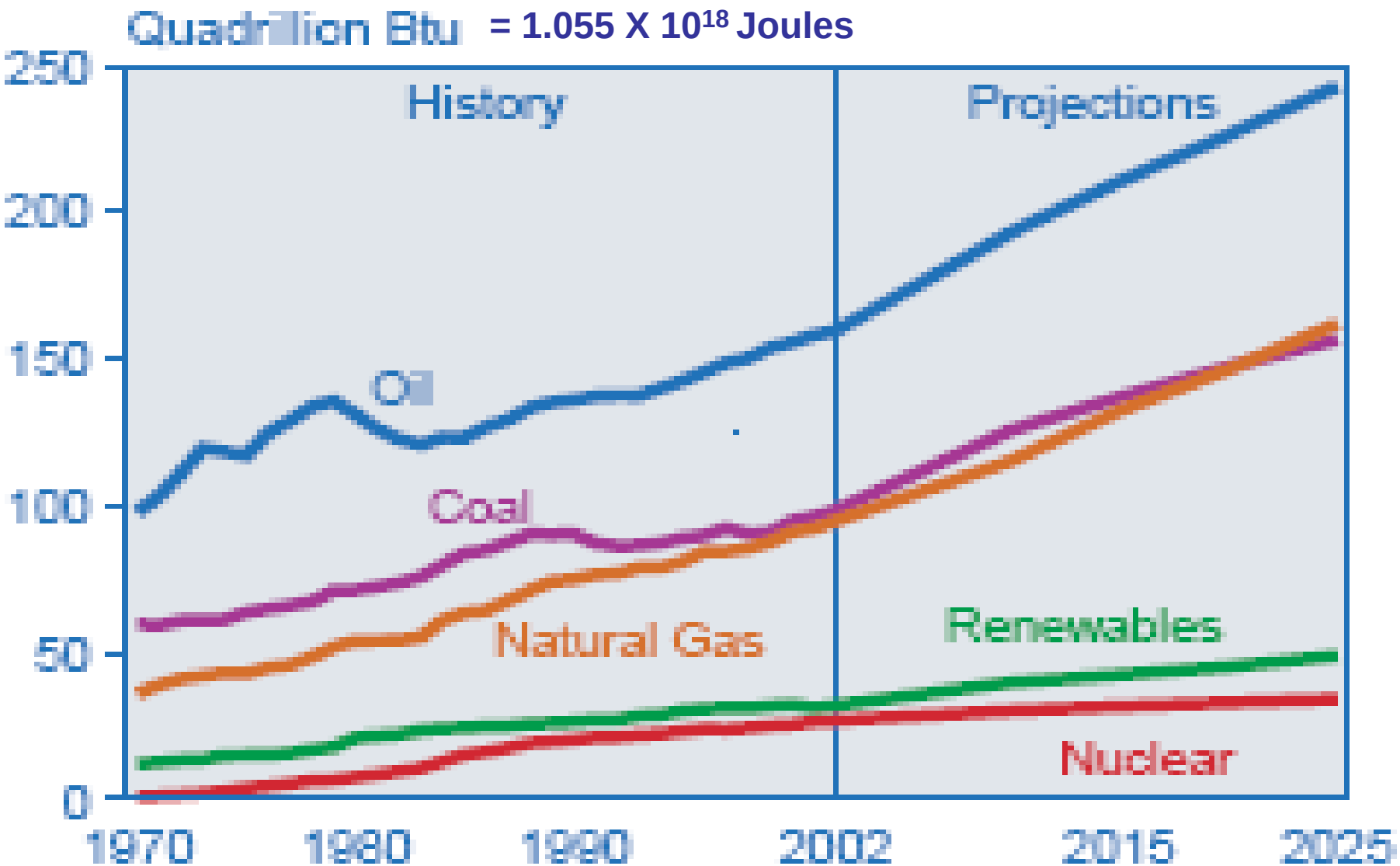
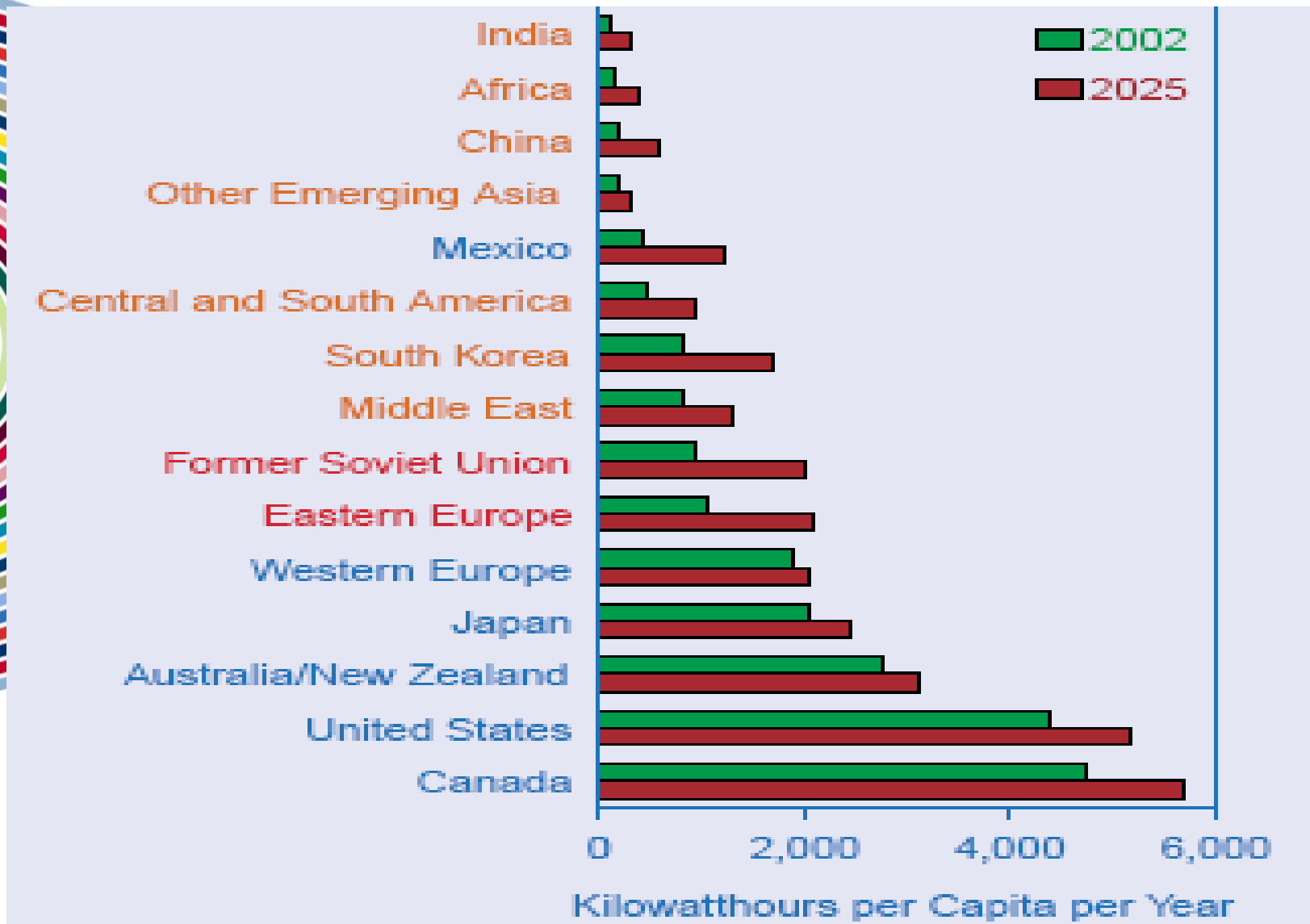
Traded Energy Use by Type (DOE, 2005)



Residential Electricity Consumption per Capita (DOE, 2005)



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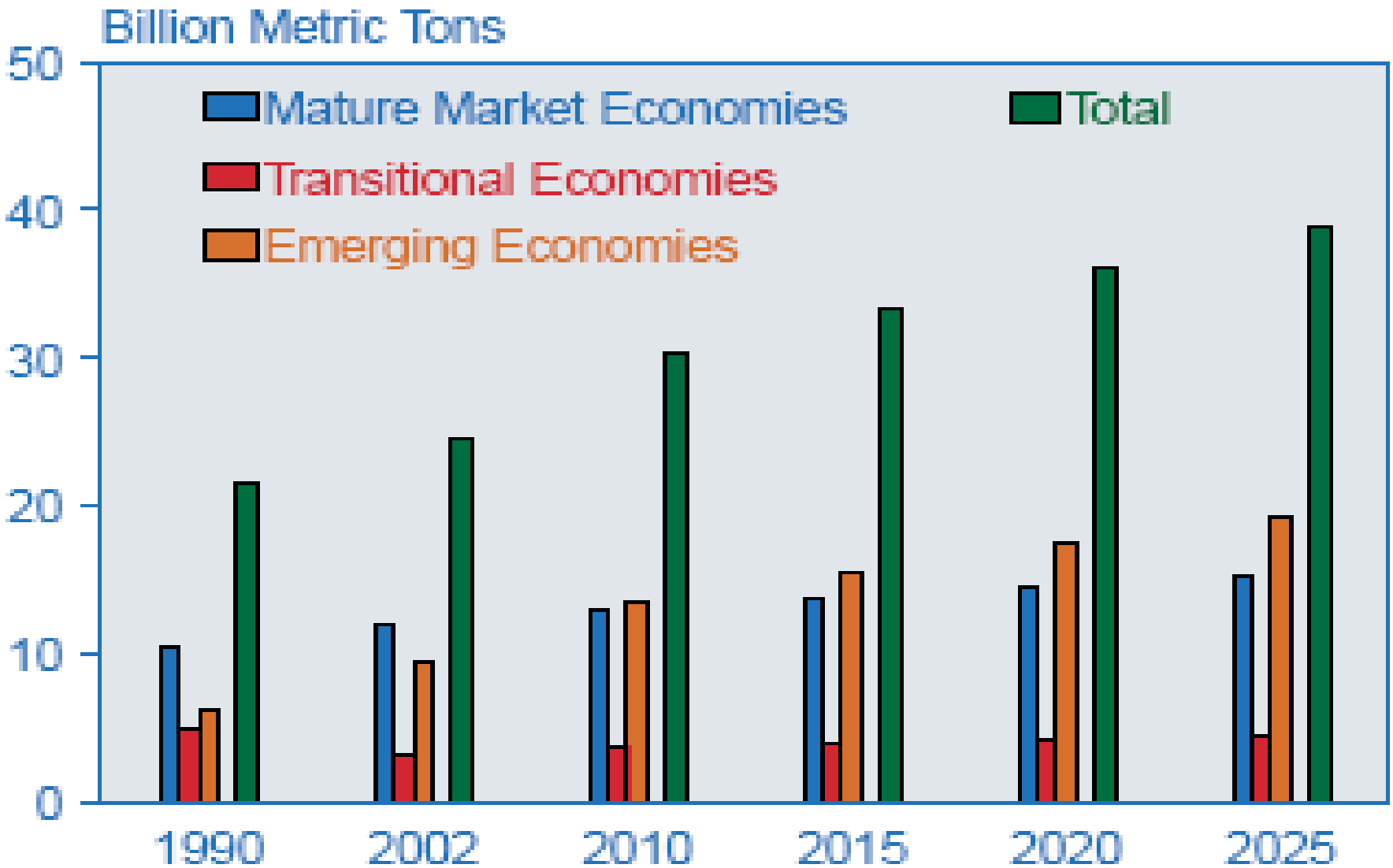
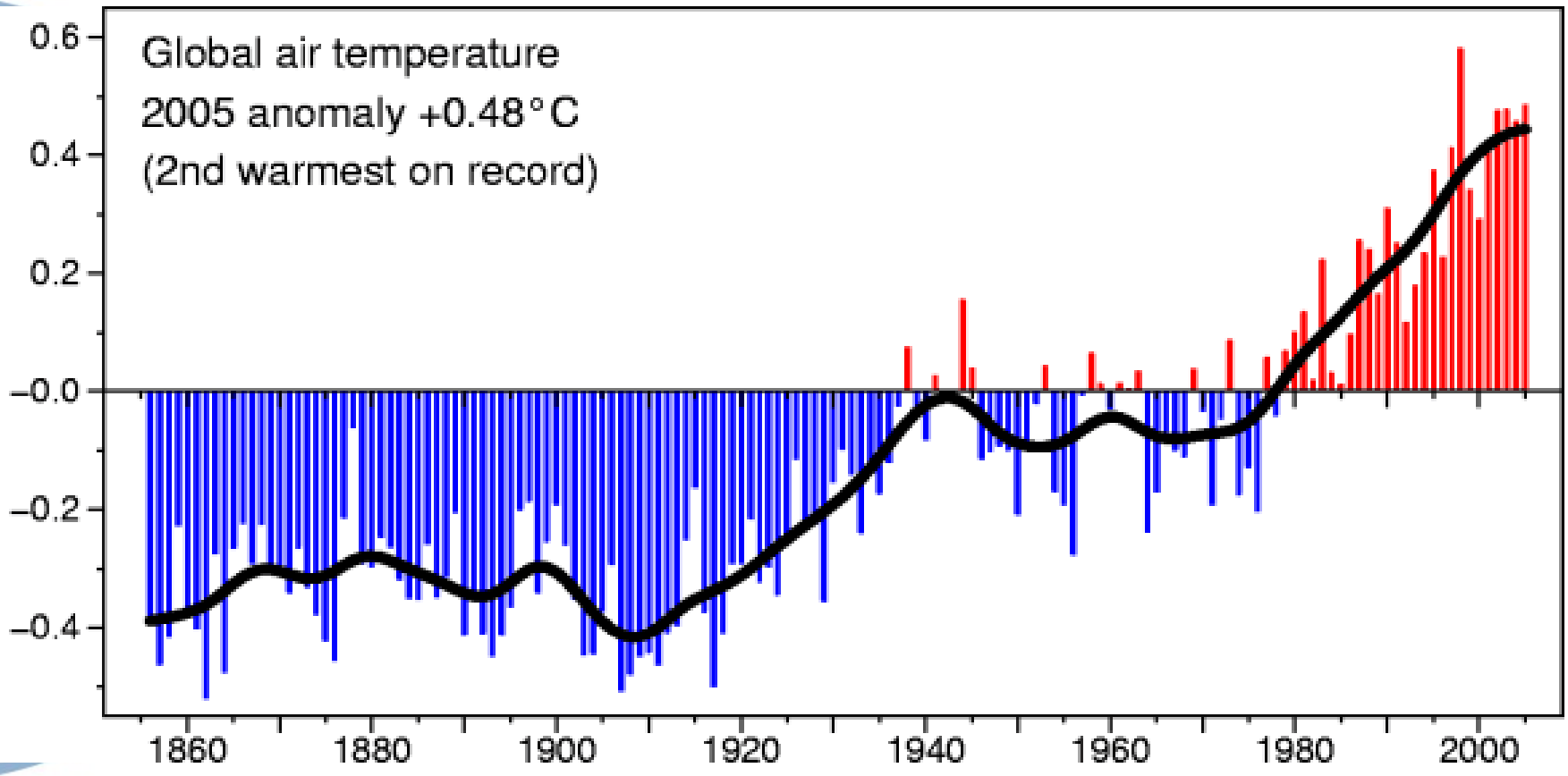
World Energy Related Greenhouse Gas Emissions (CO_2 eq) (DOE, 2005)



Global temperature trends compared to 1961-1990 average



From http://www.cru.uea.ac.uk

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The Australian Energy Situation

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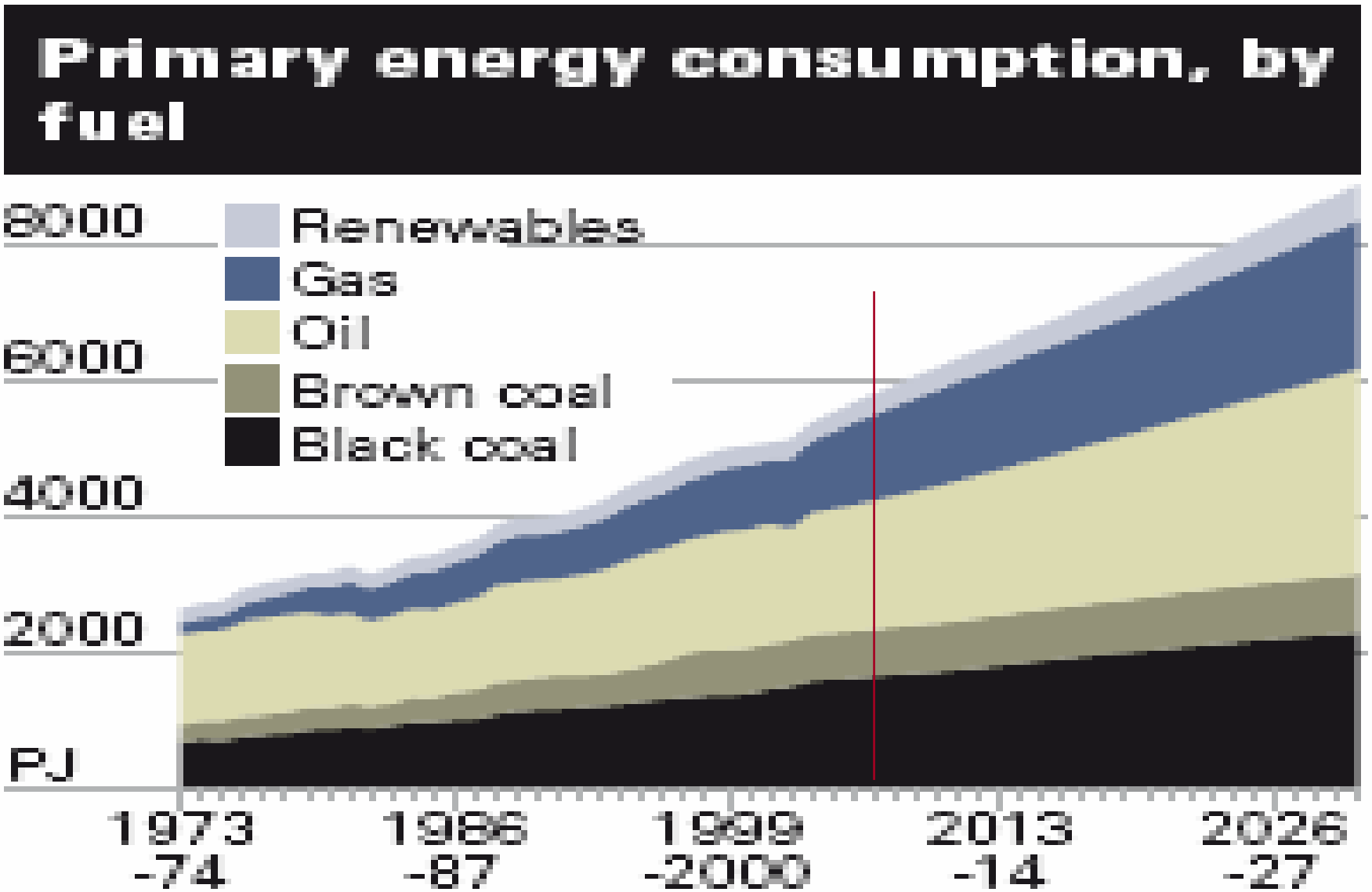
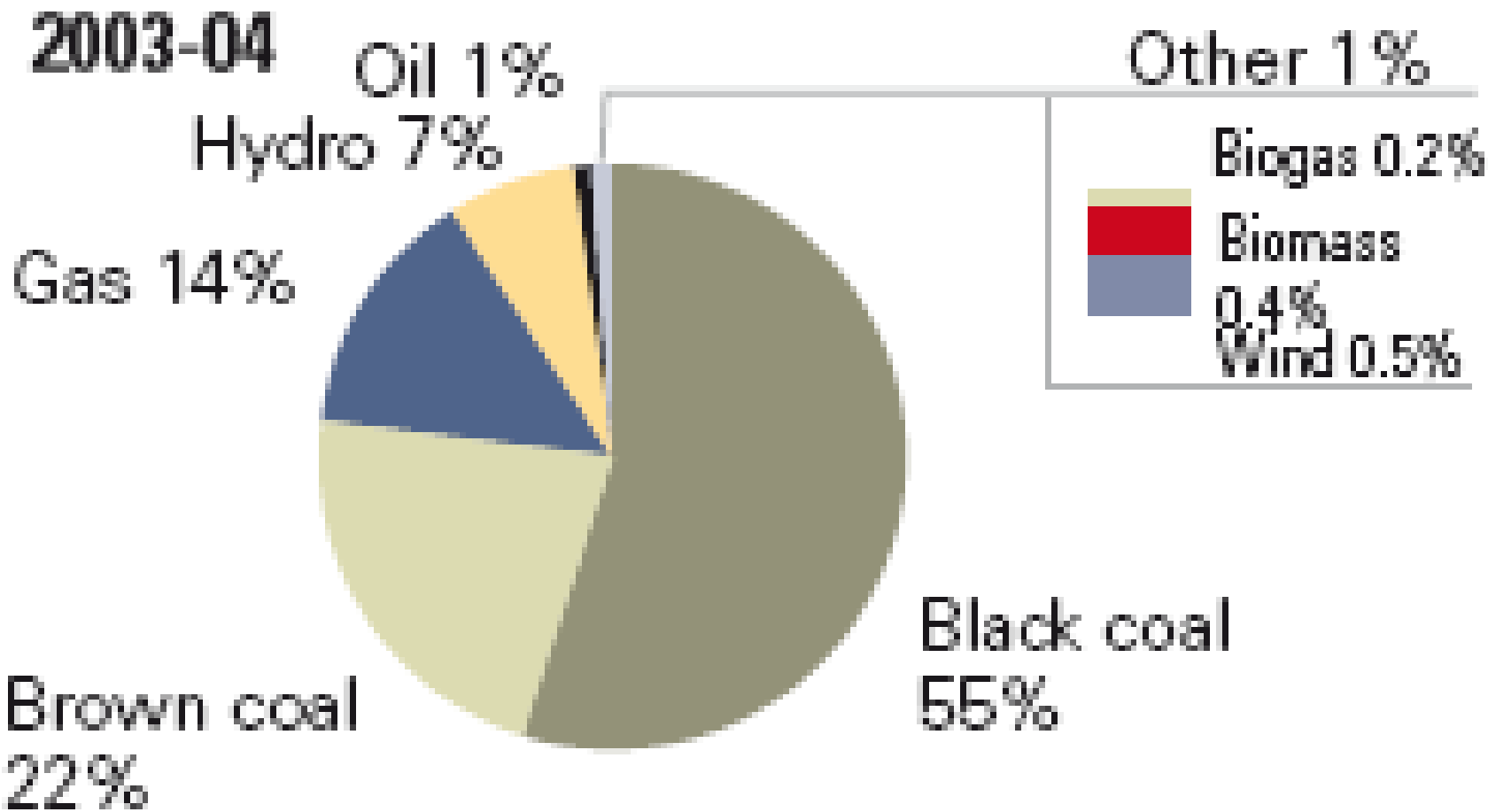
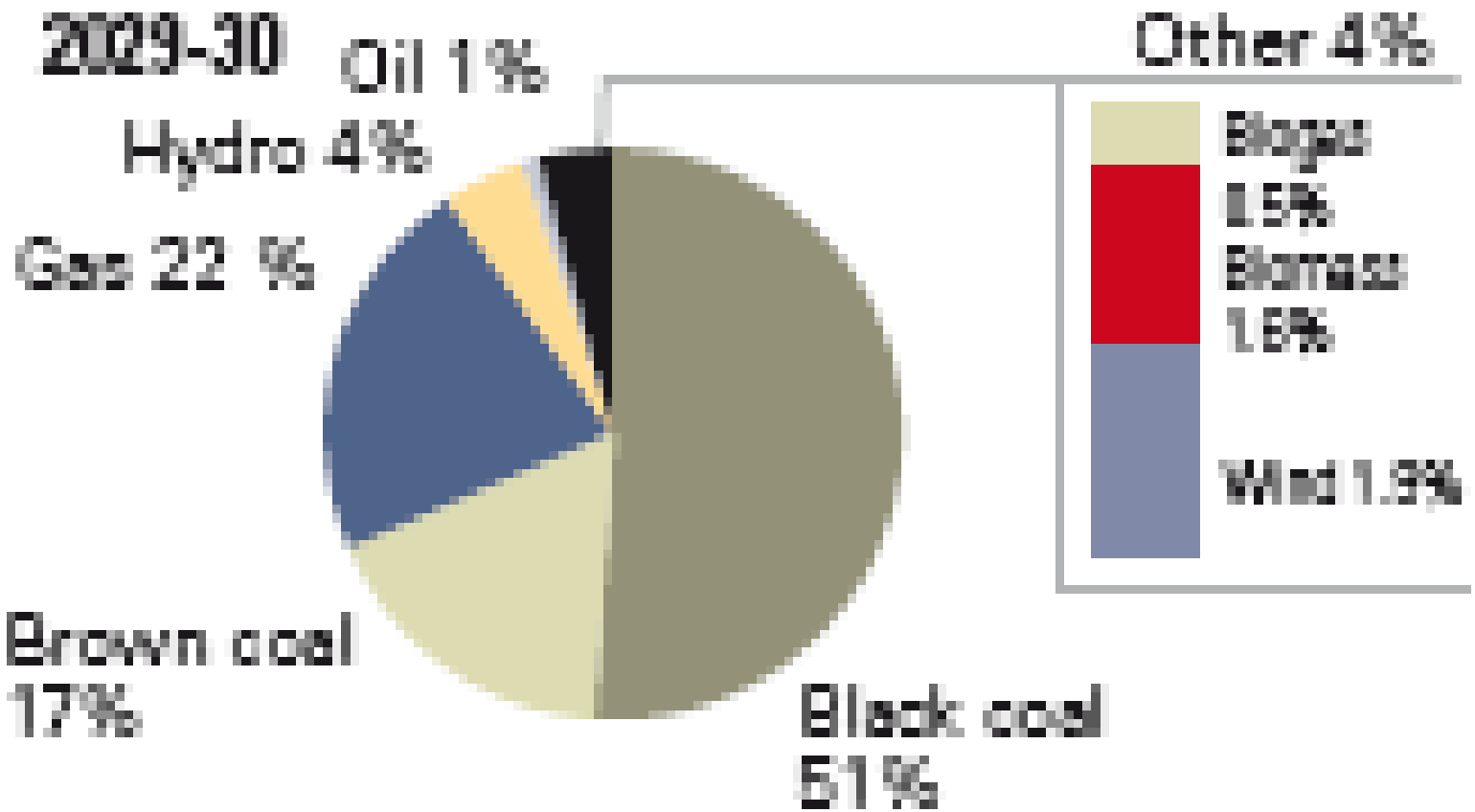
ABARE Forecast 2005



Energy Sources for Australian Electricity Generation (ABARE, 2005)



Official Forecast (ABARE 2005)



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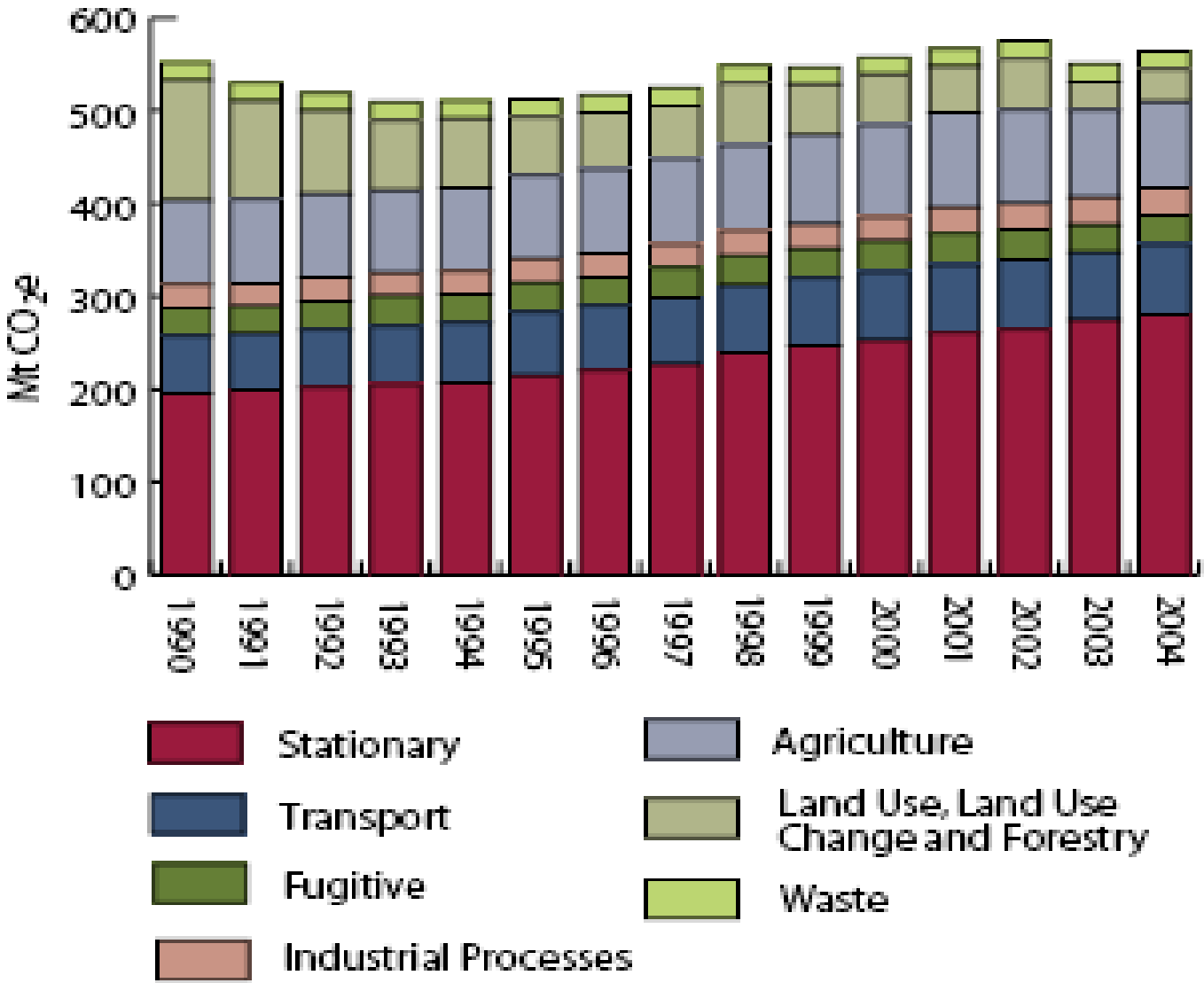
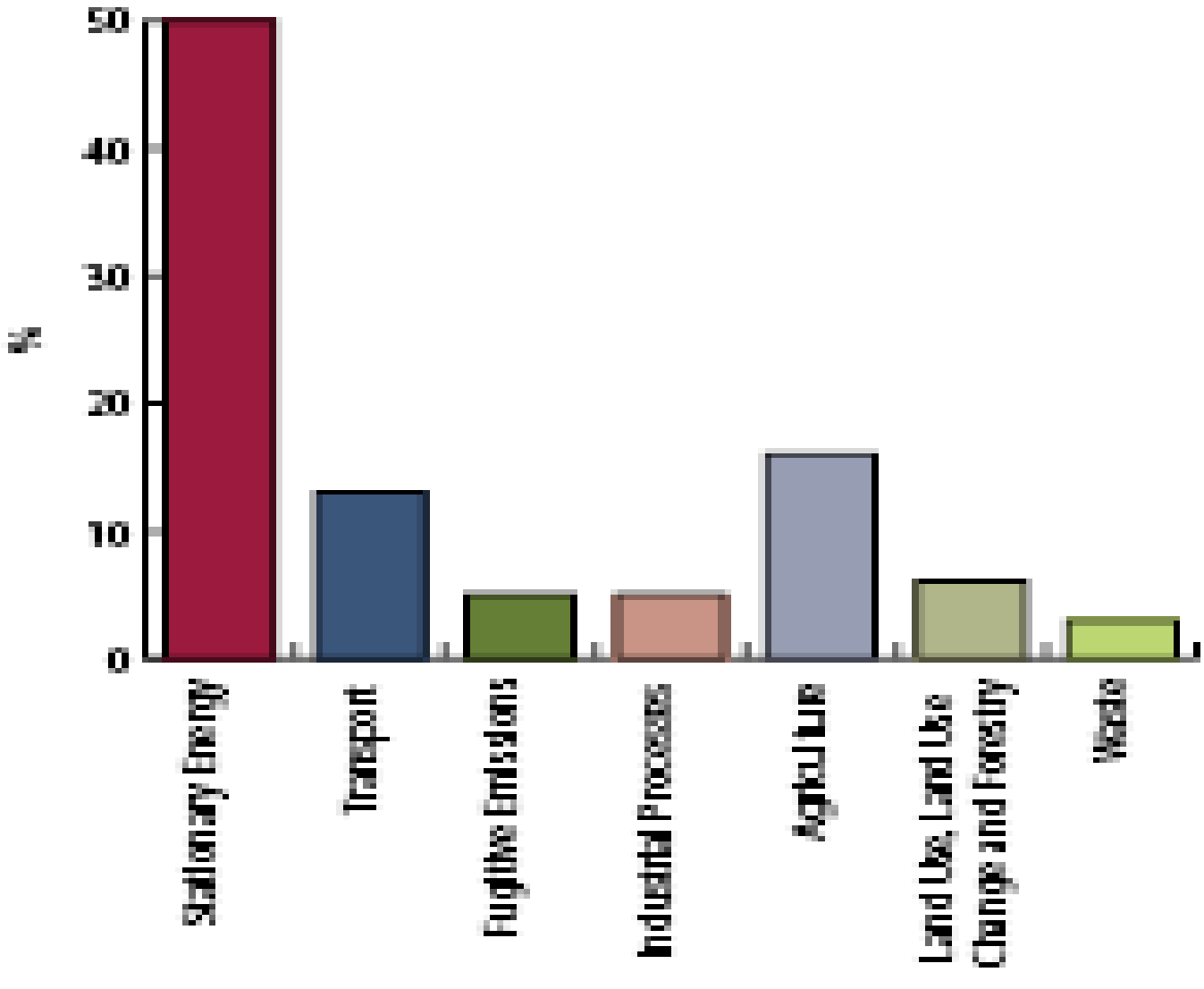
Australian Emission Trends (AGO 2006)

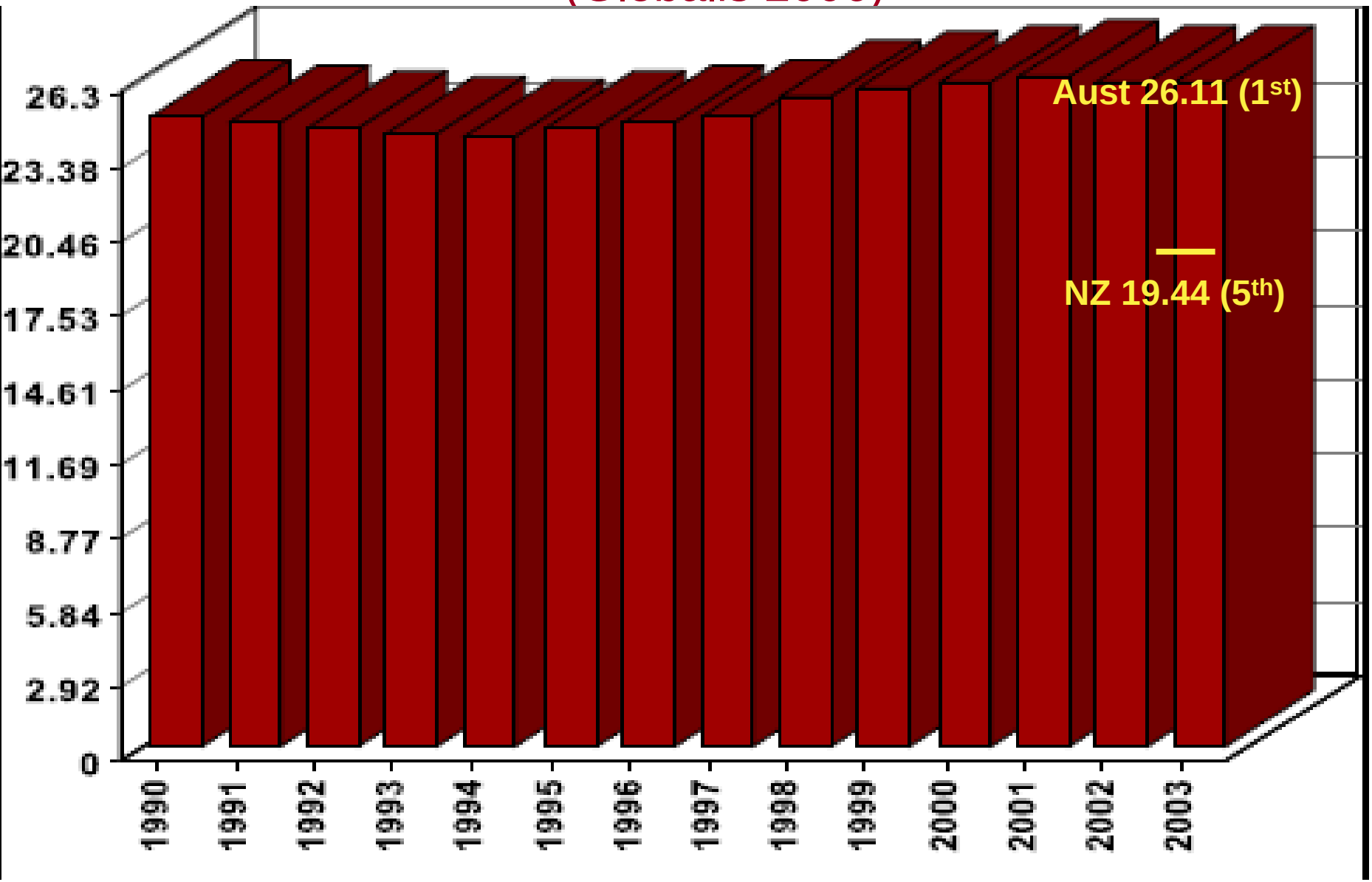


% Sectoral Contributions 2004 (AGO 2006)

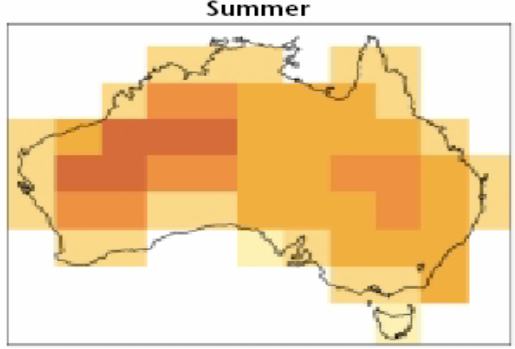


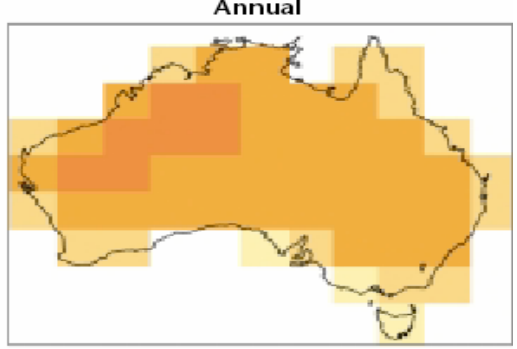
Australian per capita emission trends

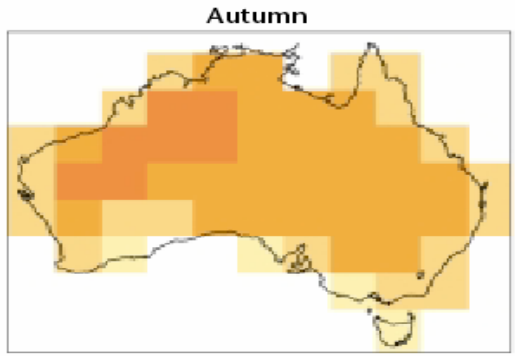
(Globalis 2006)

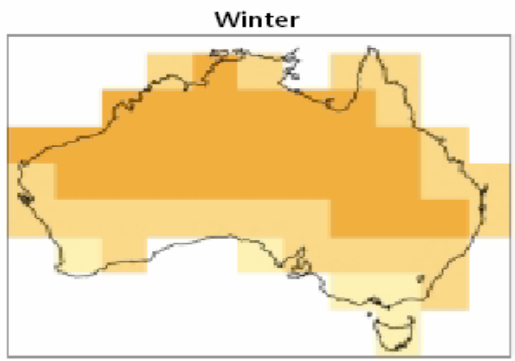


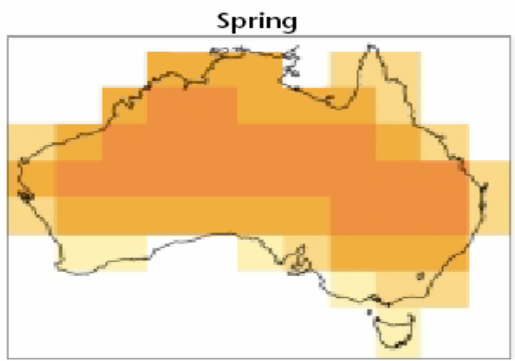
Temperature projections due to Global Warming (CSIRO 2001)

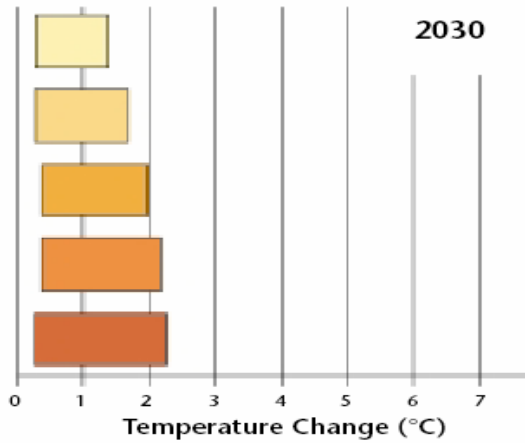


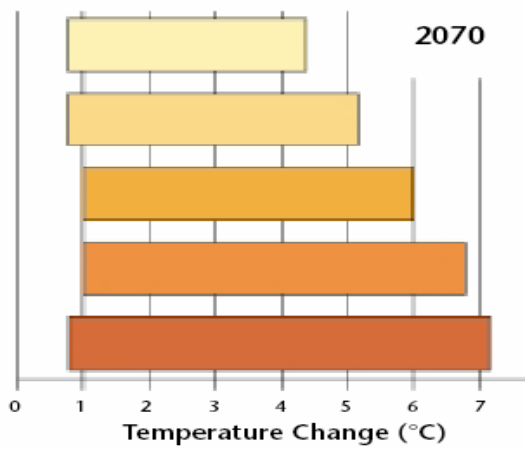




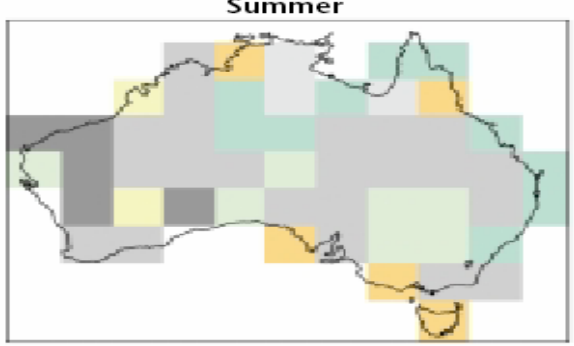


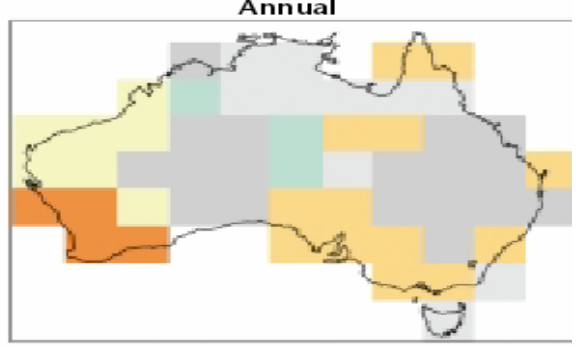


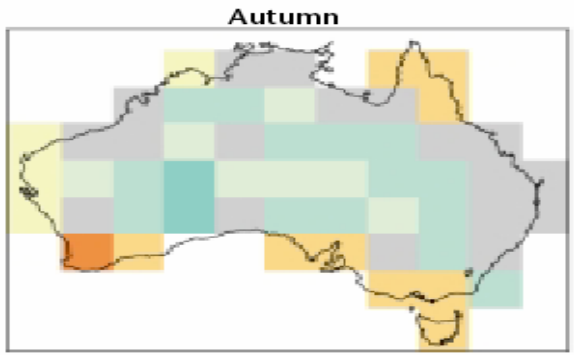


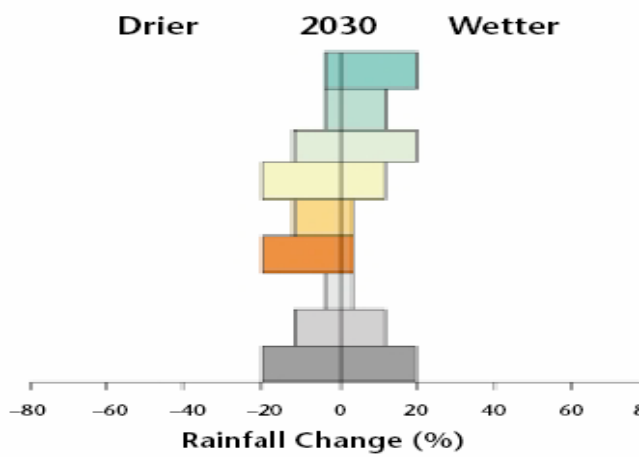


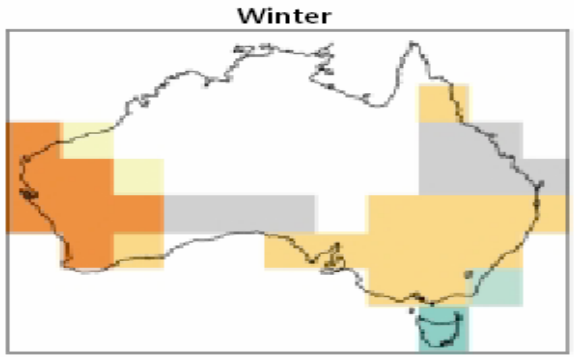
Rainfall projections (CSIRO)

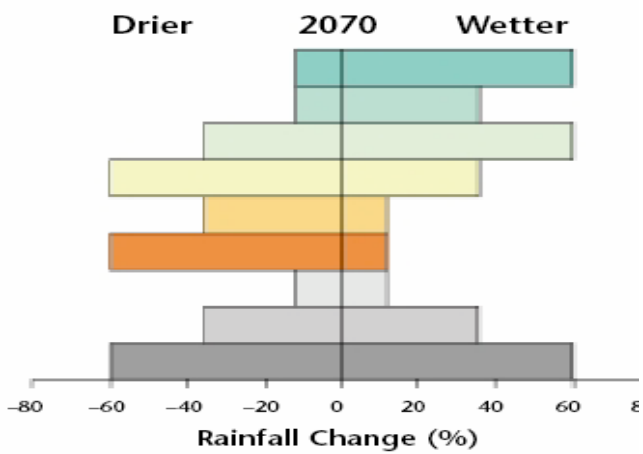


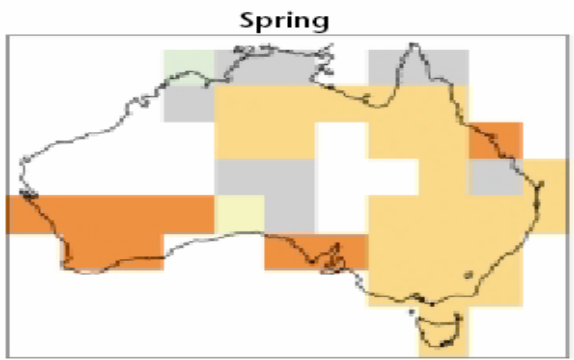












Australian Renewable Energy Potential

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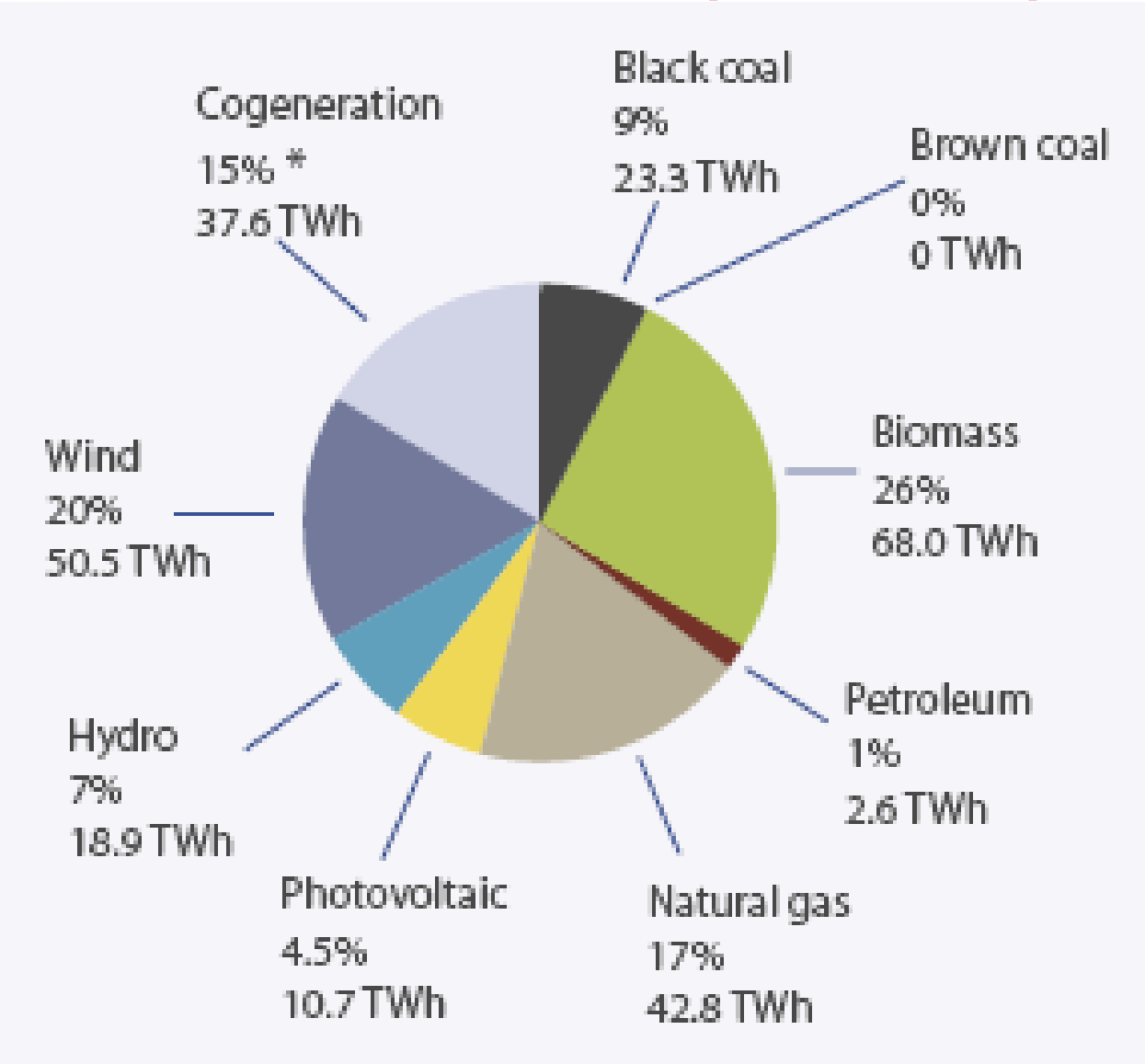
A Possible Clean Energy Future?

(BCSE 2004)



- 50% emissions reduction in stationary energy sector by 2040

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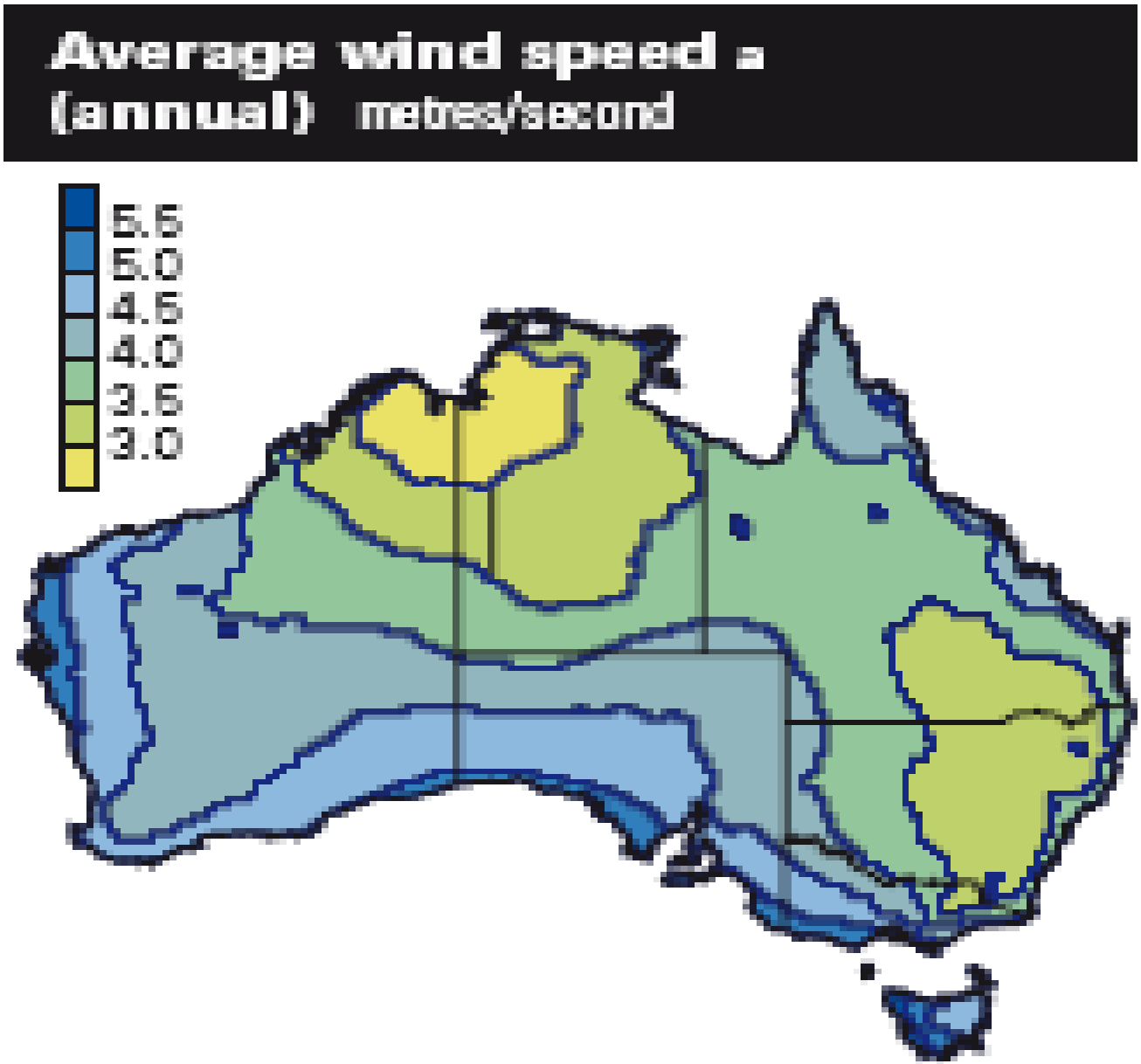
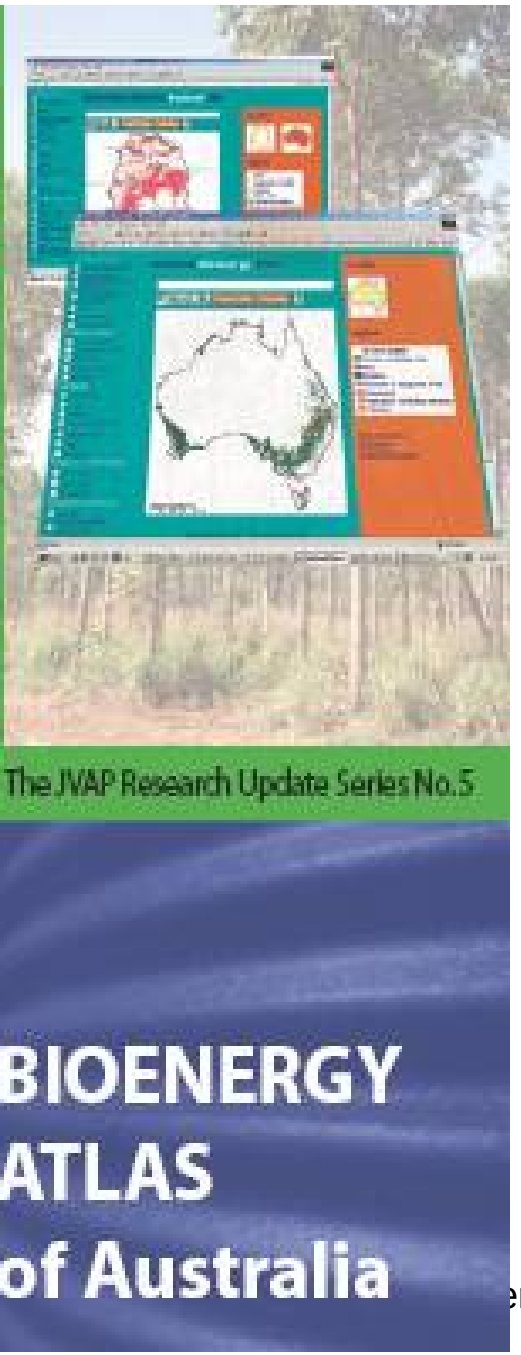
Australian Wind Resources (ABARE, 2005)





Australian Bioenergy Resources (RIRDC, 2002)

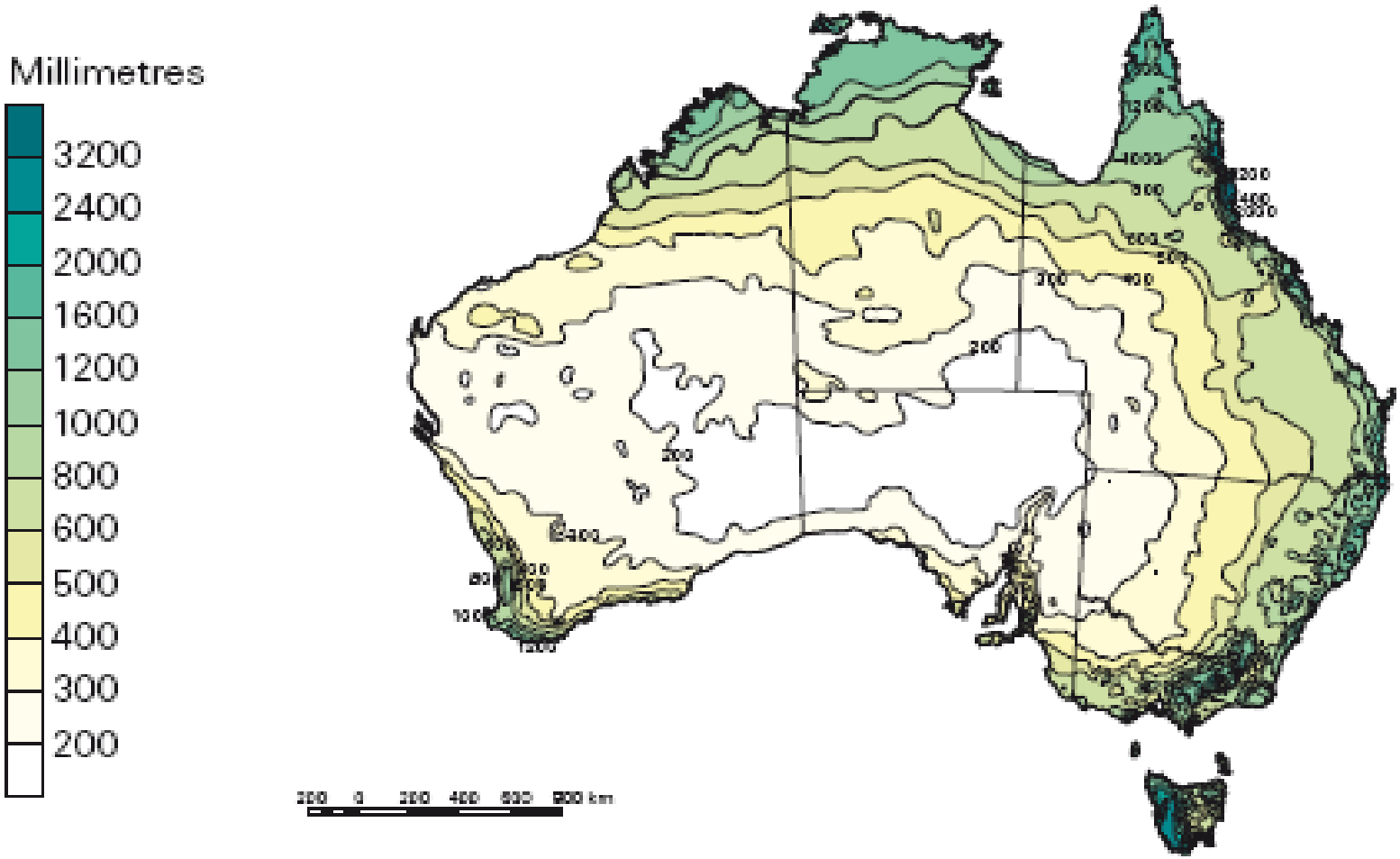
Biomass type	Estimated biomass (t)
Plant Oil (1996 incl. Cottonseed oil)	410,000
In-field Agricultural resources	55,000,000
Post-processing Agricultural resources	425,000
Forest harvesting residues	2,986,856
Uncommitted plantation resource	1,220,000
Uncommitted softwood plantation residue	260,000
Uncommitted Native Forest residue	224,000
Total estimated Sawmill residue	1,796,794

Australian Water Resources

(ABARE, 2005)

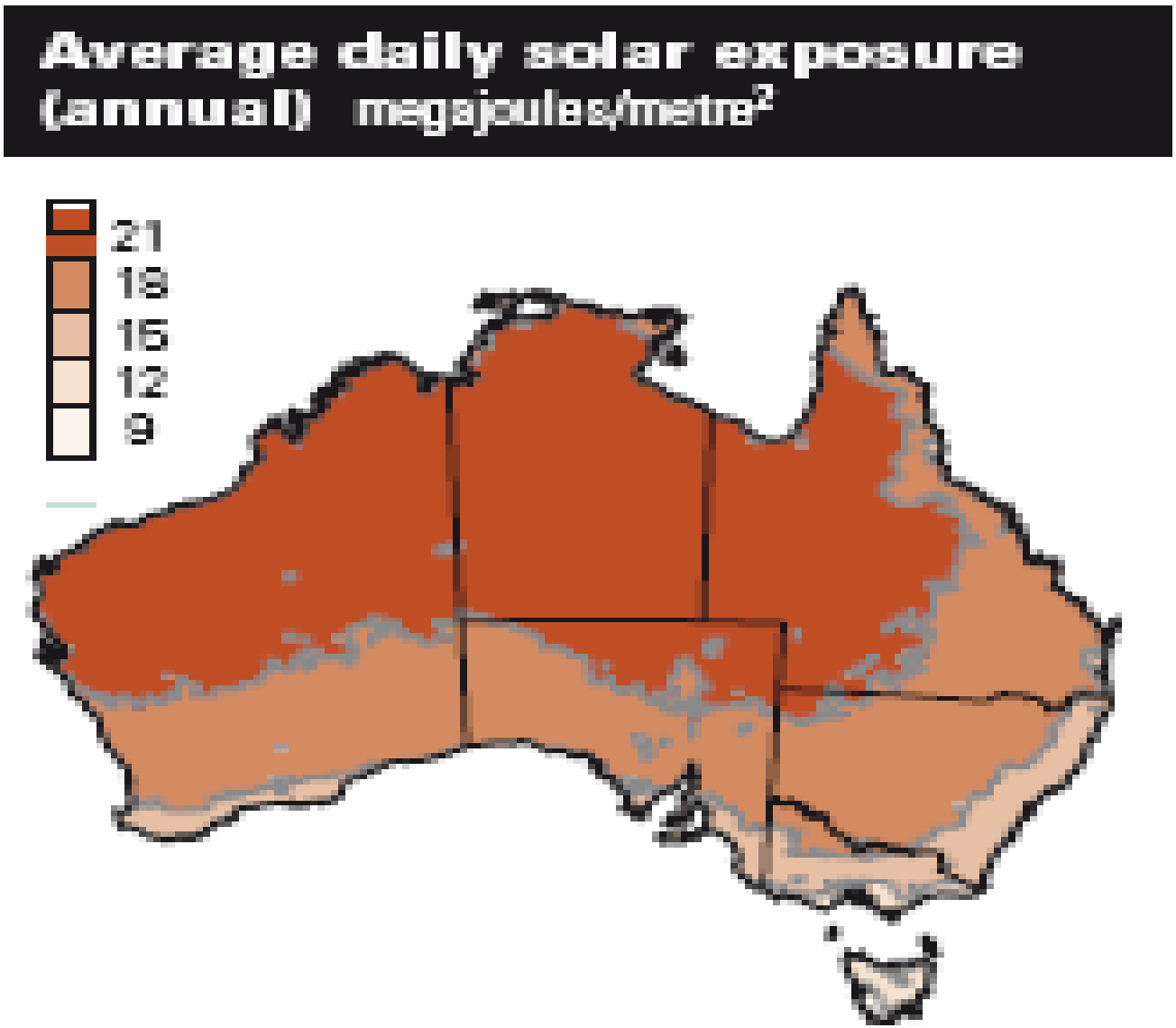
Annual rainfall

Based on a 30-year climatology (1961 to 1990)



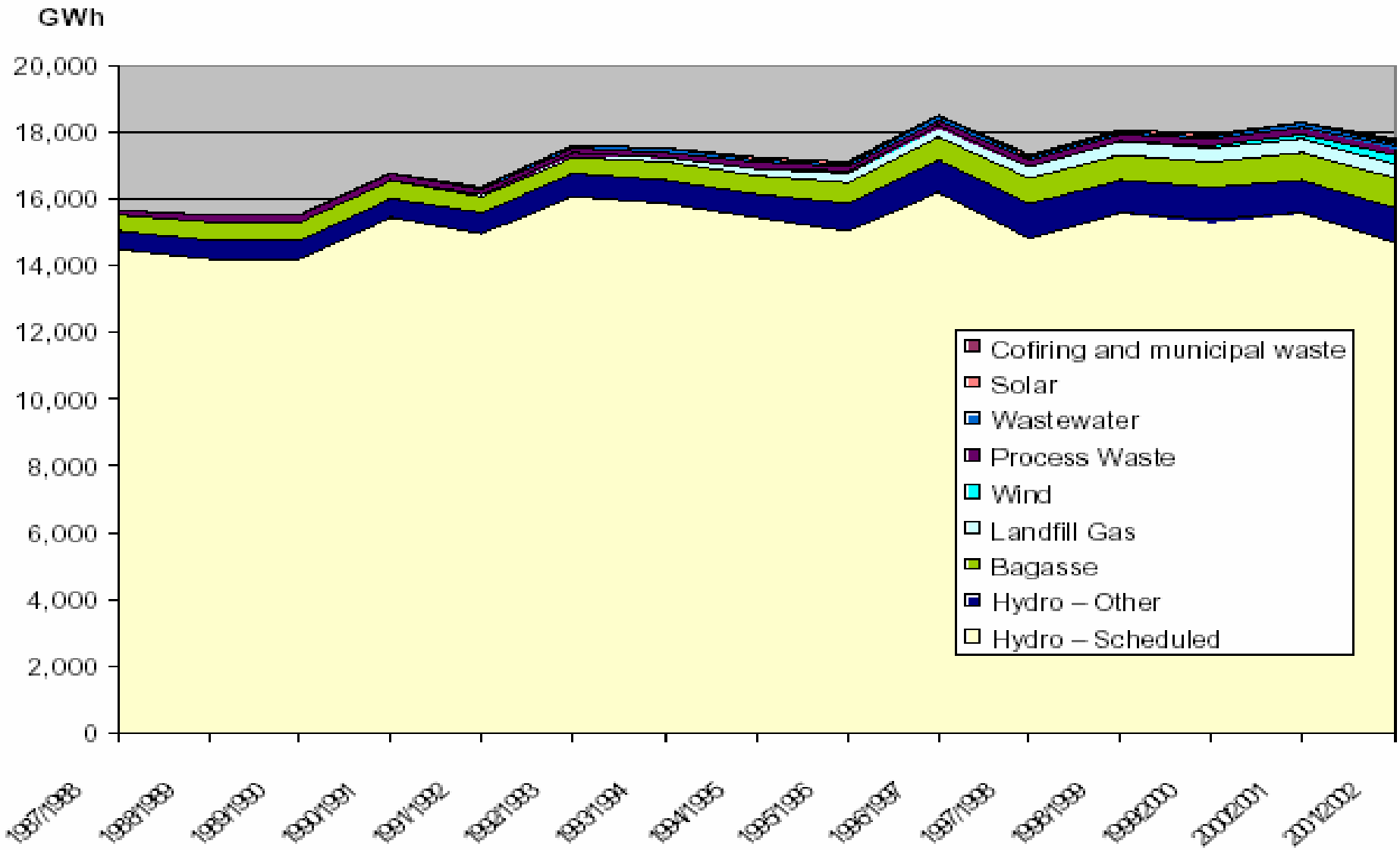
Australian Solar Resources

(ABARE, 2005)



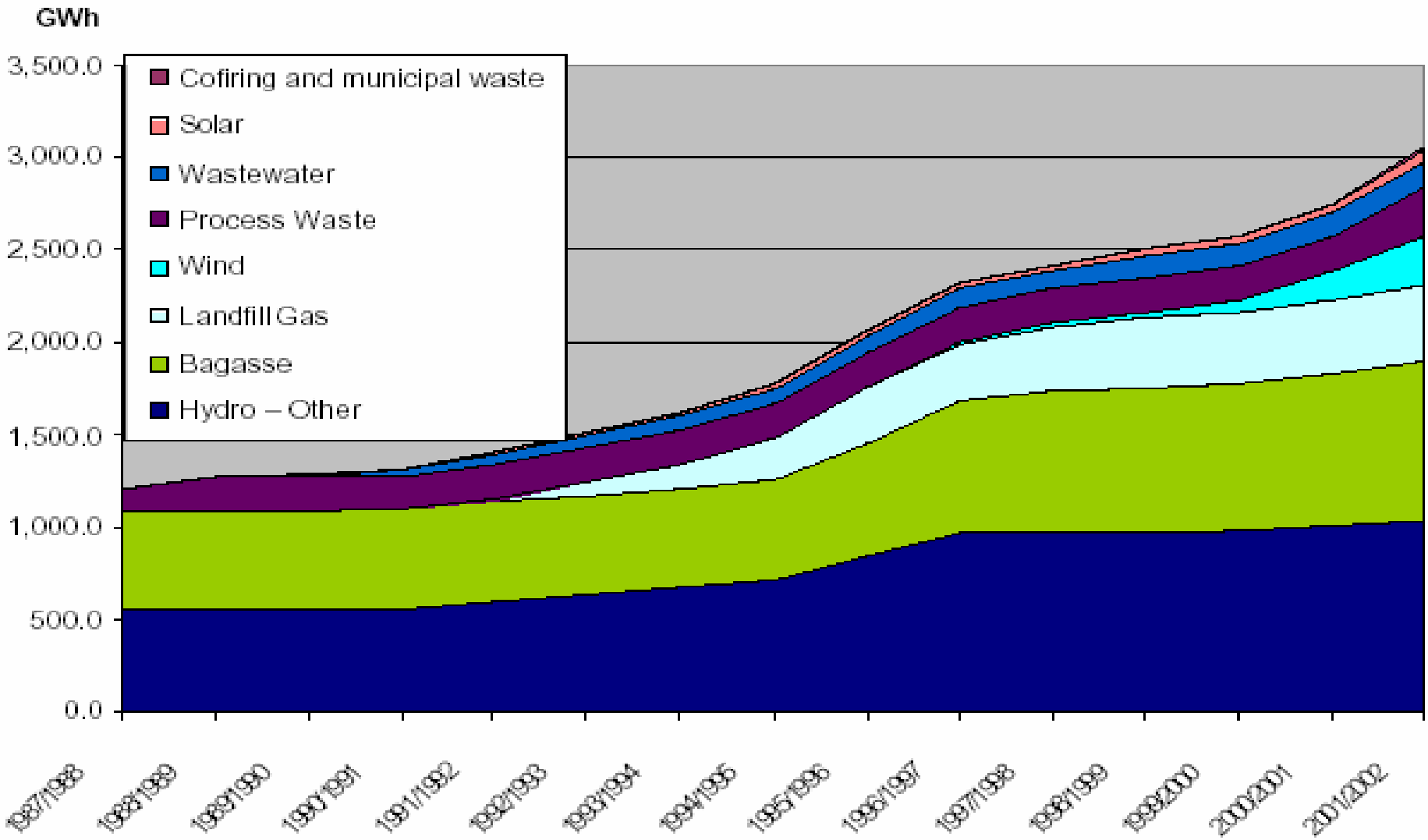
Australian Renewable Energy Use

(BCSE 2005)



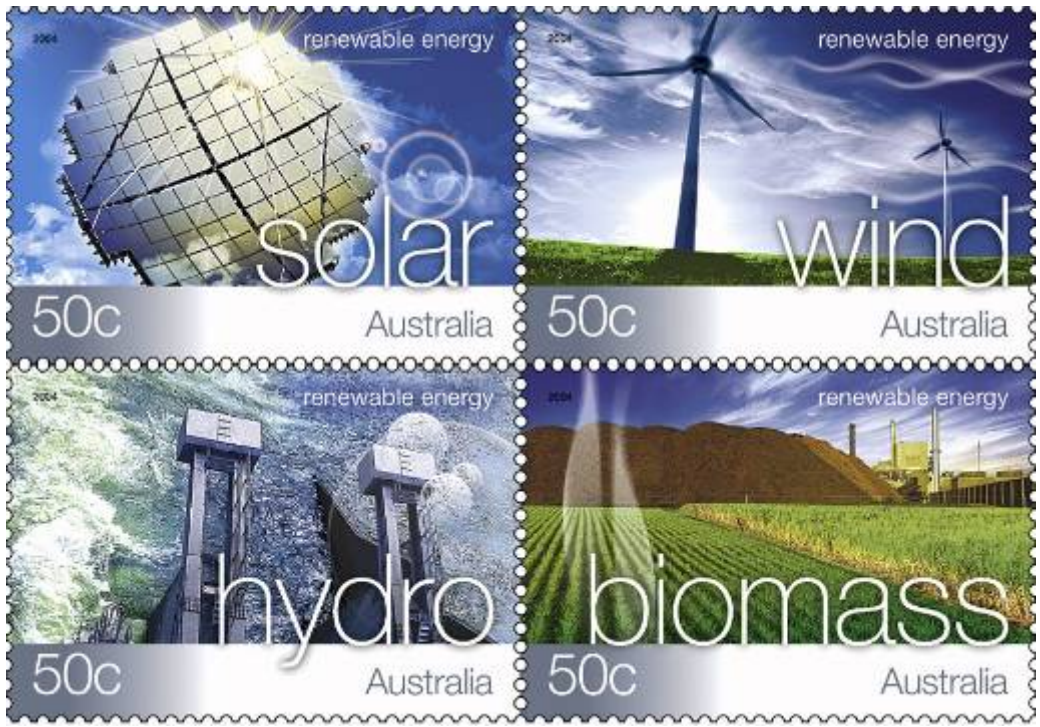
Renewables minus Large Hydro

(BCSE 2005)



The Challenge for Australia

- high levels of local coal use
- high levels of coal, LNG and uranium exports
- world leading per capita emission levels
- reducing ghg emissions & diversifying from fossil fuels is a critical long term supply security and socio-economic issue



Australian Renewable Energy Support Framework

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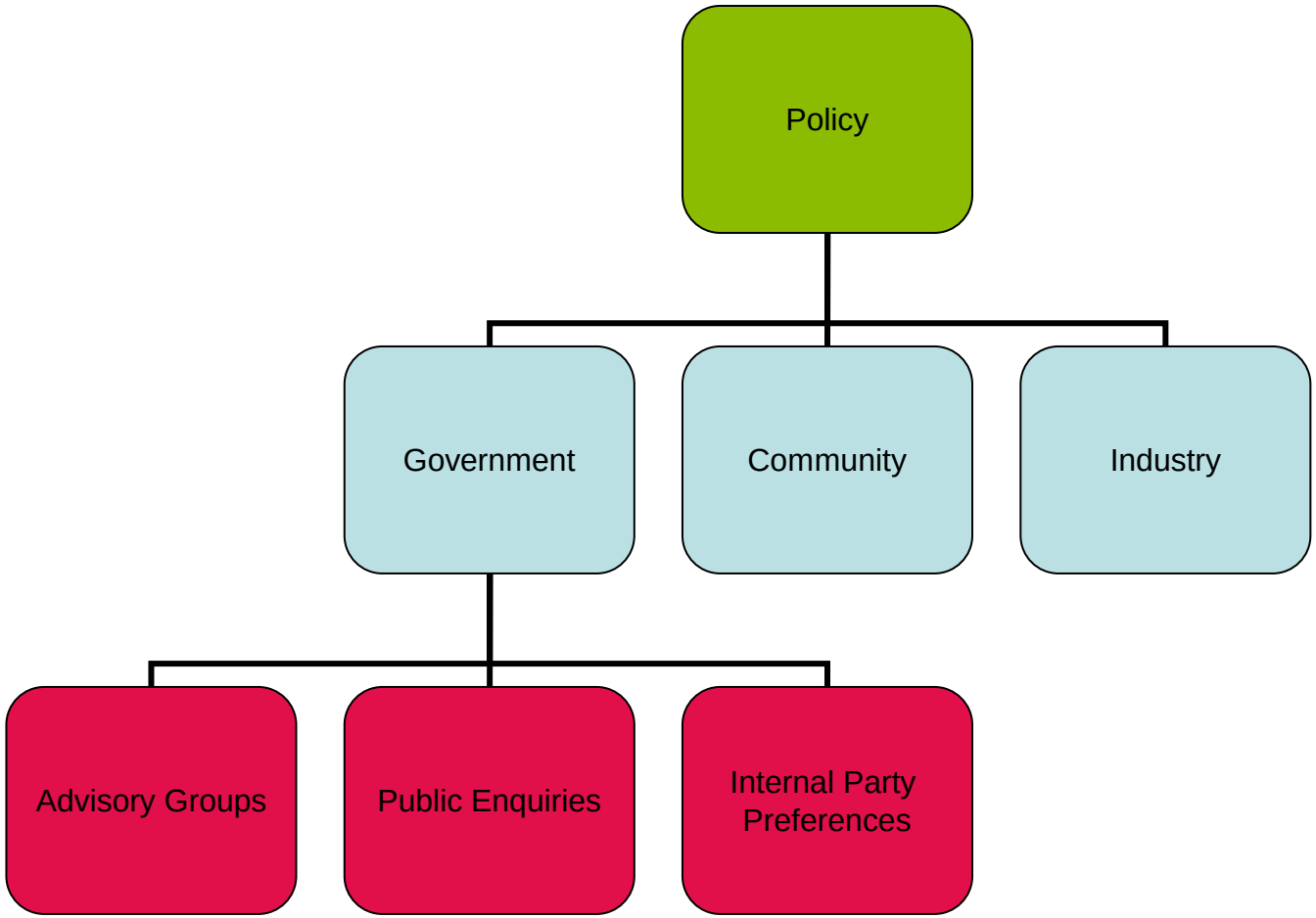
Contributors to Energy Policy



National Greenhouse Response Strategy 1992

- Australia became a party to the UN FCCC
- NGRS committed State, Territory and Commonwealth Govts to:
  - accelerate energy market reform
  - ensure new market structures deliver improved energy efficiency and emission reductions

National Greenhouse Strategy 1997

1997 - COP 3 - Kyoto Protocol

- av. 5.2% reduction of ghg by 2010 cf 1990 levels
- Australia +8% (NZ no change)

Key guiding principles of Australian NGS:

- 'no regrets' - actions justified in their own right which also deliver greenhouse benefits
- flexibility for jurisdictions re choice of measures and mechanisms
- Intergovernmental Committee on Ecologically Sustainable Development (ICESD)
  - oversees development and implementation of NGS
  - reports on progress to Council of Australian Governments (COAG)

National Greenhouse Strategy Programs

1: Profiling Australia's ghs emissions

2: Understanding & communicating climate change & its impacts

3: Partnerships for ghg action: governments, industry & the community

4: **Efficient & sustainable energy use & supply**

5: Efficient transport & sustainable urban planning

6: Ghg sinks & sustainable land management

7: Ghg best practice in industrial processes & waste management

8: Adaptation to climate change

Australian Greenhouse Office (AGO) 1997

- World first agency dedicated to GHG
- Energy, industry & environment portfolios - “whole of Government” approach
  - 1997 - $180M over 5 years
  - 1999 - extra $750M over 4 years as part of GST agreement with Democrats
- 2005 – incorporated into Department of Environment & Heritage

Energy White Paper - 2004

- Coal selected as key energy source
- Removal of diesel excise (~40%) for power generation, heating & industrial uses
- Low emission technology fund -$500m
  - Large projects (eg. geo-sequestration, maybe solar towers)
- Renewable energy - $200m (to sort out “problems”)
  - Solar cities trials
  - Wind forecasting
  - Energy storage
  - Commercialisation
  - No change to MRET target (too expensive, too few tech benefit)
- Energy Efficiency
  - Information
  - Audits of large companies
  - MEPS and other standards

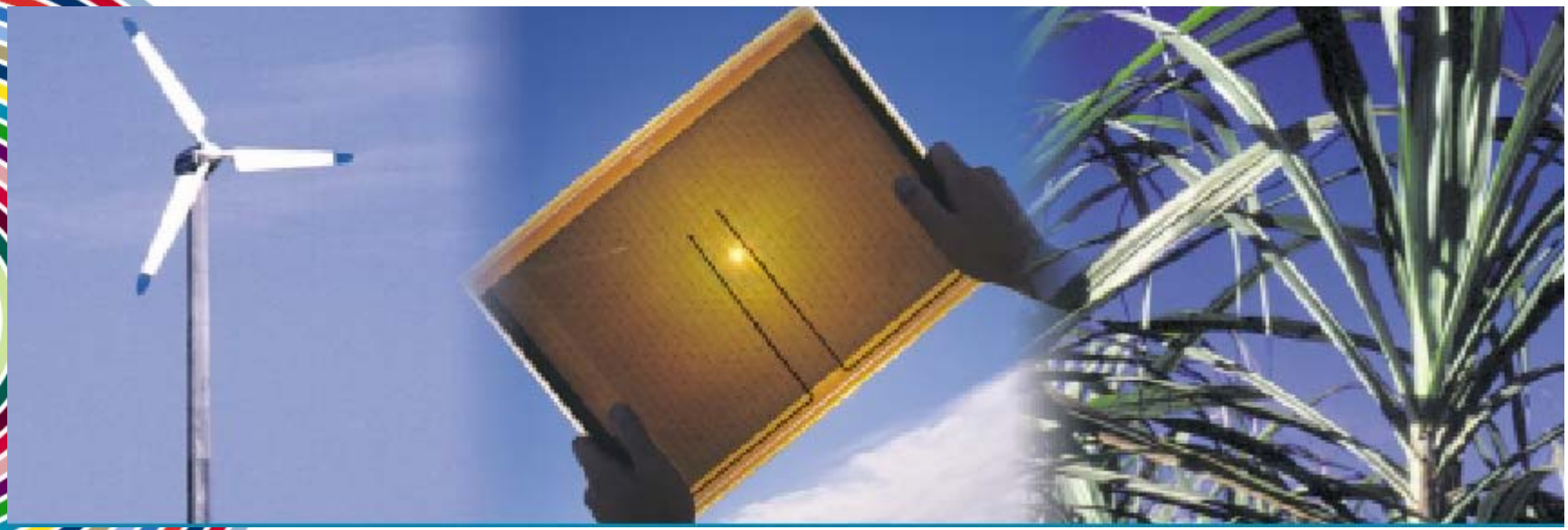
Australia Pacific Partnership on Clean Development and Climate (AP6) 2005

- *"Create a voluntary, non-legally binding framework for international cooperation to facilitate the development, diffusion, deployment and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices among the Partners"*
- United States, Australia, Japan, South Korea, China and India
  - 50% world's population, GDP, energy consumption and ghg emissions
  - 4 largest coal producers - China, US, India and Australia
  - 2 largest coal importers - Japan and Korea
  - All in the world's top ten coal consuming countries
- Public-Private sector taskforces:
  - (1) cleaner fossil energy; (2) **renewable energy and distributed generation**; (3) power generation and transmission; (4) steel; (5) aluminium; (6) cement; (7) coal mining; (8) buildings and appliances

Comparison of Kyoto & AP6

- Australian Prime Minister, John Howard, “The fairness and effectiveness of this proposal will be superior to the Kyoto Protocol.”
- AP6 is intended to complement rather than replace Kyoto
- AP6 has no binding emissions targets
- Kyoto has binding targets for developed countries and a growing market for CDM projected to average 150-250 MtCO2-e/year over 2008-12 which would represent funding to developing countries for emissions reduction projects of around €1-1.8b
- Agreed funding for AP6 to date is A$100m over five years (Oz only)
- ABARE’s scenarios of possible AP6 outcomes all see global emissions more than doubling to 2050
- Different implications for US and Australia than other 4 members who all ratified Kyoto

Australia's Renewable Energy Action Agenda



- Vision:

  sustainable and internationally competitive renewable energy industry with annual sales of $4 billion by 2010

5 Strategies

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Action Agenda Targets

	Domestic	Exports	Total
Sales of RE bulk power	$850m	$250m	$1100m
Sales of RE products	$800m	$1200m	$2000m
Provision of RE services	$200m	$300m	$500m
Other	$400m		$400m
	$2250	**$1750m**	**$4000m**

Renewable Energy Technology Roadmap

A comprehensive technology strategy to achieve the goals of the Action Agenda Vision by:

- **assisting firms and industry sectors to identify future customer needs and critical future technology developments**
- **coordinating technology development actions by industry and government that facilitate the capture of future market opportunities**

Target Status by 2004

Technology	Domestic	International/ Export	Total
Overall renewable energy sales	$431.7m	$301.1m	$732.2m
Overall renewable energy sales with abatement revenue included	$531.1m	No data available	$832.2m
REAA 2004 OVERALL TARGET	**$662.0m**	**$347.0m**	**$1,009.0m**
Difference between target and actual	**-20%**	**-13%**	**-18%**

Renewable Energy Support Strategies used in Australia

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AGO Renewable Energy Programs ~ $400 M

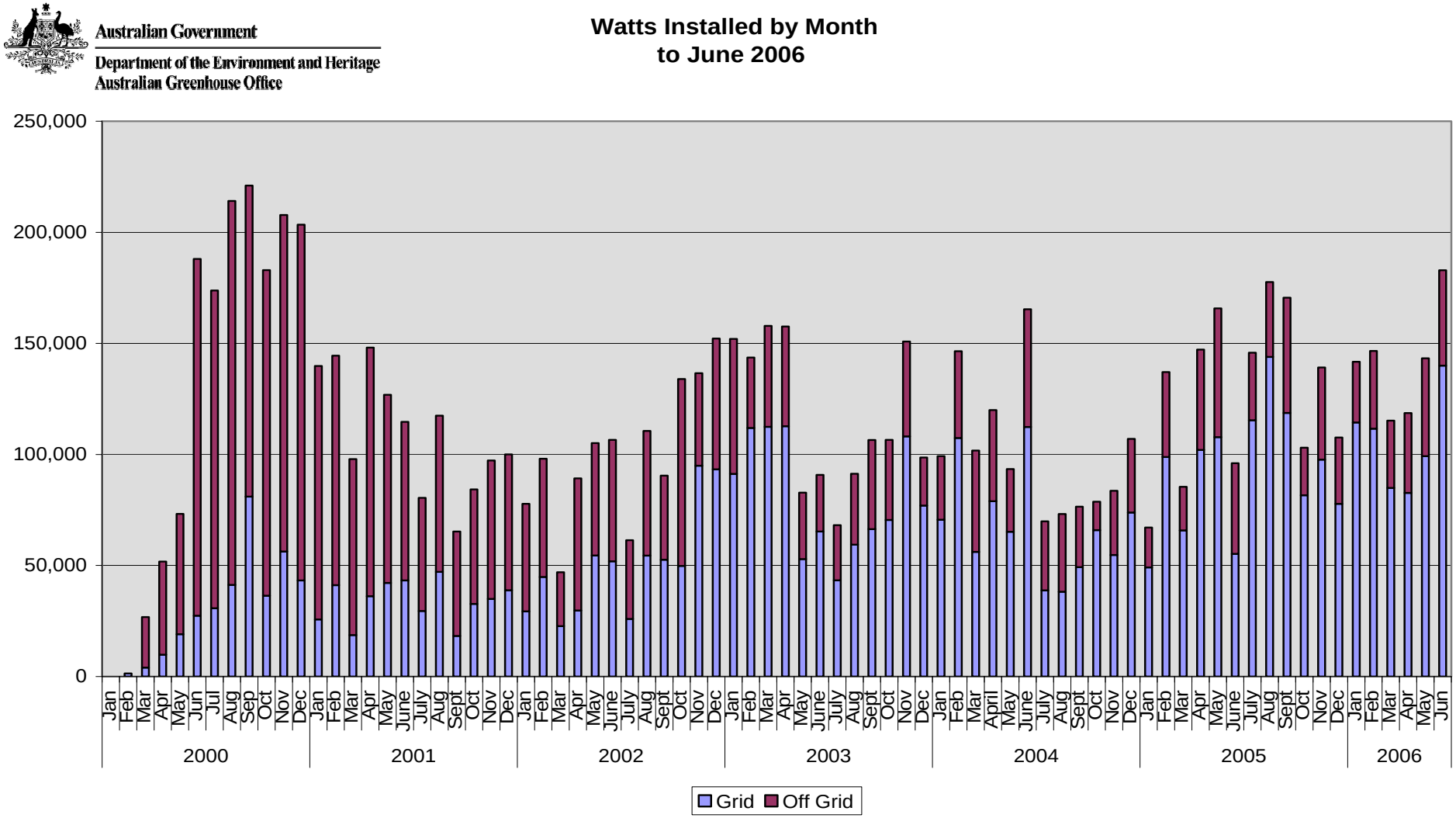
- PV Rebate Program - $46.1M
  - ($31M in 1999+ $9.4M in 2003 + $5.7M in 2005)
- RE for Remote Power Generation - $387M
  - ($264M in 1999 + $123M in 2006)
- RE Commercialisation Fund - $66M
  - RE Showcase - $10M
  - RE Industry Program - $6M
- RE Equity Fund - Venture capital - $21M

PV Rebate Programme (PVRP)

- Commenced in 2000 and currently runs until 2007 (under review)
- Funded by Australian Government, with administration by States & Territories
- Rebates on PV capital costs for householders or community building owners
- Rebate of $4/Wp capped at $4,000 (was higher)
- $2.50/Wp for extensions to an existing system
- $1M available to housing developers - $3.50/Wp in $50,000 blocks.
- 6 600 systems, using 8 MWp of PV, have been installed and rebates of over $40M provided
- 50% grid connected (in 2005 88% of grid market)

PVRP Installations

Australian Government
Department of the Environment and Heritage
Australian Greenhouse Office



Otago University October 2006

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Renewable Remote Power Generation Programme (RRPGP)

- Commenced in 2000 with $264M over 10 years for RE use in RAPS (including public generators and mini-grids) rather than fossil fuels.
- Grants up to 50% of the capital value of RE components.
- From 2005 eligibility extended to fringe-of-grid installations, energy efficiency measures & solar water heaters.
- Administered by States and Territories, some provide supplementary funding.
- From 2006, only WA and NT had funding remaining
- Extra $123m announced – for States which have used up original allocation
- Sub-programmes:
  - Bushlight - for small remote aboriginal community RE systems in, plus training and awareness
  - RESLab - RE systems test centre, Murdoch Uni, Perth.

Bushlight

Grant Wallace cleans the solar panels at House 5 at Corkwood Bore

Past RE Implementation Issues

- Little community involvement
- Low reliability
- Little technical support & maintenance
- Energy demand management by default

Bushlight Community Energy Planning Model

- Stages
  - Prepare
  - Select
  - Install
  - Maintain
  - Sustain

Bushlight Household RE System at Dingo Spring
(photo: Bushlight)

Issues arising with capital cost subsidies

- Can create markets when up front costs high
- Need to be long term, not stop-start to encourage manufacturing, sales & services packages, financing
- Can reduce incentives to reduce prices, although increased sales should streamline supply & costs
- Marketing needed but can lead to oversubscription
- Need to ensure quality of products & services
- Best with utility cooperation
- Need to find a way of weaning off subsidy

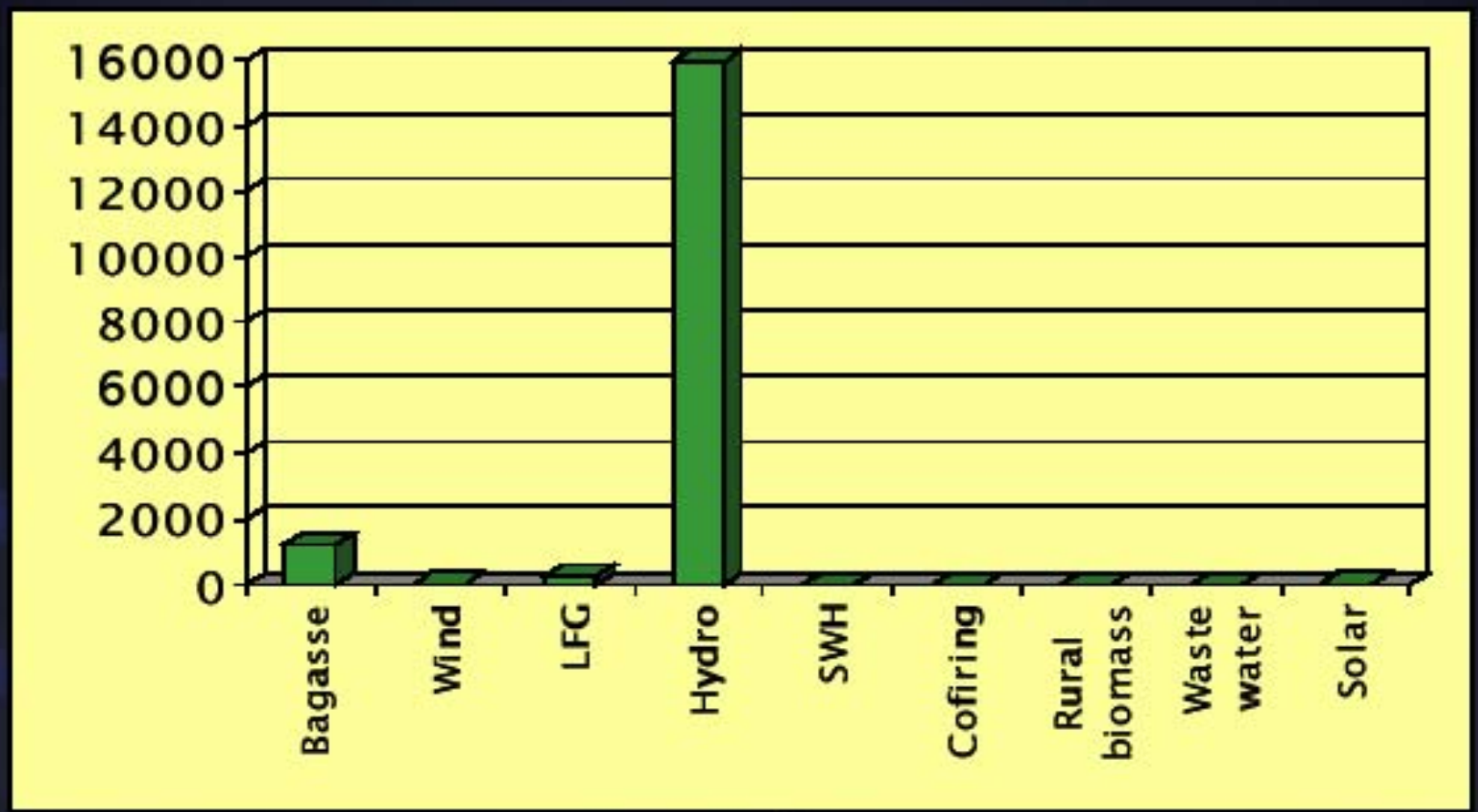
Mandatory Renewable Energy Target (MRET)

- Commenced 1 April 2001
- Target of 9500 GWh additional RE by 2010, based on 1997 levels of 15,970 GWh (mostly large hydro)
- Target level must be maintained to 2020
- Certified RE generators can sell 1 renewable energy certificate (REC) for each MWh generated
- Liable parties (electricity retailers & large users) purchase certificates (or generate their own) according to their annual allocation
- Penalty of $40/MWh for non-compliance

Eligible renewables under MRET

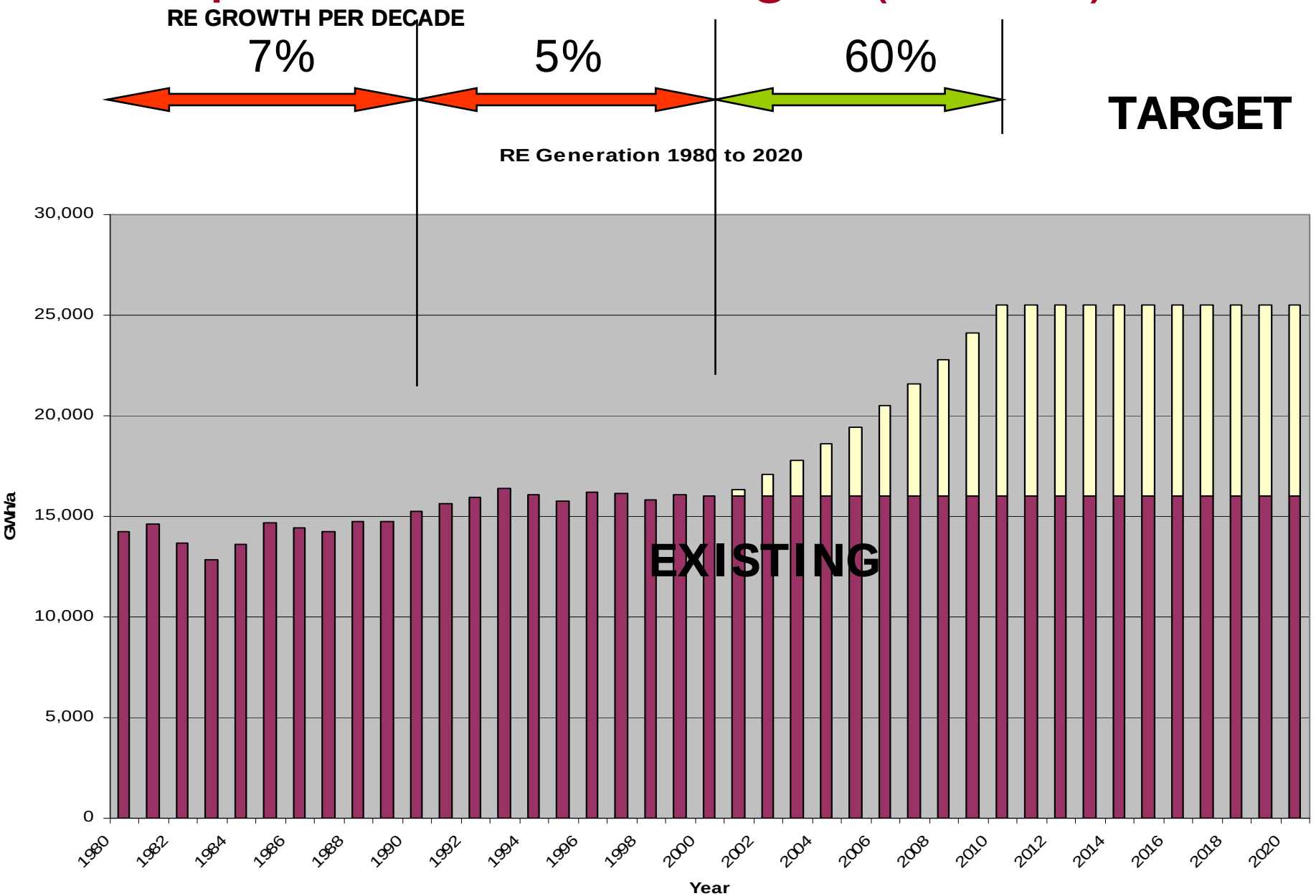
- hydro
- wind
- solar
- bagasse
- co -generation
- black liquor
- wood waste
- energy crops
- crop waste
- food and agric. wet waste
- landfill gas
- MSW sewage gas
- geothermal (HDR and aq)
- ocean
- wave
- tidal
- PV, wind, hydro RSAPS
- solar hot water
- co-firing
- fuel cells

1997 EXISTING RENEWABLES

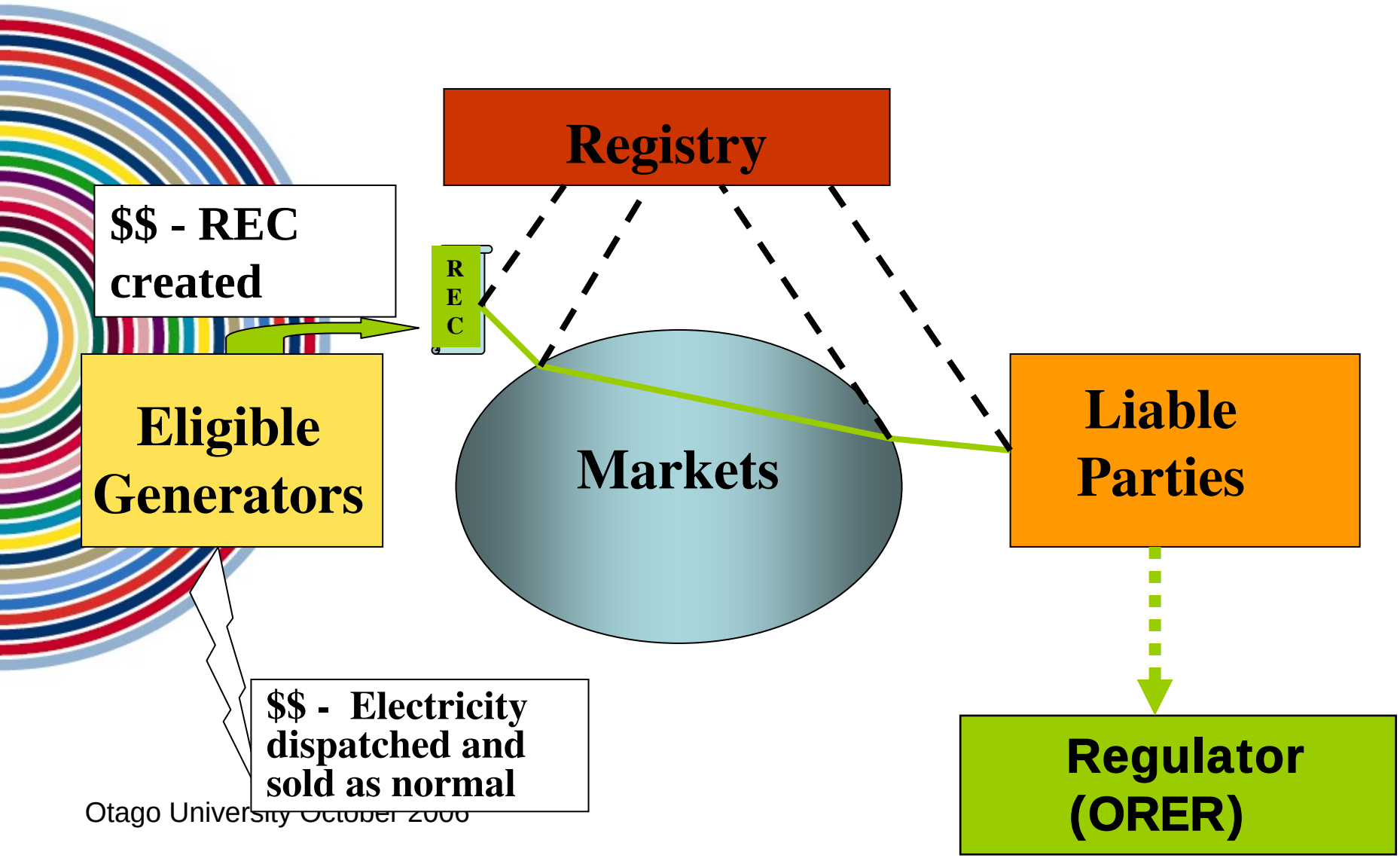


ORER
OFFICE OF THE RENEWABLE ENERGY REGULATOR

Impact of MRET Target (ORER)



THE REC MARKET FORM



CURRENT REC PRICES

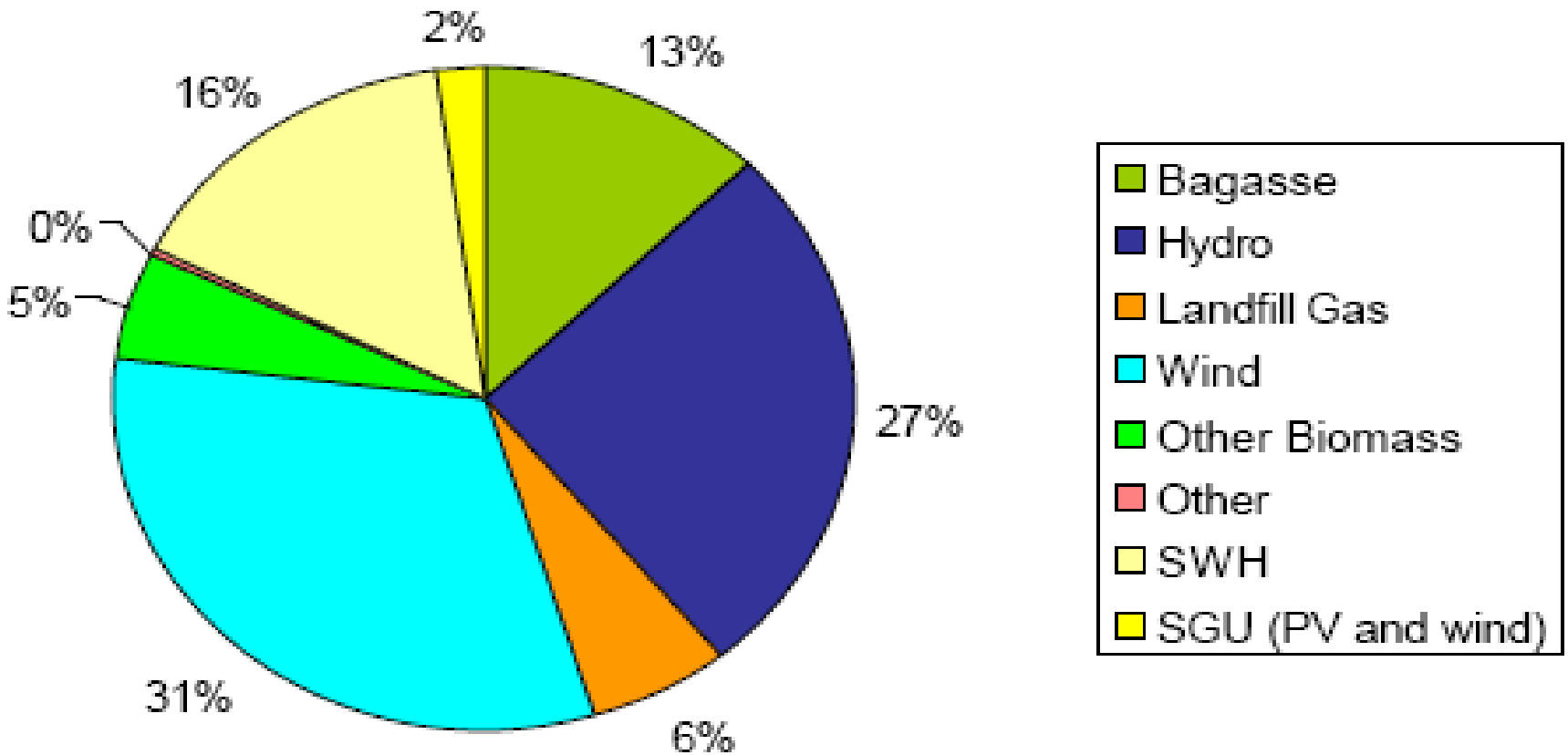
- spot prices around $19 per MWh, down from $35-$40 over the first few years
- Liable parties have now secured sufficient RECs and little new installation likely after current committed projects are installed
- mostly forward contracts ~ $25 per MWh
- Price differentiation depending on fuel source $3-4
- Estimated cost of compliance:

  <0.1% of average electricity price to date

  ~1.3 to 2.5% by 2010

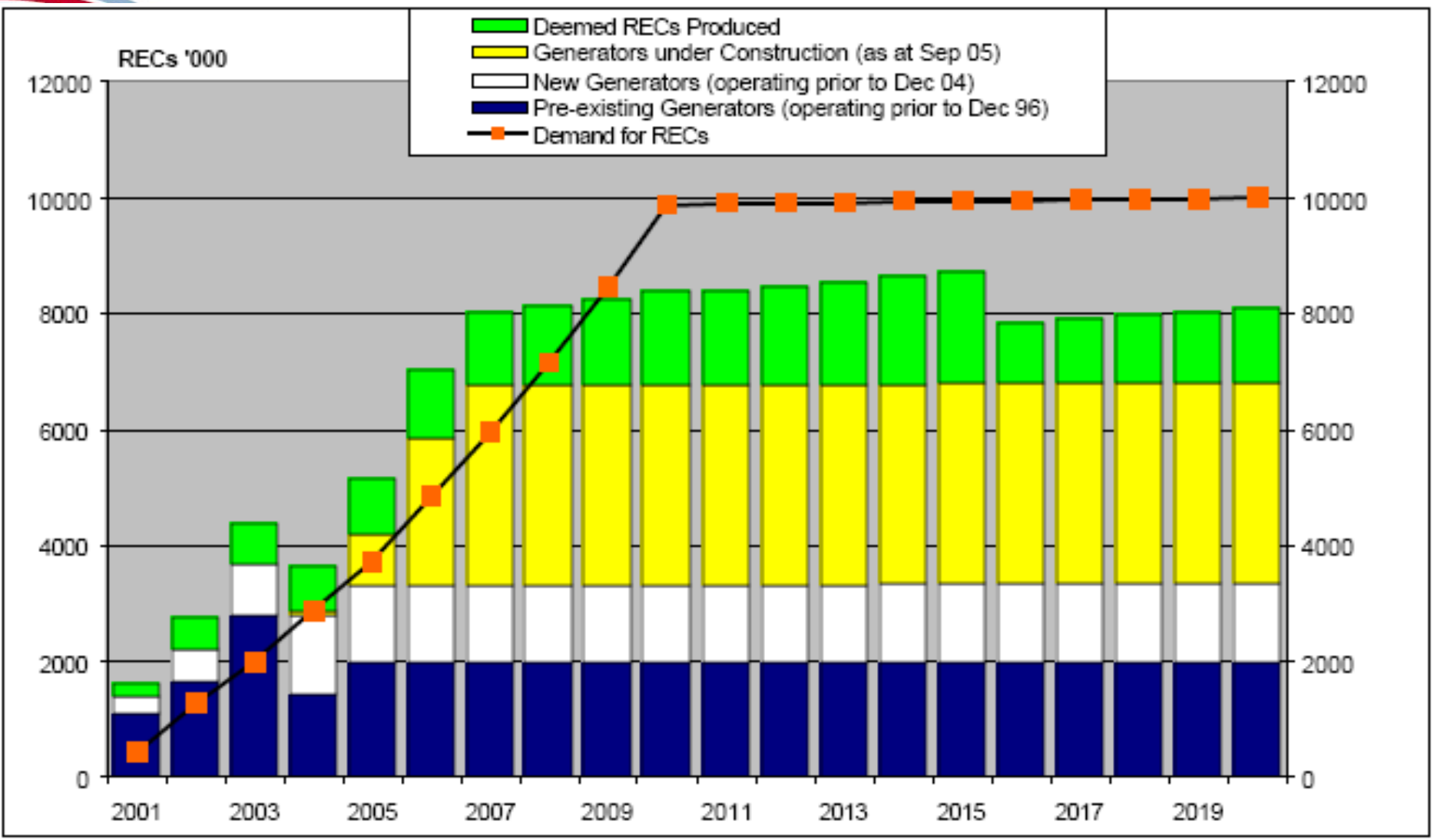
Current Projected 2020 MRET Mix

(BCSE, 2005a)

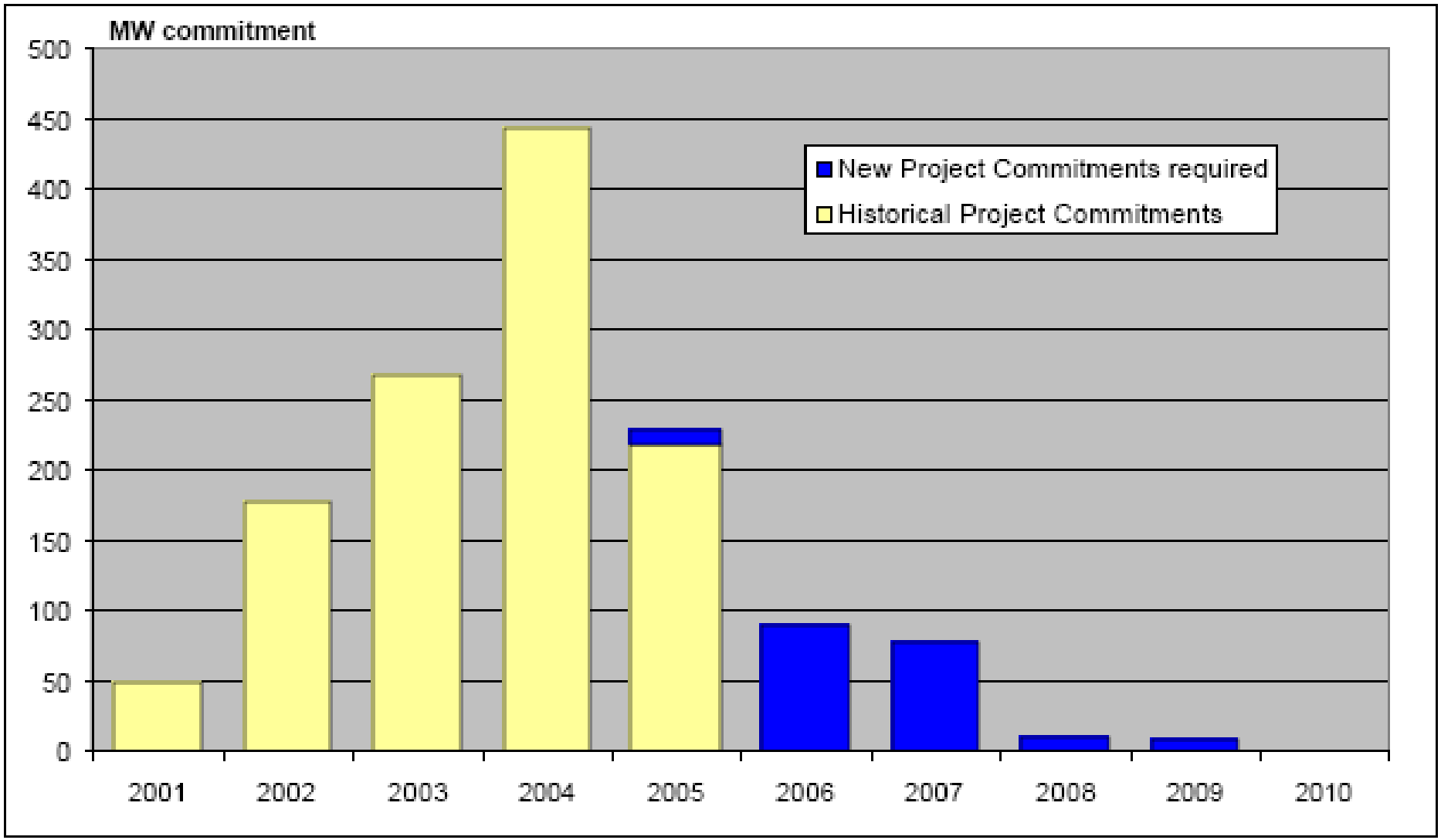


RECs available to meet demand

(BCSE, 2005a)



Projected New Project Commitments Required (BCSE, 2005a)



Implications of MRET

- First longer term RE market based policy in Australia
- MRET moved the focus from research to deployment
- Combined objectives:
  - Industry development
    - $2B projected to be invested
  - Emissions reduction
- Supply side focus
- Fixed target gives no incentive for demand management
- Large increase in electricity usage since 1997 has reduced impact from projected 2% increase in Renewable electricity to around 1%
- Sustainability issues have arisen:
  - biomass sources, native forest products, wind farm siting
- Major beneficiaries have been wind, solar water heaters and existing hydro

Issues arising with Target Mechanisms

- Can be capacity (MW, MWh) or %
- Technology specific or neutral
  - If neutral can favour 1 or 2 mature technologies
- Can be staged to facilitate industry expansion
  - Early project advantage
  - Need for time limit on project eligibility
- Can create ceilings
- Need transparent compliance & disclosure mechanisms
  - Issue with hydro baseline
- Usually small impact on electricity prices

Solar Cities trials

- $75M over 5 years to demonstrate high penetration uptake of solar technologies, energy efficiency, smart metering
- aimed at improving the market for distributed generation and demand side energy solutions
- Tenders called 2005 – must include monitoring and associated tariffs, marketing and financing
- Eleven consortia short-listed
- Adelaide & Townsville announced
- Others pending

Renewable Energy Development Initiative (REDI)

- Launched 2005 - $100M over 7 years as competitive grants to Australian industry to support renewable energy technology:
  - early-stage commercialisation;
  - research and development;
  - technology diffusion
  - proof-of-concept activities
- Projects must demonstrate strong commercial and emissions-reduction potential

Low Emissions Technology and Abatement (LETA) Fund

- $26.9M to reduce greenhouse gas emissions over the longer term for:
  - identification and implementation of cost effective abatement opportunities
  - uptake of small scale low emission technologies in business, industry and local communities
- Support for renewables via an industry development sub-programme available to State and Territory Governments and renewable energy industry associations

Advanced Electricity Storage Technologies

- $20.4M to:
  - overcome barriers to renewables and other intermittent energy sources
  - demonstrate world-leading electricity storage technologies
  - develop creative solutions that benefit both electricity storage and renewable energy industries
- includes batteries, electro-mechanical, thermal and chemical storage

Greenpower

EnergyAustralia's Singleton PV power station

- Voluntary scheme
- reflects importance of customer preference
- Customers pay a premium
- Two models:
  - Contribution products, a fixed amount per quarter or a rounding up of each bill;
  - Consumption products, payments based on a percentage of the customer's bill.
- At least 80% new generation (post 1 Jan 1997)
- Blended products – accredited GP makes up a % of total

Green Power Accreditation

- GP is not delivered directly to customers, need a credible auditing system
- 1997: NSW Green Power Accreditation Program
- 2000: National Green Power Accreditation Program and Steering Group to:
  - facilitate the installation of new renewable energy generators across Australia beyond mandatory renewable requirements;
  - encourage growth in consumer demand for renewable energy;
  - provide consumer choice for, and increase confidence in credible renewable energy products;
  - increase consumer awareness of renewable energy and greenhouse issues; and
  - decrease greenhouse gas emissions associated with electricity generation.

Accreditation (cont)

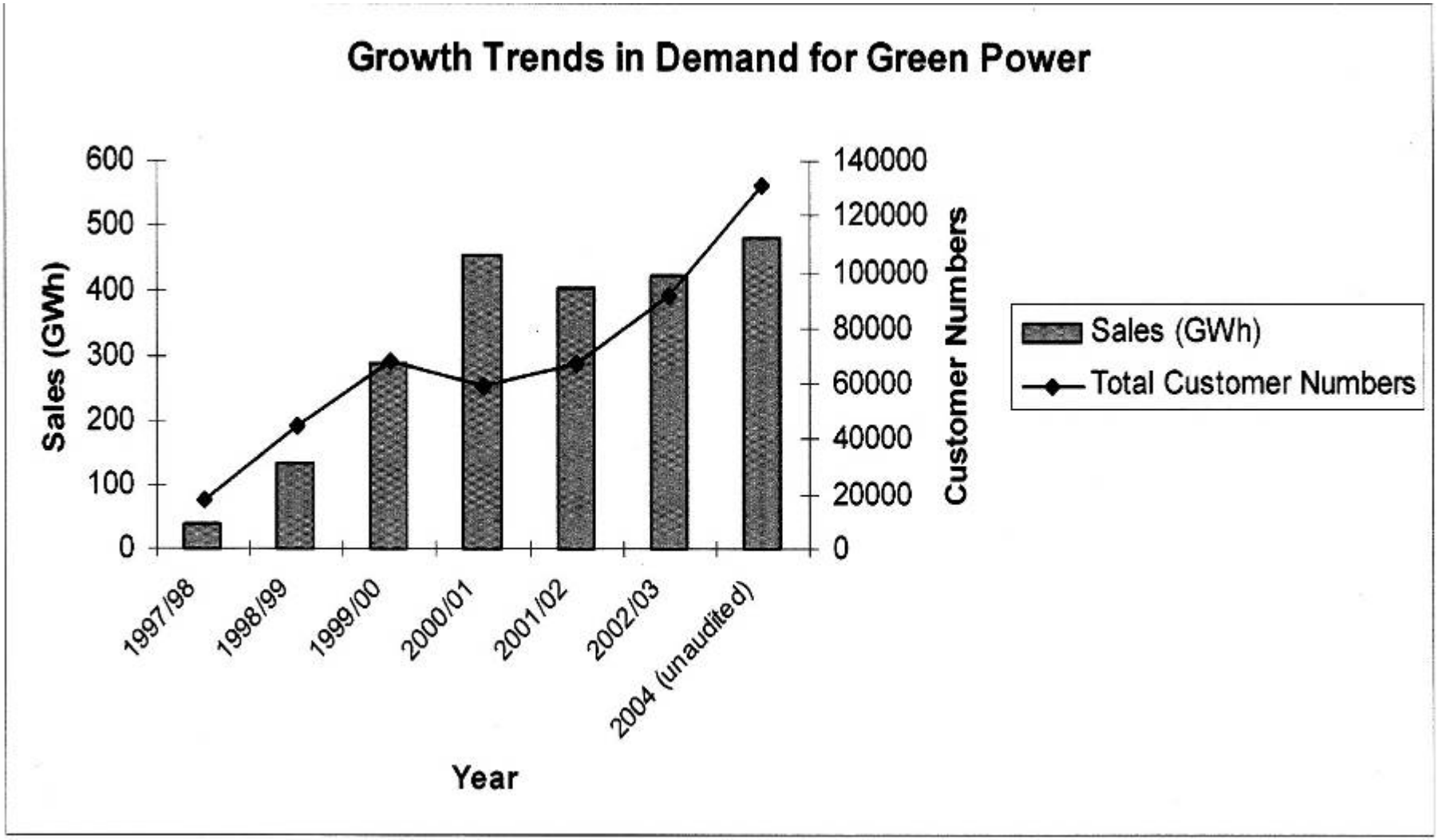
Retailers

- independently audited
- must deposit a REC into a designated GP account held by ORER for each MWh of GP sold (ensures is in addition to MRET requirements)
- must purchase a Green Power Right for each MWh of GP sold

Generators

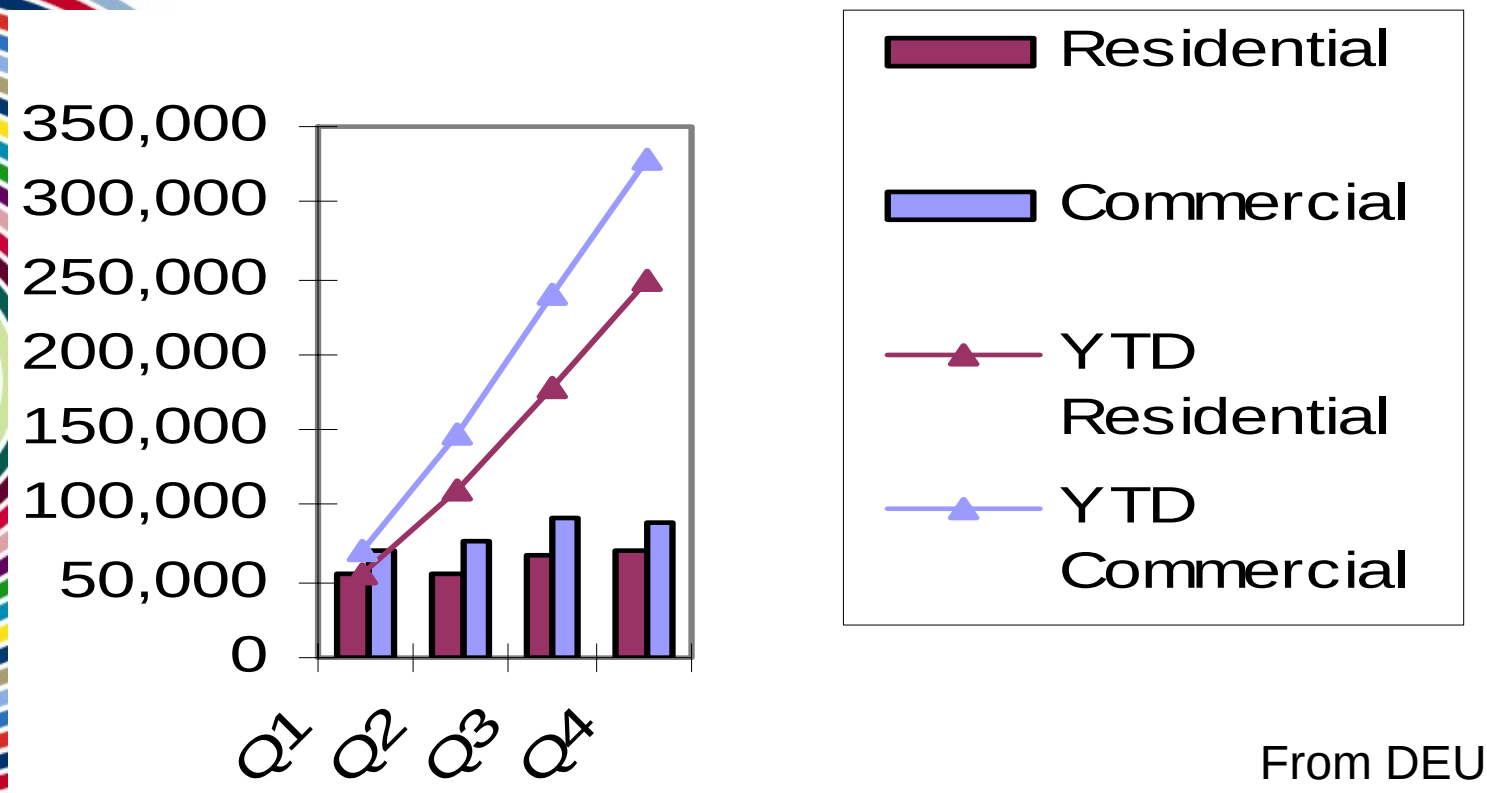
- about 258 generators accredited, 168 are ‘new’
- must comply with Green Power accreditation guidelines
- guidelines stricter than MRET
- no SWH, no old hydro, no old-growth forests
- assessed on case-by-case basis
- must submit Generation Reports (crosschecked with retailer claims of eligible generation)
- create a REC and a GPR for each MWh of electricity generated
- GPRs have very little value, used more for auditing process

GP Growth



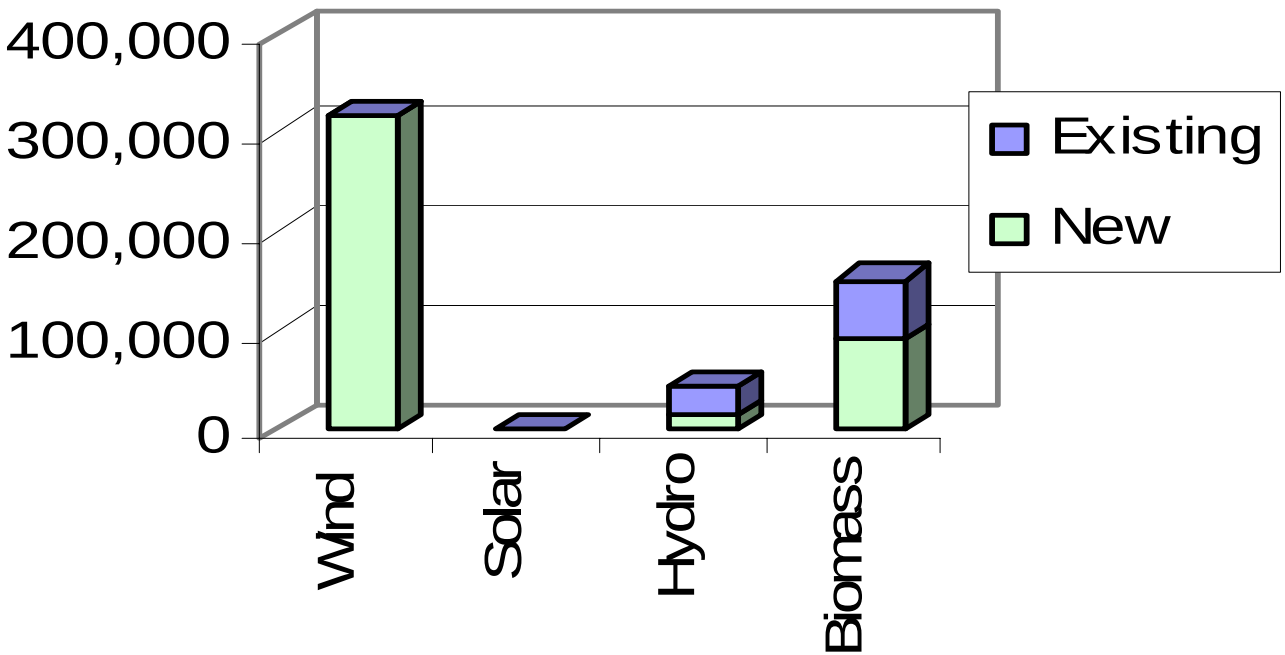
From NGPAP (2005)

Commercial and domestic sales 4Q 2005



From DEUS (2005)

New vs existing generation

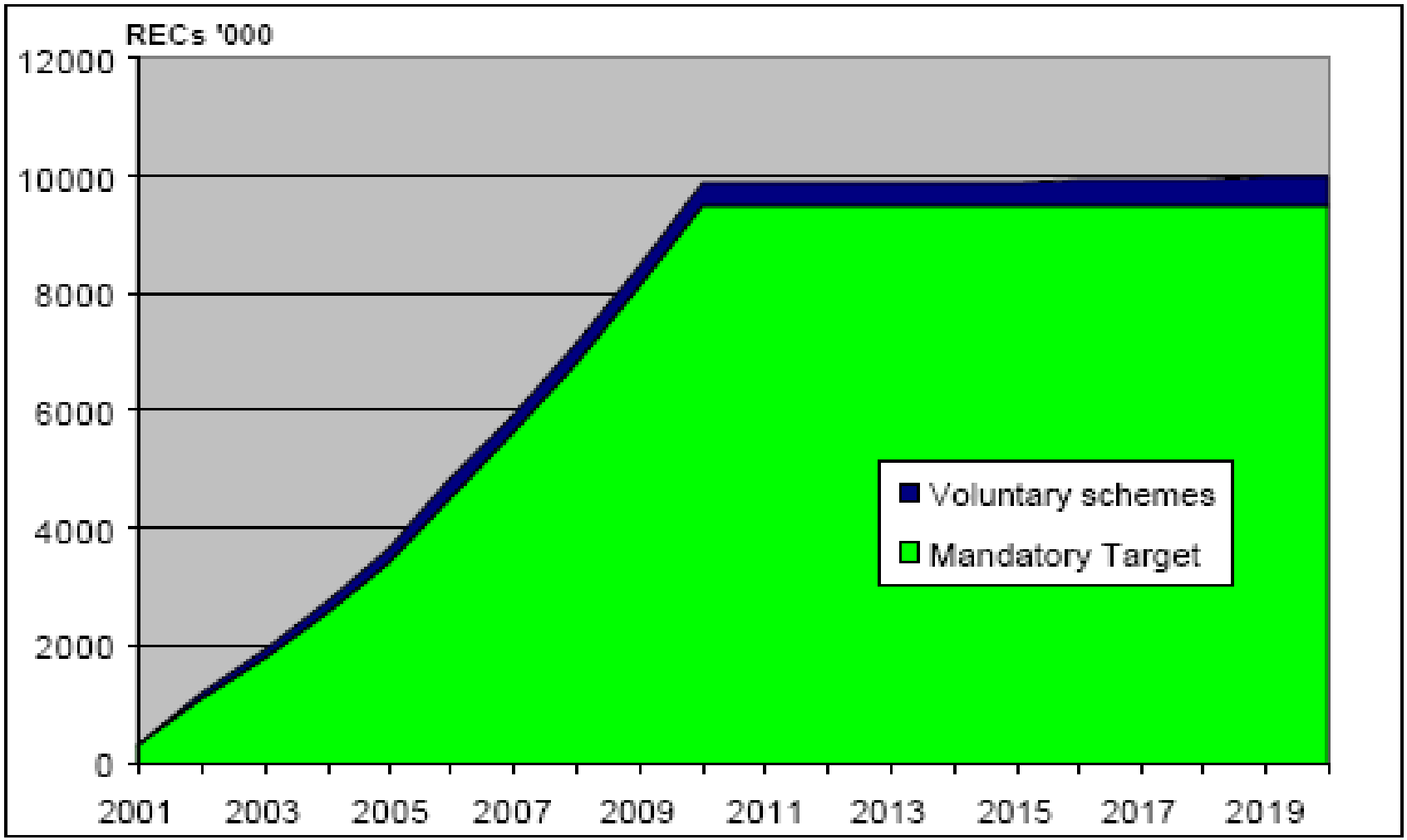


From DEUS (2005)

2005 Report

- 19 Green Power products, offered by 12 retailers
- Just over 200,000 customers
  - up 61% on the same period last year
- commercial sales 56%, residential 44%
- 579 GWh sold in 2004 (0.3% of total in NEM each year)
  - 20% greater than the same period in 2004
- total of about 2,400 GWh since inception (`~ 180MW of wind for 5 years)

Green Power Significance



From BCSE (2005)

Non-accredited Green Power

Generator produces:

- 1MWh electricity (+1 REC and 1 GPR)
- 1 REC ($35; bought by retailer 1 and used to meet MRET obligations)
- 1 GPR ($1; bought by retailer 2 and combined with 1MWh from existing hydro [or even worse, the electricity pool] and sold as renewable energy)

Why Switch to Jackgreen Renewable Energy?

- receive 100% renewable* energy at no extra cost**
- reduce harmful greenhouse gas emissions from your household energy consumption
- benefit from smoothed monthly & quarterly billing plans
- support the renewable energy industry
- help Planet Ark in their commitment to saving the environment

***"For every kilowatt hour of energy used by our customers, an off-setting kilowatt hour of renewable energy is generated."**

From www.jackgreen.com.au

Status of Australia Renewable Energy Industry

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RE Industry Development Issues

- Conflict between aims of ghg reduction & industry development
- No political consensus and hence no consistent industry development support
- Access to customers, networks & information restricted
- Little infrastructure
- Price disadvantages
- High capital vs running costs

Market Challenges

- Energy industry restructuring => competition => lower energy prices
- Evolving community and market expectations for social and environmental accountability
- Rapid technical innovation in a range of energy conversion technologies, particularly small scale distributed electricity
- Consumers interested in end-use services not energy
- Property rights for RE forms not be well-defined, eg. solar access

Wind development

- Australia has world class wind energy resource (long coastline)
- MRET triggered significant project development (over 3000 MW under development)

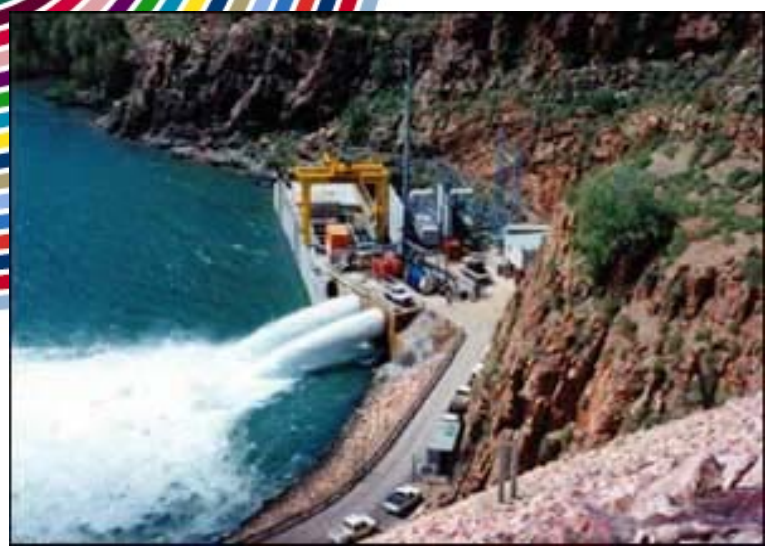
Source: BCSE

Sugar cogeneration - bagasse

- Australia has 30 sugar mills, many at worlds best practice
- Boiler manufacturers export to Asian sugar industry
- CSR $100m expansion at Pioneer mill under way (63 MW)

Source: BCSE

Hydro – international expertise



- International engineering and development consultancy services
- Small hydro also developing

Source: BCSE

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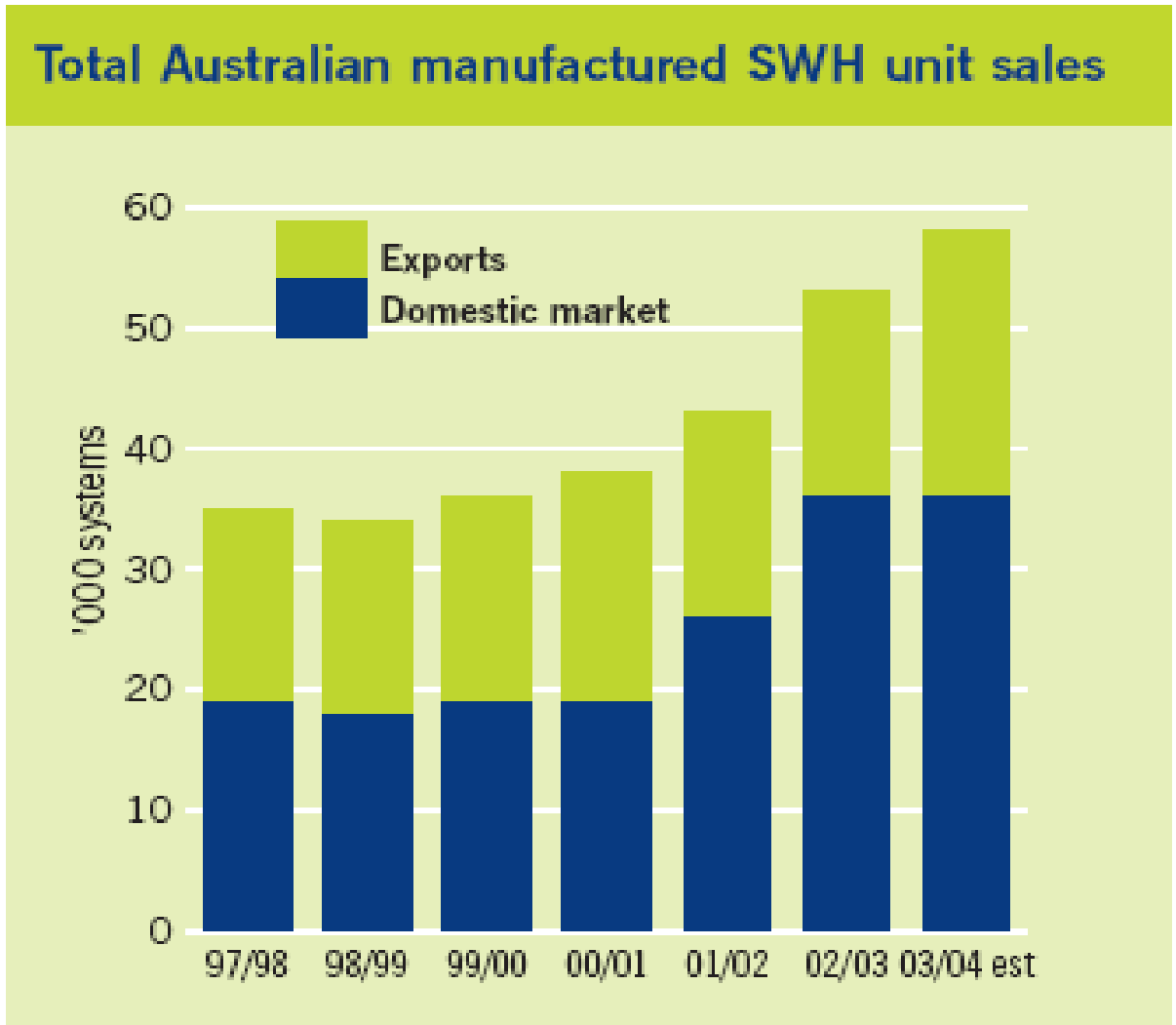
Australian Solar water heater industry

- **Growing at over 30% per annum (from low base) as a result of MRET**
- **State govt building regulations also useful**
- **Currently accounts for 5% of water heater sales**
- **Export to more than 70 countries**
- **5 major manufacturing facilities**

Source: BCSE



Solar Water Heater Production

- Australian production of solar hot water systems since 1950's and regarded as world leaders
- ANU's Combined Heat and Power Solar (CHAPS) concentrator

Source: BCSE

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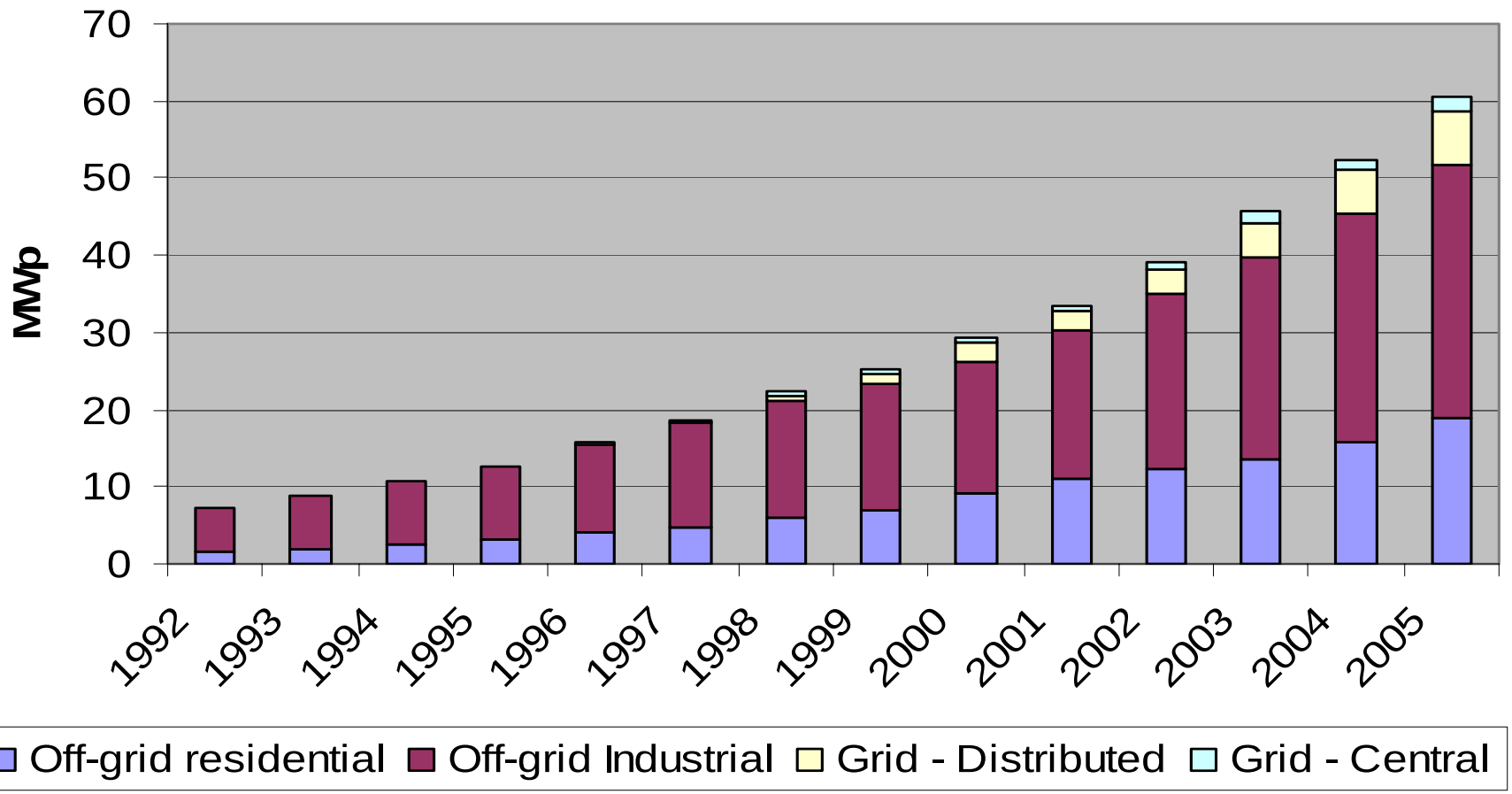
Solar Thermal Electric

- Pyramid Salt – solar pond
- ANU - trough and parabolic concentrators
- SU – linear concentrators with coal fired power stations
- CSIRO – Newcastle Energy Centre – solar thermal ammonia storage system

ANU–Wizard Power Big Dish

Australian Photovoltaics Industry

Installations increasing at 15 % per annum (from very small base)



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PV module manufacturing

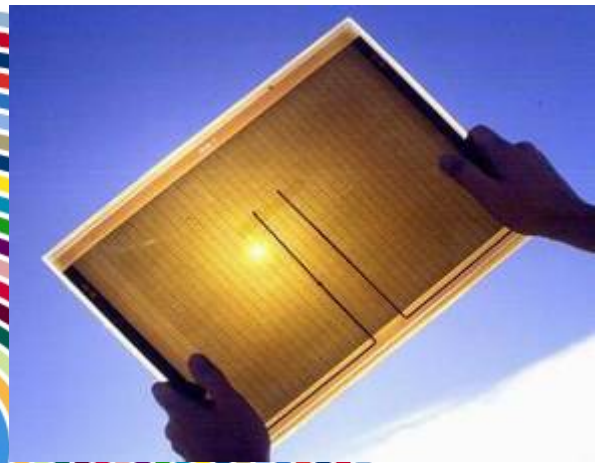
Modules first manufactured in 1975

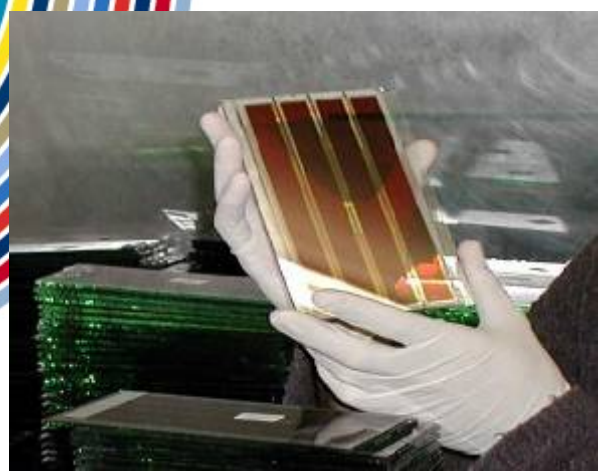
BP Solar's Olympic Park factory, NSW (50 MW/a)

ANU / Origin Energy's new efficient sliver cell (pilot plant Adelaide)

Source: BCSE

Other PV Pilot plants





- Pacific Solar (and UNSW) - Crystalline Silicon on Glass
  - now CSG Solar, manufactured in Germany
- Dyesol's titania dye-sensitised solar cell

Source: BCSE

Remote Power Stations

Solar System's 220 kWp concentrator system (Pitjantjatjara, SA)

Mawson, wind project, Antarctica (Powercorp)

Source: BCSE

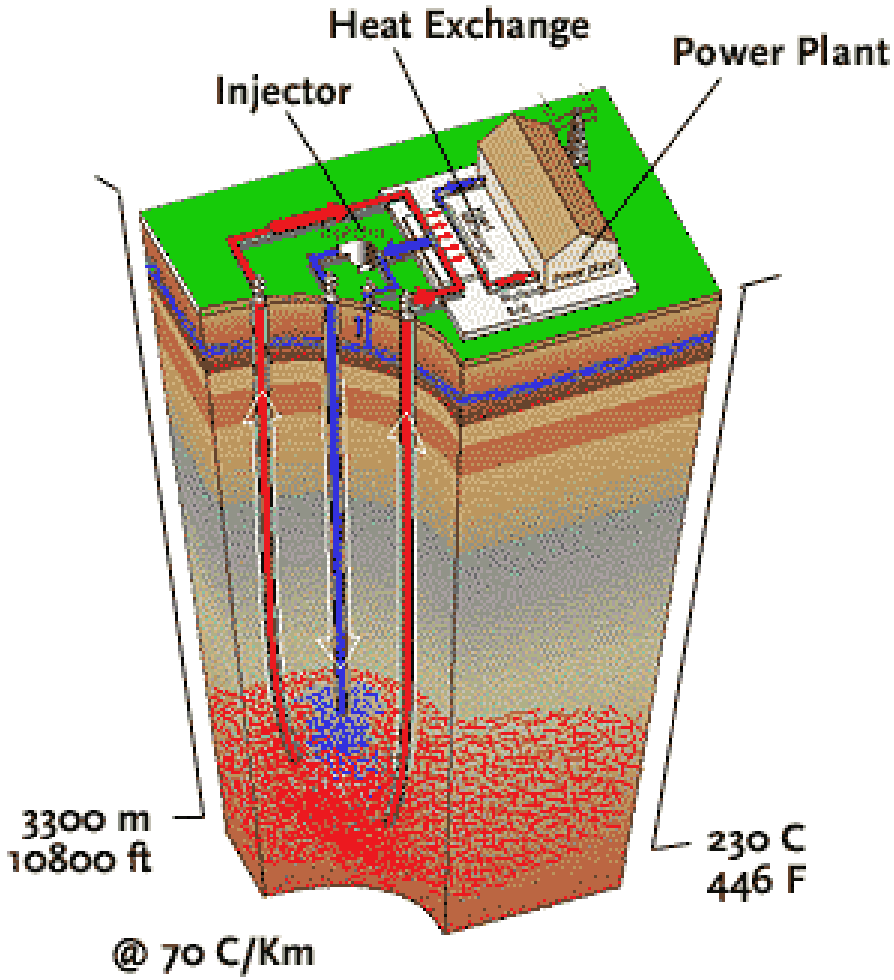
Landfill Gas

- Energy developments
  - 19 projects in Australia and 28 in Europe, Asia and the US

Source: BCSE

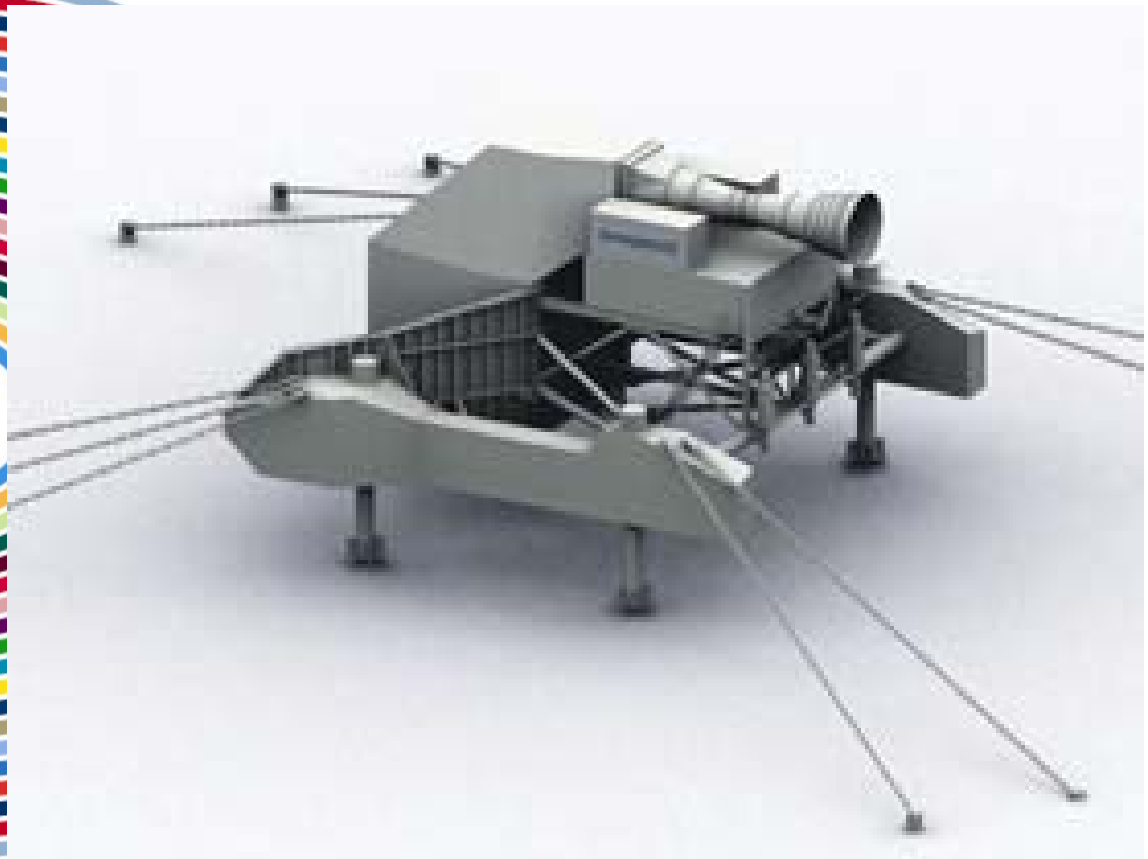
Hot Dry Rocks

- Geodynamics
  - SA pilot plant



Source: Doone Wyborn
ANU Geology Dept

Wave Power



- Energetec Port Kembla
- 500 MWh/an
- 200 m offshore

Employment

Source: BCSE

Technology	Sub-sector	Employment
HYDRO	Manufacturing	50
	Major development and operating companies	1516*
	TOTAL	**1566**
WIND	Manufacturing	205
	Construction	374
	Operations	120
	Other	75
	TOTAL	**774**
PHOTOVOLTAIC	Research & Development	85
	Manufacturers	420
	Distributors	400
	Systems and installation	400
	Utilities and government	30
	TOTAL	**1335**
SOLAR HOT WATER	Distribution and sales	480
	Manufacturing	360
	Installation, administration and research	360
	TOTAL	**1200**
GEOTHERMAL		**100**
WAVE	Construction	10
	Operation and Research	10
	TOTAL	**20**
BIOENERGY	Operation, maintenance and project development	430-500
	Engineering, manufacturing and construction	200-300
	TOTAL	**630-900**
ACROSS ALL TECHNOLOGIES		**5,625 – 5,895**

Status of Australian Renewable Energy Policy

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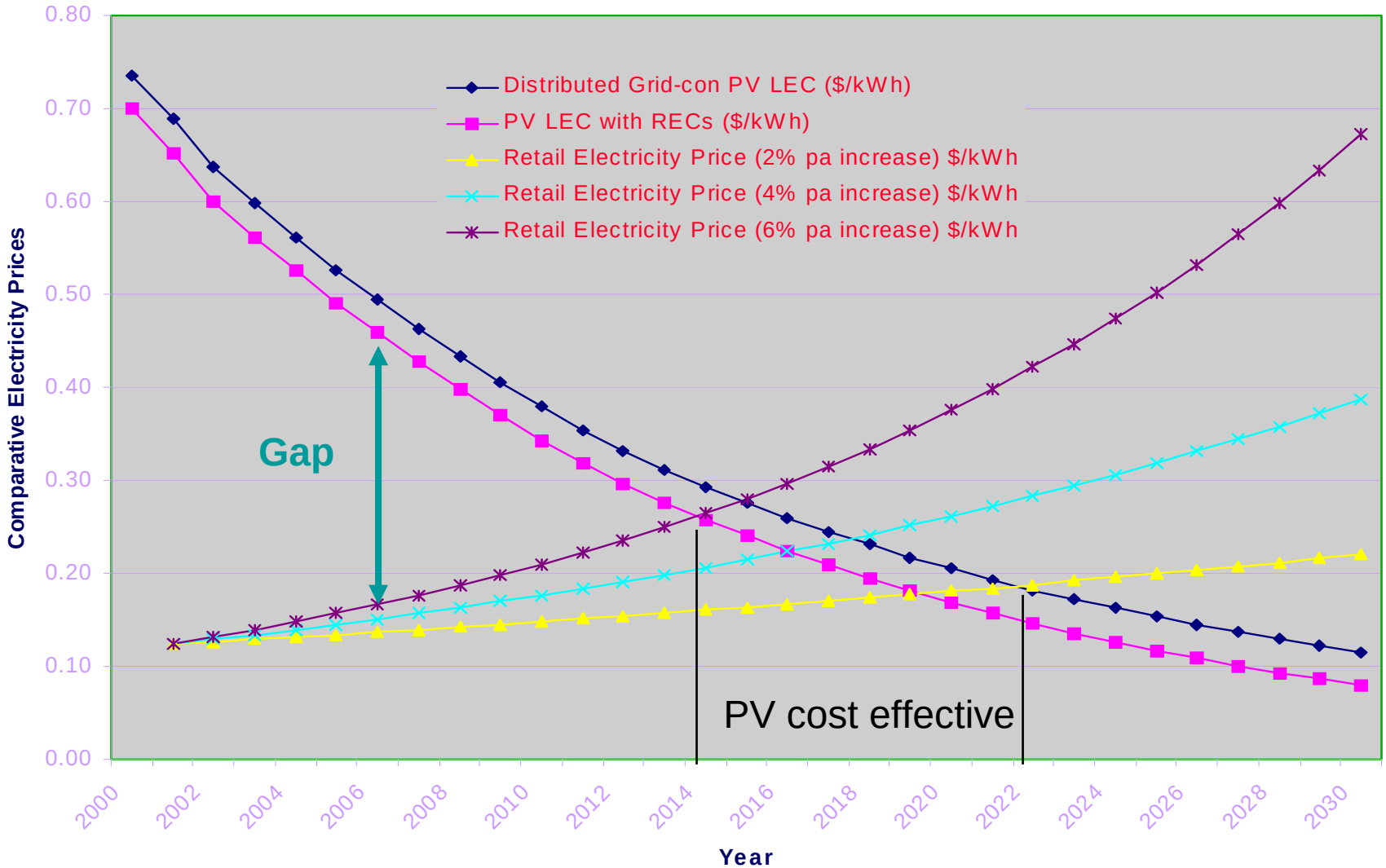
Forecast PV and electricity prices

(BCSE 2004a)



Status of Australian Energy Policy

- Aust not ratifying Kyoto but committed to 108% ghg reduction target
- Focus on AP6
- Europe has emissions trading and is focussed on Kyoto targets
- Australia
  - Will only reach target through accounting processes re changes in land clearing, not through reduced emissions
  - range of RE programmes – focus moved from deployment to R&D
  - no tax or other mainstream support mechanisms
  - beginnings of longer term strategy focussing on carbon sequestration
  - increasing interest in nuclear
  - emissions trading ruled out so far
  - continued increase in emissions, especially from electricity sector

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