



Centre for Energy and  
Environmental Markets

UNSW  
THE UNIVERSITY OF NEW SOUTH WALES  
SYDNEY • AUSTRALIA



## Challenges and Opportunities for Bioenergy to Contribute to an Expanded Renewable Energy Target Within the Australian NEM

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CEEM, UNSW

*BIOENERGY AUSTRALIA 2009  
– FROM OPPORTUNITY TO  
IMPLEMENTATION*

*Gold Coast, 8-10<sup>th</sup> Nov. 2009*



# Bioenergy's diverse values

## ■ Energy

- depends on investment + operational costs compared against benefits of energy provision + alternative supply options
- *significant temporal + locational variability + uncertainty determined by desired energy services, combined investment + operational characteristics of all demand + generation*

## ■ Environmental

- greenhouse emission reductions – electricity related reductions depend on displaced generation; possible lifecycle issues; also highly prospective sequestration opportunities for some bioenergy options
- Industry development provides future option for energy transformation
- Potential regional air + water benefits, yet also costs

## ■ Social

- possible investment + job outcomes with industry development, largely focused in regional Australia
- As with all technologies, major deployment will require social consensus



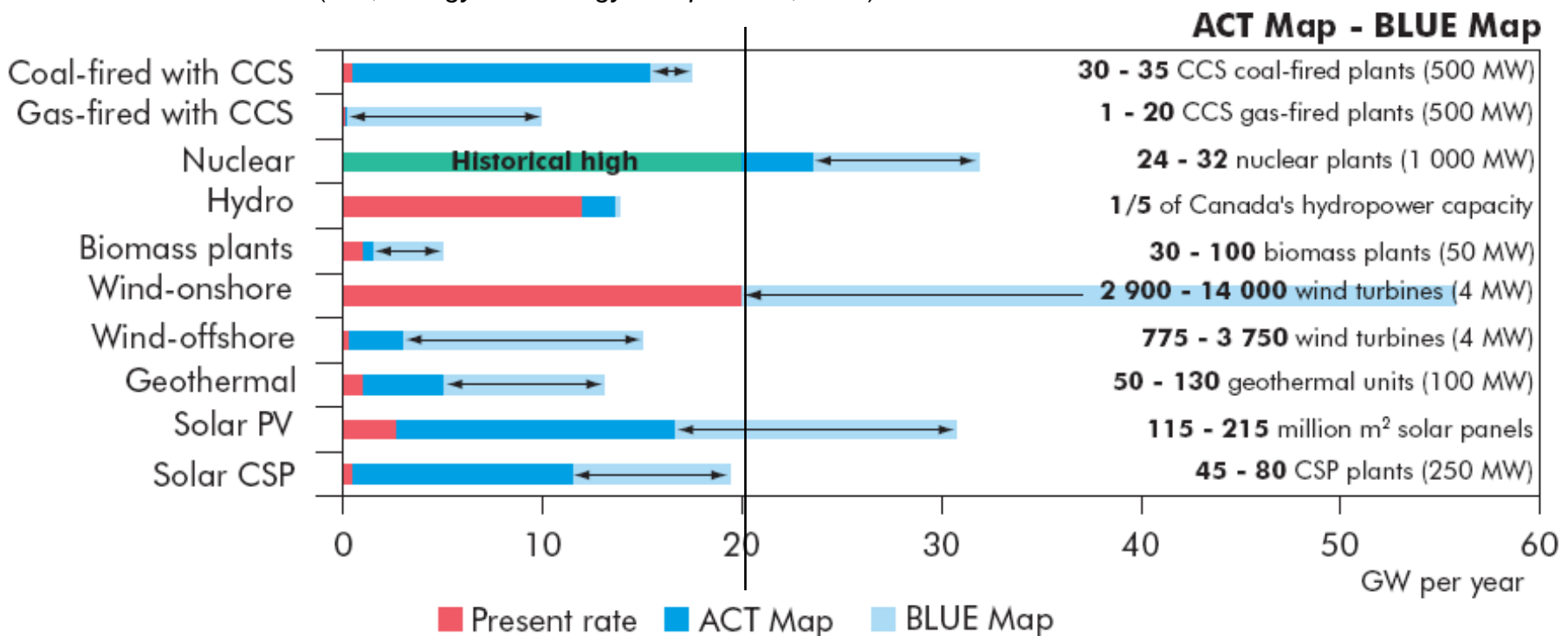
# Bioenergy – proven potential for low-carbon energy futures

Likely major role for climate protection, especially short-med term

- Eg. IEA *Energy Perspectives Scenarios* (BLUE = 450ppm) for 2050 suggest potential Bioenergy role around 30% of coal-fired generation with CCS ... *and Bioenergy currently exists*

**Figure ES.3** ▶ Additional investment in the electricity sector in the ACT Map and BLUE Map scenarios (compared to the Baseline, 2005-2050)

(IEA, *Energy Technology Perspectives*, 2008)

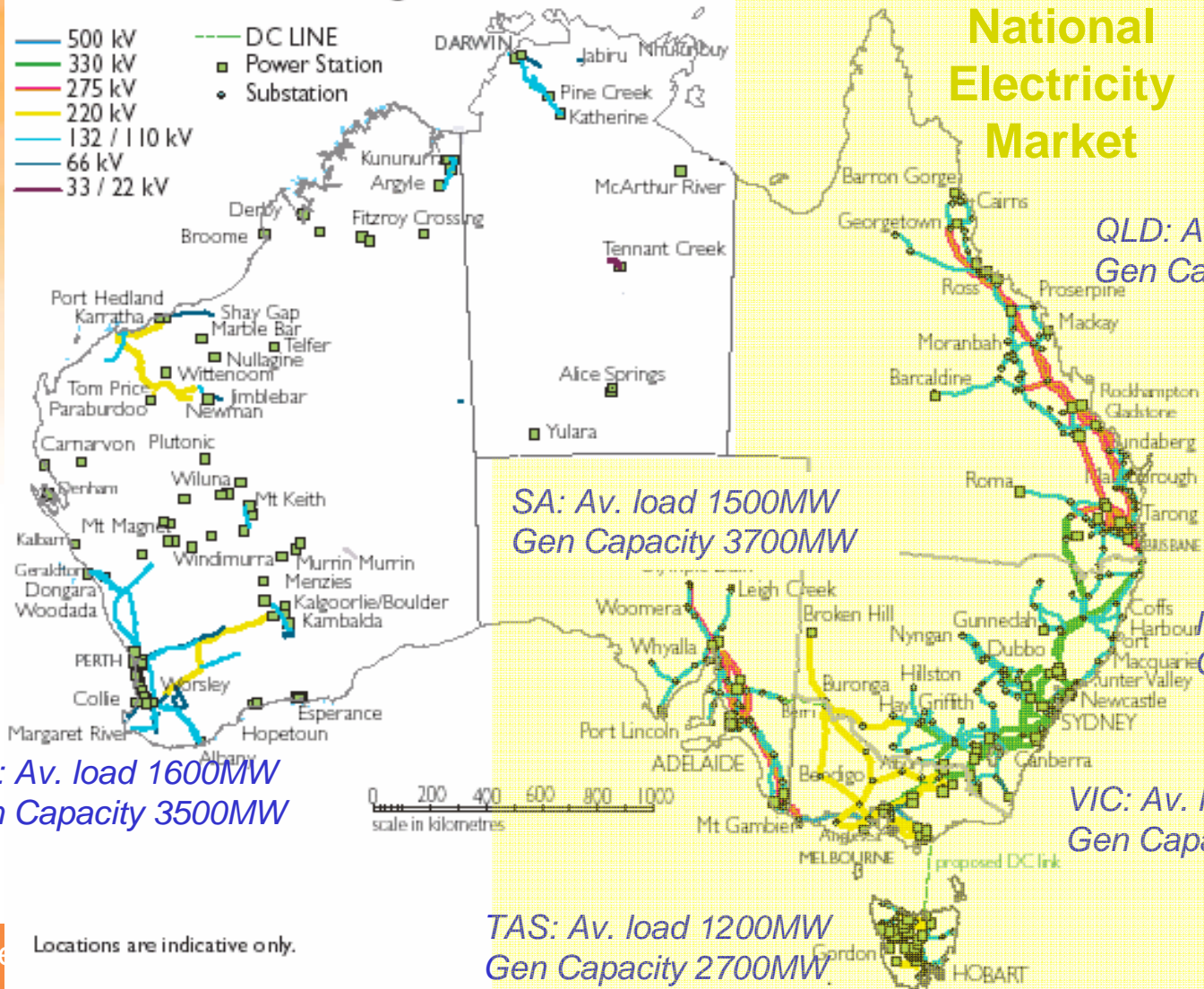




# NEM: Our largest environmental (externalities) market

## Transmission lines and generators

- 500 kV
- 330 kV
- 275 kV
- 220 kV
- 132 / 110 kV
- 66 kV
- 33 / 22 kV
- DC LINE
- Power Station
- Substation



## The Australian National Electricity Market

QLD: Av. load 5600MW  
Gen Capacity 11,300MW

SA: Av. load 1500MW  
Gen Capacity 3700MW

NSW: Av. load 8500MW  
Gen Capacity 12,500MW

VIC: Av. load 5700MW  
Gen Capacity 8800MW

TAS: Av. load 1200MW  
Gen Capacity 2700MW

WA: Av. load 1600MW  
Gen Capacity 3500MW

Challenge Locations are indicative only.

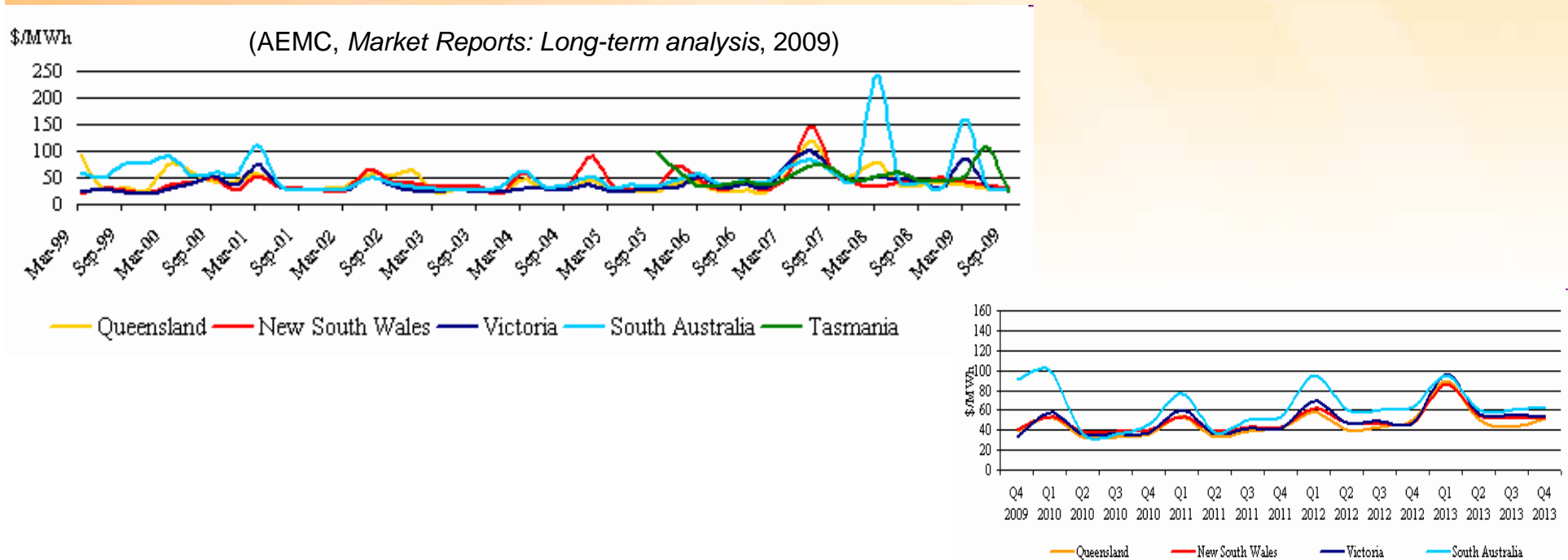


## National Electricity Law: *Overall objective for the National Electricity Market (NEM)*

- *NEL Section 7:*
  - *The national electricity market objective is to promote efficient investment in, and efficient use of, electricity services for the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system*
- Lack of environmental and wider sustainability objectives is a **design choice**
- *If societal desire that NEM contribute to achieving sustainability objectives then governments have to implement ‘external’ policies that will drive such changes*  
*Not an imposition but an obligation for market participants...*
- ...and the NEM needs to facilitate technical, institutional and behavioural change towards such changes



# NEM spot price history... and directions





## Where from ... and next for NEM?

- NEM appears to have performed reasonably well to date in securely & reasonably efficiently supplying growing demand & peak demand, integrating modest wind & managing brief periods of energy constraints
- However, prices rising due to range of (non-climate policy) drivers and emissions have climbed significantly
- Current NEM restructuring efforts relevant to challenges including climate policies
  - **Integration of intermittent generation a key challenge**
  - Gas markets
  - Demand-side participation
  - Retail Markets
  - Advanced Metering Infrastructure
  - Network investment



# Large and growing emissions – the reason is coal

(Australian figures – NEM has higher per-capita emissions & intensity)

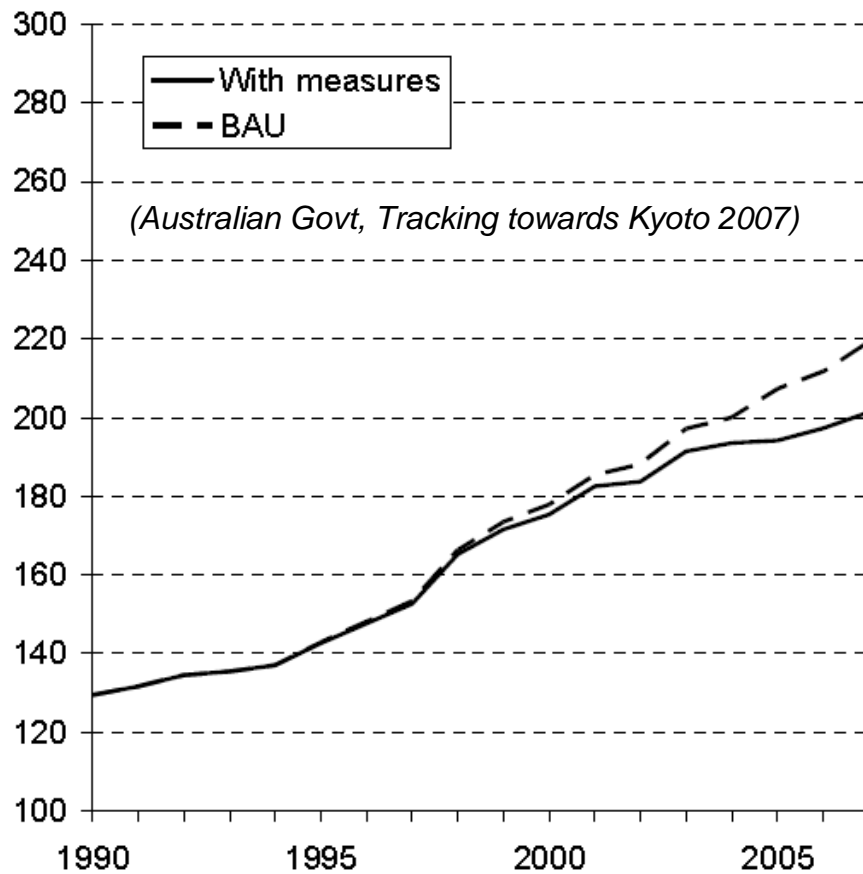


Figure 7.9 Per capita emissions due to electricity, 2005

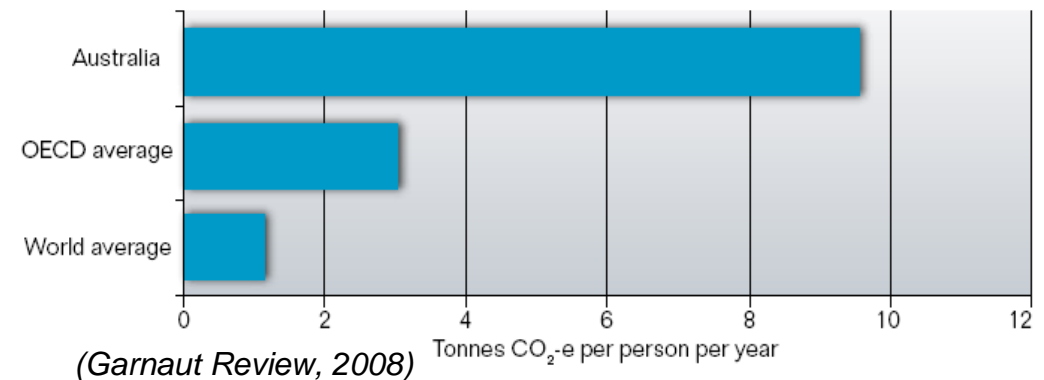
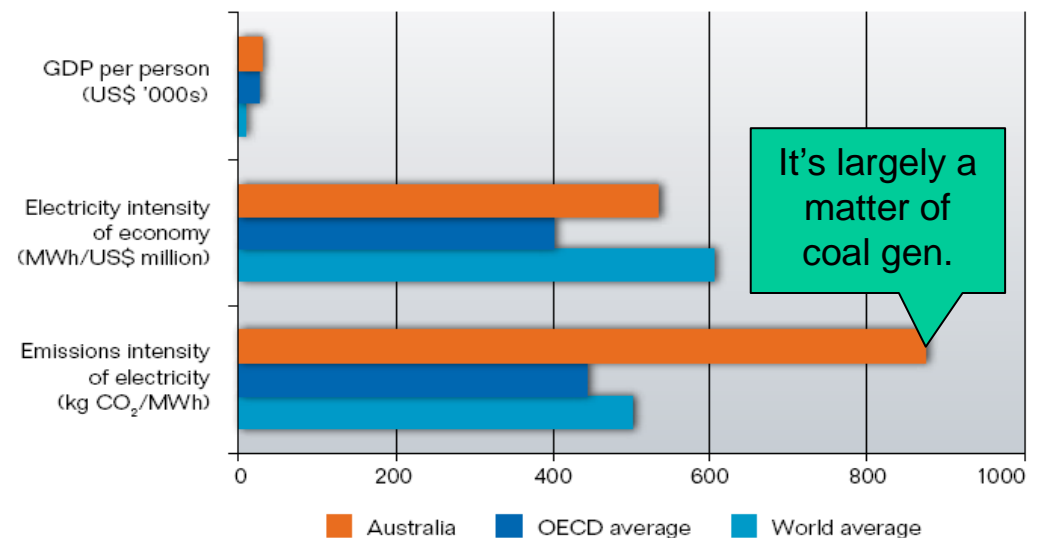


Figure 7.10 Factors underlying per capita electricity emissions, 2005

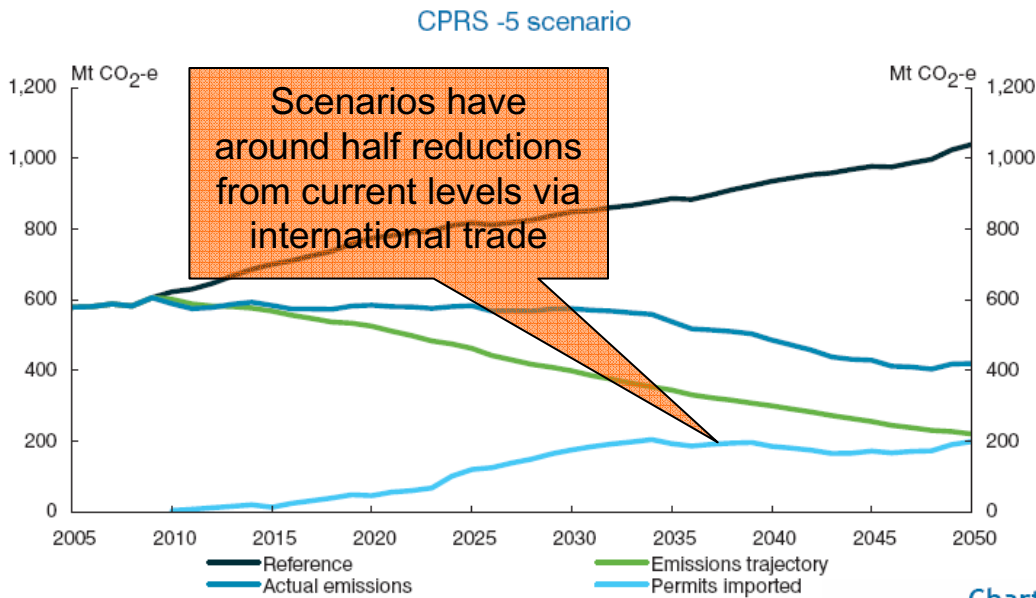




## Possible CPRS impacts on electricity industry

- CPRS may drive little significant change to at least 2020
  - Proposed weak reduction targets, especially -5%
  - Proposed CPRS design with borrowing, price cap, unlimited use of international CDM credits, forestry opt-in, ongoing subsidies to large EITE, significant so-called ‘compensation’ to large electricity industry emitters subject to ongoing contribution to ‘reliability’, very limited targeted assistance to drive efficiency improvements or bring in low emission technologies, initial subsidies to offset fuel price increases...
  - Electricity Industry seen as the key sector for CPRS impact, however Government White Paper acknowledges CPRS unlikely to have major impacts to 2020 beyond changing new investment to lower emission options
    - .... Only limited opportunities for such investment if CPRS doesn't drive exit of high emitting activities and plants... will only drive exit if destroys value of large emitters – is there political will for this?*

Chart 3.6: Australia's trajectory, actual emissions and permit trade



# CPRS: Some earlier treasury modelling details

(Australian Treasury, *CPRS Modelling*, 2008)

Chart B.6: Energy commodity price assumptions  
Foreign currency – 2005-06 dollars

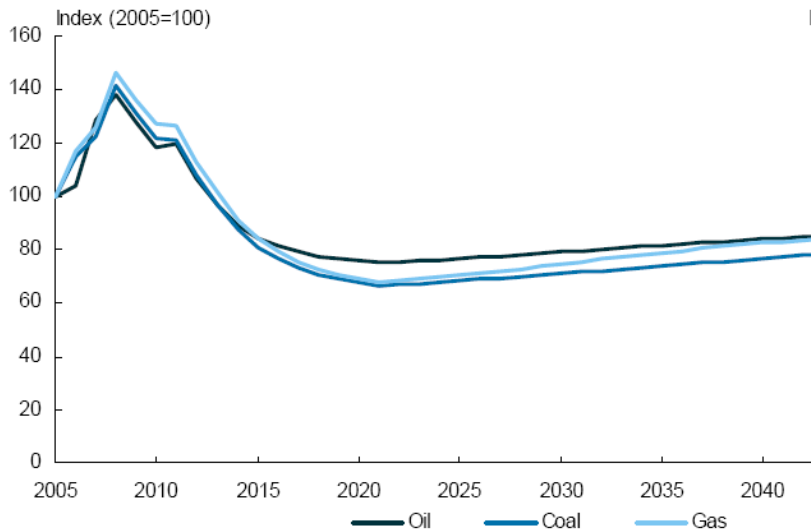
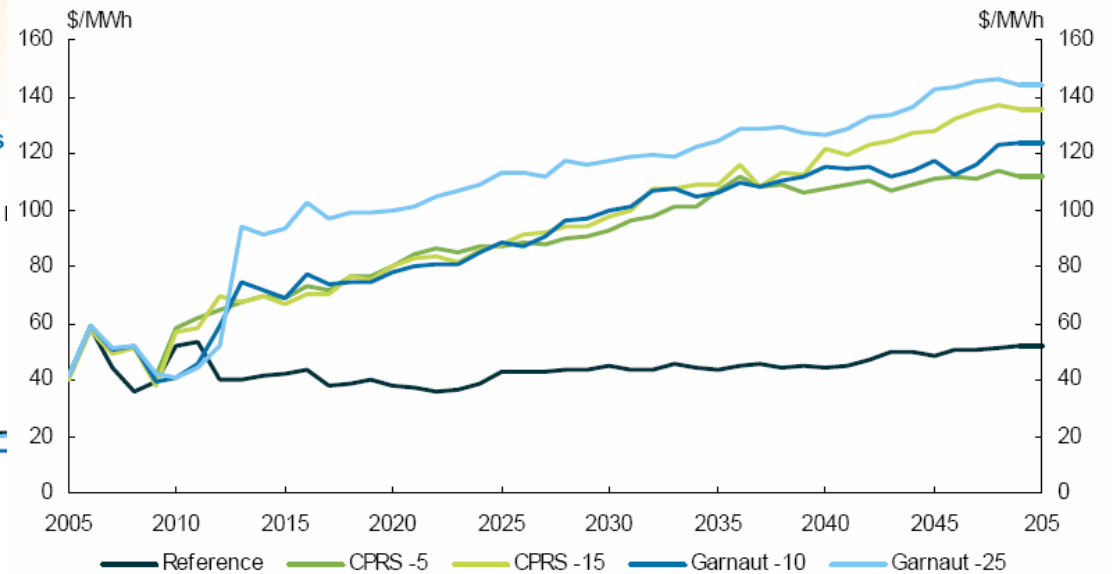


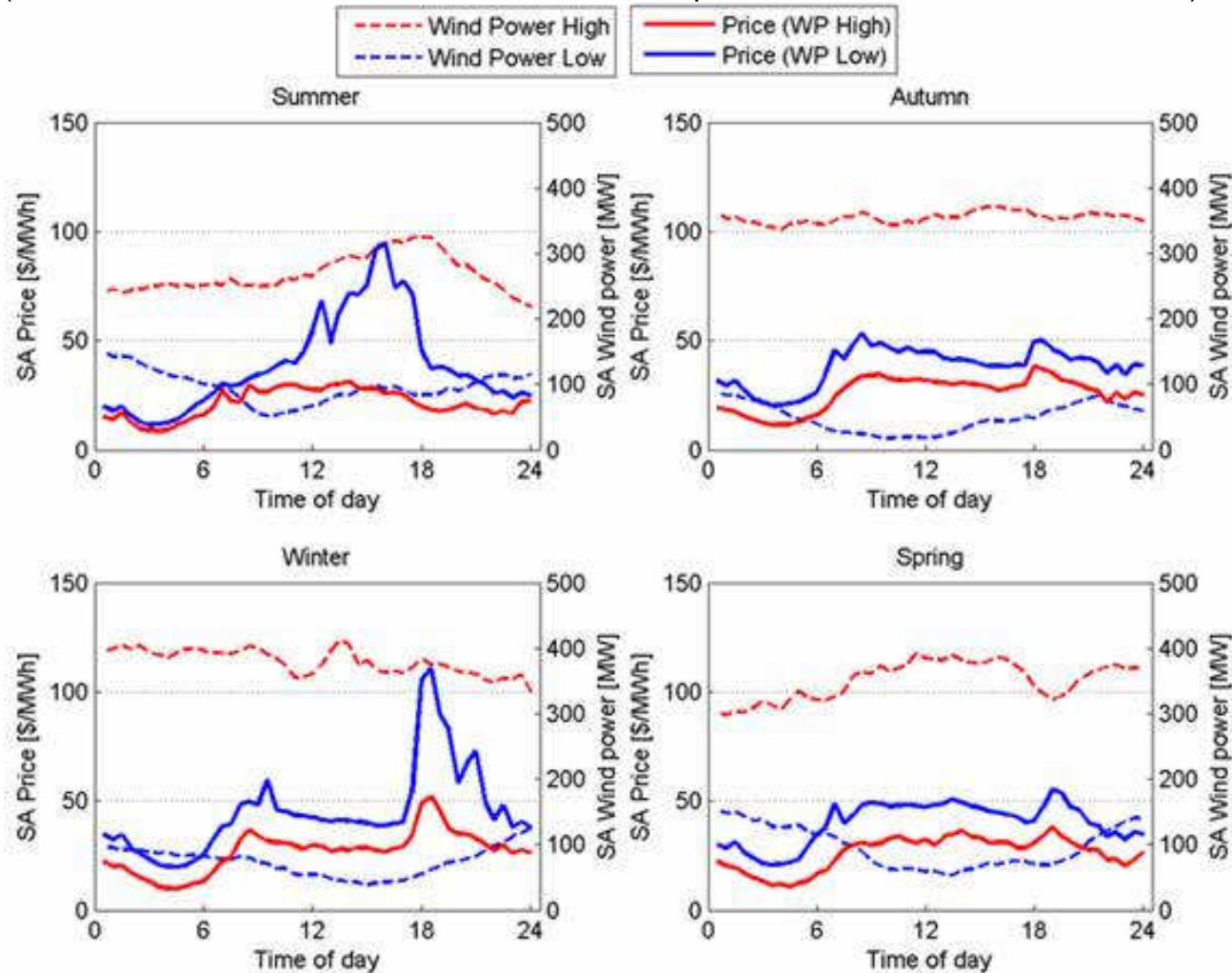
Chart 6.27: Average Australian wholesale electricity prices





# An opportunity for bioenergy: dispatchability has significant potential value

(Cutler, MacGill and Outhred, *CEEM Discussion Paper on Wind in South Australia, 2009*)





# MRET... + eRET- 'designer' markets

Succeed or fail on quality of governance

The objects of this Act are:

- (a) to encourage the additional generation of electricity from renewable sources; and
- (b) to reduce emissions of greenhouse gases; and
- (c) to ensure that renewable energy sources are ecologically sustainable.

RE Certificates representing 1 MWh of new 'renewables'

Initially set as 9500 GWhyr 2010-20

non-zero baseline if pre-1997

**REC providers**  
Deliver certified new Renewables to create RECs

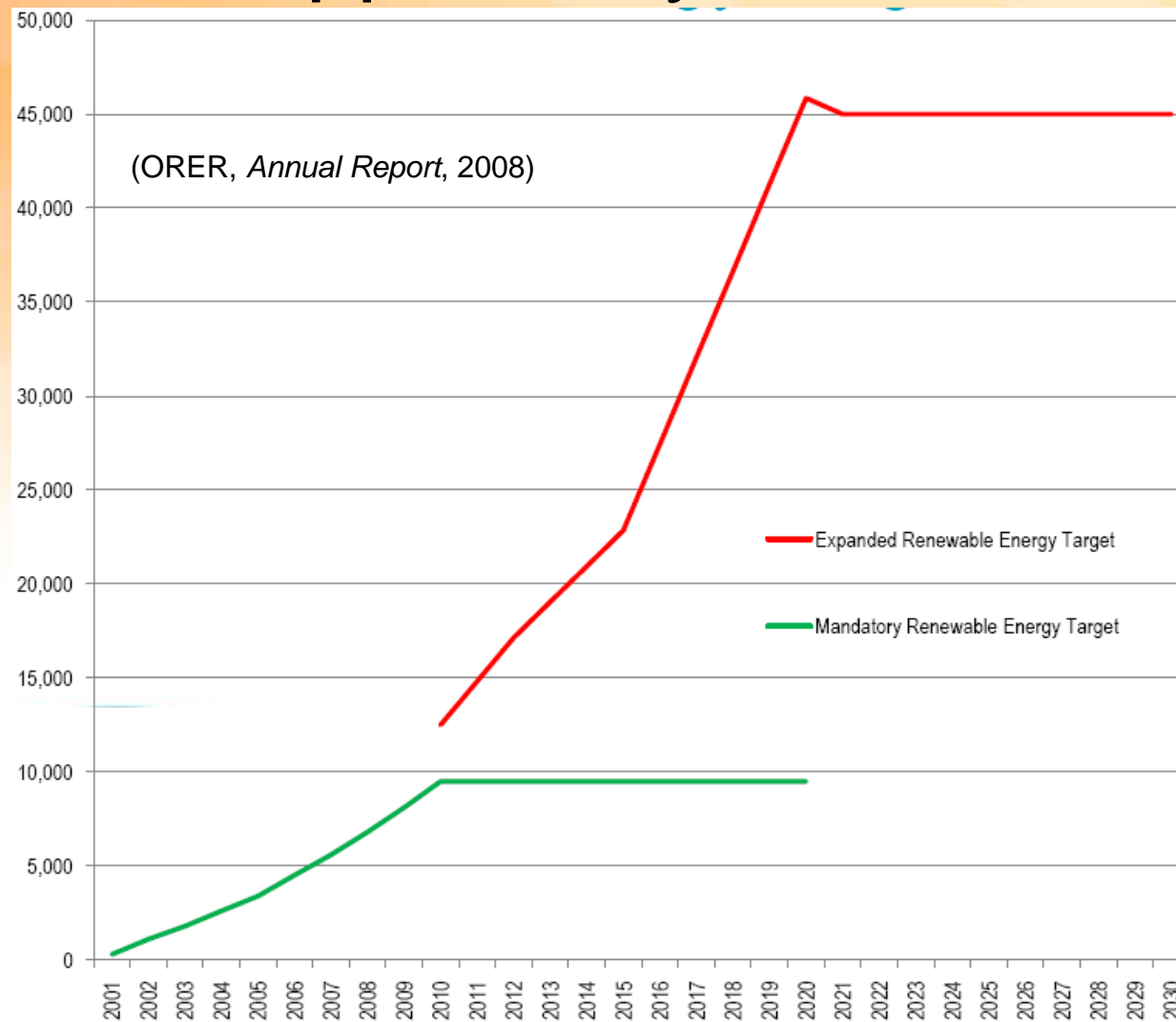
**RE Certificate trading**  
To improve economic efficiency

**Liabile parties**  
Obligated to acquit RECs as part of societal obligation

**Scheme administrator**  
Certify Certificates      Maintain register      Ensure liable parties oblige



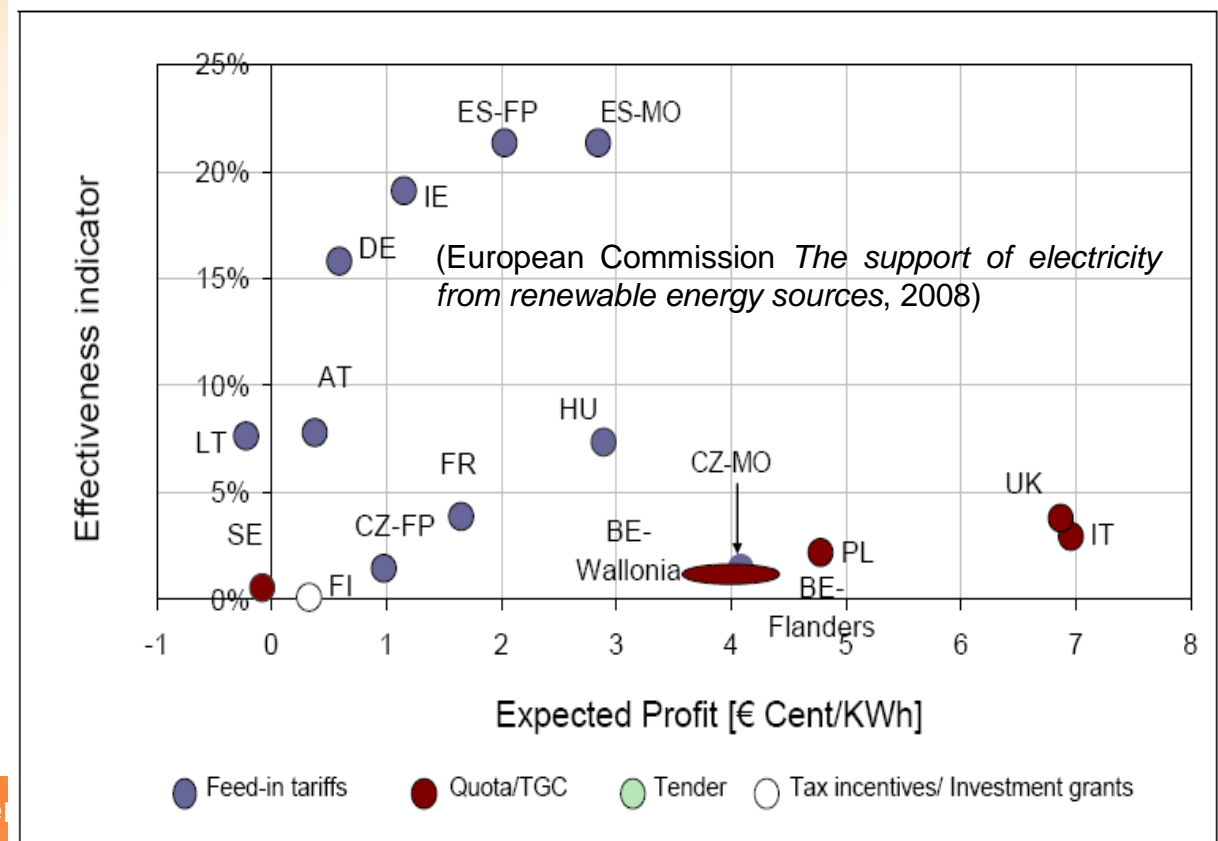
# The eRET opportunity





# MRET performance to date... and for 2020?

- **To date:** modest ramping target easily met + considerable new investment with apparent efficiency – low subsidy \$/MWh by international standards
- **Yet:** international experience generally poor with certificate schemes for reasons that seem to include governance capture by incumbents, risks for developers, market power on ‘buy’ side, single price for all
- **NEM** increasingly stressed infrastructure, changing structure including gentailers
- **Hence,** past modest success no guarantee of future performance with a significant target





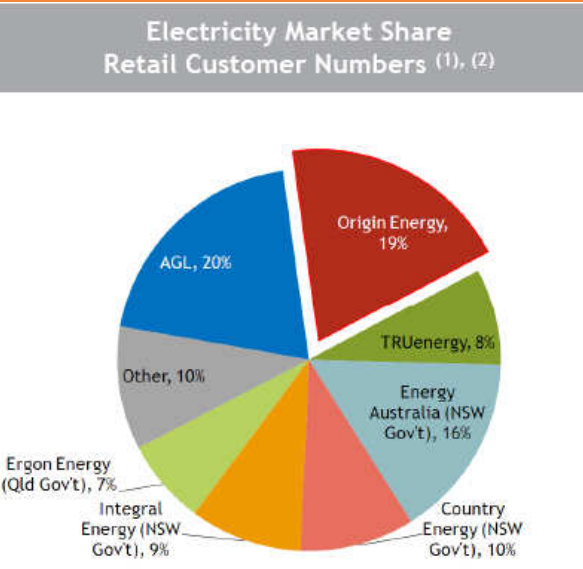
# eRET design

- Eligible sources
  - same criteria as current MRET scheme including solar hot water:
  - **Comment: SHW is not renewable electricity generation – weakens target. Inclusion of Heat Pumps even more problematic – an energy efficiency option**
- Project eligibility periods and treatment of existing generators
  - No limit to timeframe within which projects may create RECs.
  - All existing projects eligible under MRET eligible for eRET for life of scheme
  - **Comment: projects financed on basis of 2020 target now earn RECs for another 10 years including 'old hydro' earning windfall profits**
- REC multiplier for small generators (first 1.5kW of system capacity)
  - 5 RECs/MWh of deemed renewable energy to June 2012, ramping down to 1 REC/MWh from July 2015
  - **Comment: Phantom RECs reduce real target. Feed-in tariffs likely a better choice for small generators. eRET should not be expected to address all policy 'gaps'**
- Non-participation by EITE consumers in paying for eRET
  - **Comment: governance appears to be going backwards – MRET 'principle' of paying according to usage abandoned**



# Early challenges for eRET

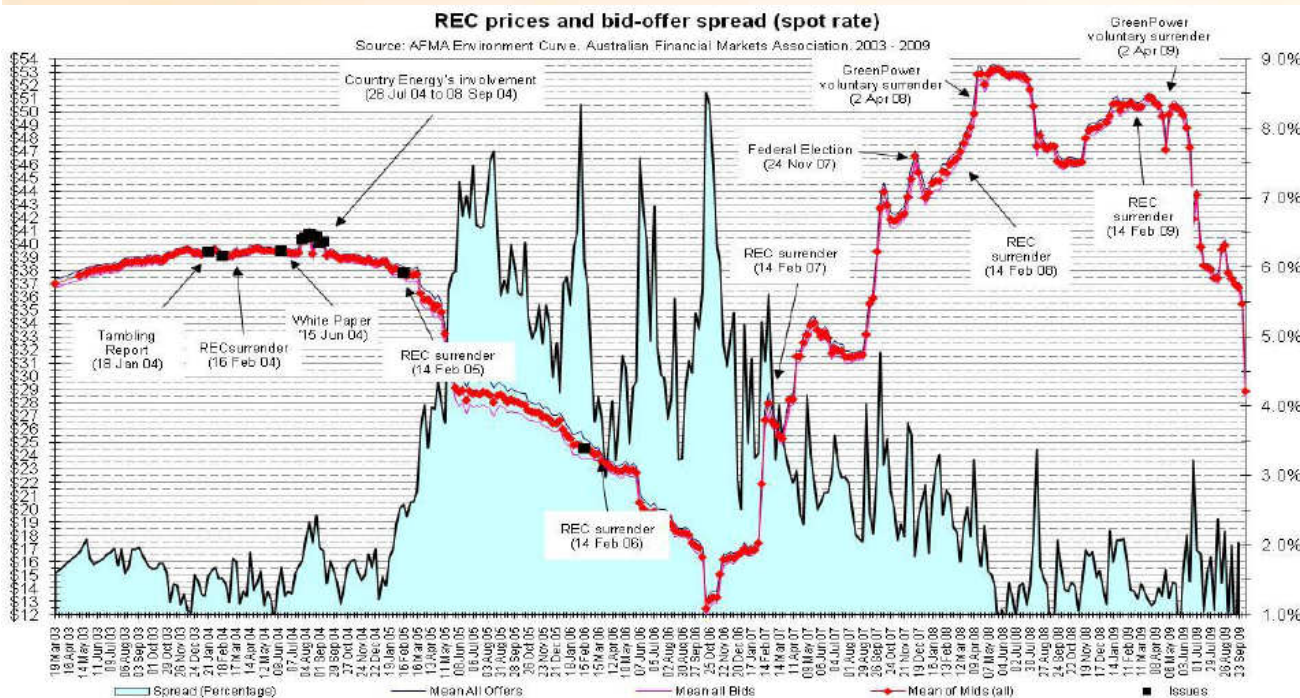
(ORER, 2008 Annual Report, 2009)



(Origin, Presentation to JP Morgan Australian Corporate Access Days, 2009)

(IES, eRET Report to CEC, 2009)

Fuel Type	2008	2009 (to 9/10)
Solar Water Heater	2,994,001	5,842,677
S.G.U. - Solar	377,241	868,839
Wood Waste	105,391	123,781
Energy Crops	-	9,705
S.G.U. - Wind	518	668
S.G.U. - Hydro	132	170
Photovoltaic	2	-
Agricultural Waste	375	329
Food Processing Waste	58	-
Solar	2,598	1,261
Food Waste	7,787	5,433
Agricultural Waste	13,469	10,151
Municipal Solid Waste	71,817	66,178
Sewage Gas	73,307	61,467
Black Liquor	100,823	63,393
Bagasse	518,503	393,655
Wind	3,126,324	2,995,505
Landfill Gas	712,664	557,436
Hydro	632,576	185,986
<b>Total</b>	<b>8,737,586</b>	<b>11,186,634</b>



Source: AFMA Environment Curve, Australian Financial Markets Association, 2003 - 2009

Challenging early opportunities for electricity in the eRET



# Projections inherently problematic

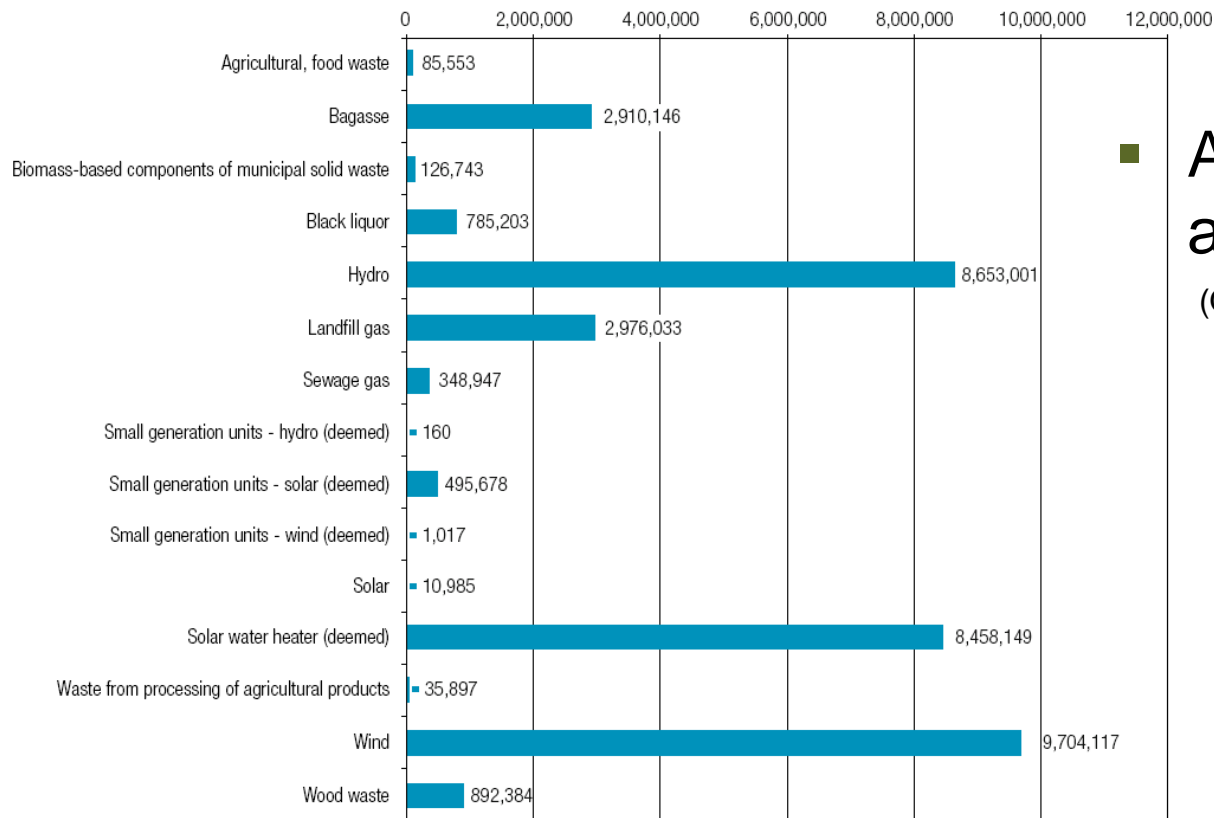
- Some projected MRET outcomes in 2001

(ABARE, *Meeting the mandated renewable electricity target, 2001*)

Table 3 Contributions to total renewables, reference case *versus* mandated target case, 2000, 2010

	reference case				mandated target case	
	2000		2010		2010	
	TWh	% shares	TWh	% shares	TWh	% shares
Bagasse sugar mills	914	4.6	808	3.9	3611	12.9
Hydro and pumped storage	17992	90.8	18303	88.1	19028	68.2
Wind	67	0.3	67	0.3	1250	4.5
Biomass co-firing	0	0.0	0	0.0	814	2.9
Municipal biomass	622	3.1	883	4.3	2500	9.0
Forestry residues and wood waste	153	0.8	622	3.0	617	2.2
Other	67	0.3	81	0.4	89	0.3
<b>Total</b>	<b>19814</b>	<b>100.0</b>	<b>20764</b>	<b>100.0</b>	<b>27908</b>	<b>100.0</b>

RECs created by 31 December 2008 by eligible renewable energy sources<sup>1</sup>



- Actual MRET outcomes at end-2008

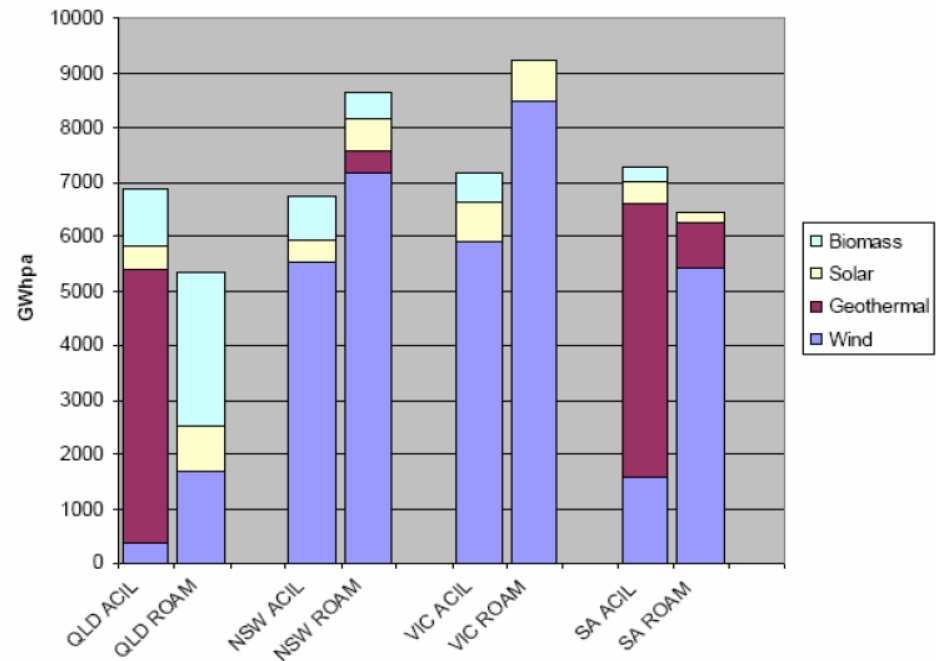
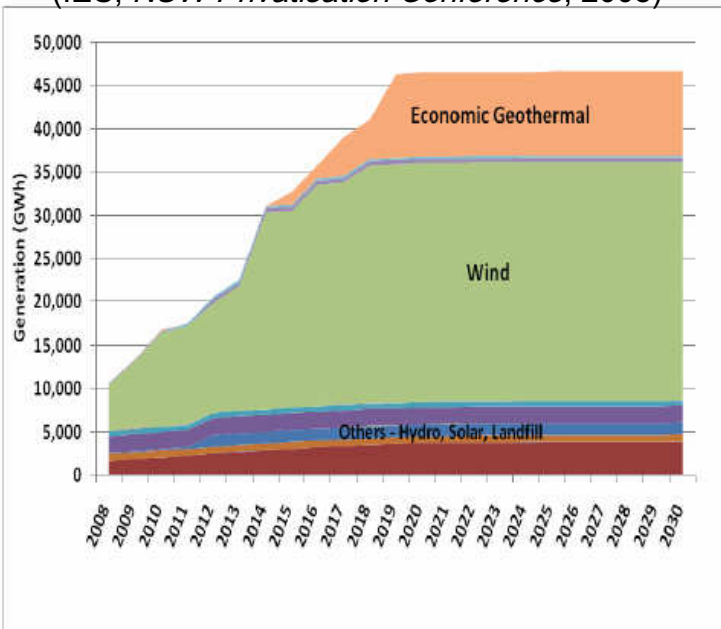
(ORER, *Annual Report, 2008*)



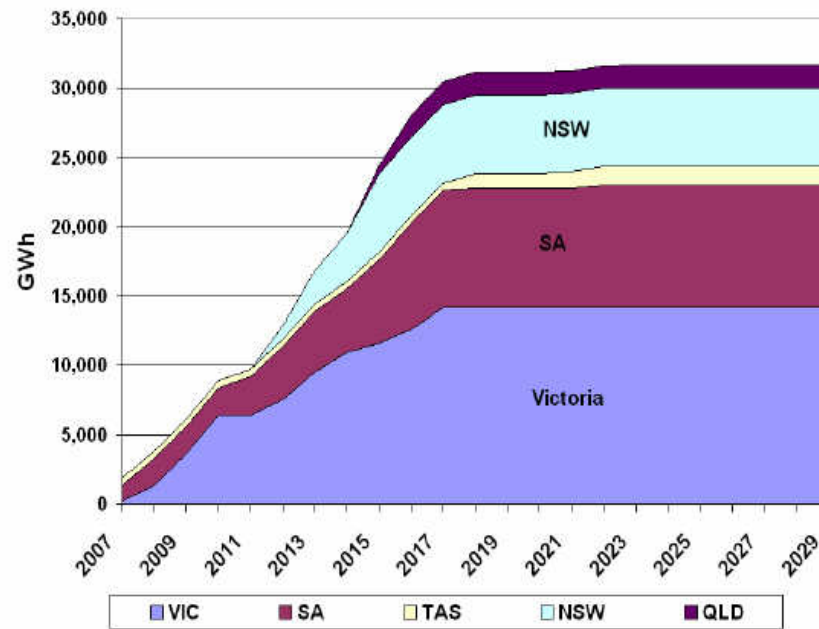
# eRET projections

- A wide range to choose from
- Work to date generally doesn't appear to have captured all aspects of some key poor design choices
- Limited consensus on which technologies, where and when

(IES, NSW Privatisation Conference, 2008)



(AEMC, Survey of Evidence on the Implications of Climate Change Policies for Energy Markets, 2008)





# Bioenergy roadmap target challenging... and significant competition

The bioenergy target for electricity generation by 2020  
(Clean Energy Council, *Australian Bioenergy Roadmap*, 2008)

Resource	2020 Target (GWh)
Sugarcane	3,165
Wood-related wastes	2,948
Landfill gas	1,880
Sewage gas	901
Agricultural-related wastes	791
Urban biomass (including urban timber wastes)	721
Energy crops	218
<b>Total</b>	<b>10,624</b>



# Need policy targets.. but much more

(Ernst & Young, *Renewable Markets Country Attractiveness Index*, 2009)

Rank <sup>1</sup>	Country	All renewables	Wind index	Onshore wind	Offshore wind	Solar	Biomass/ other
1 (1)	US <sup>3</sup>	70	71	75	59	73	64
2 (2)	Germany	66	67	66	71	65	64
2 (3)	China	66	69	73	59	54	56
4 (4)	India	62	63	70	42	61	56
5 (5)	Spain	60	61	66	46	66	53
6 (6)	Italy	59	59	64	46	64	55
7 (7)	UK	57	61	59	66	37	55
7 (8)	France	57	59	60	54	53	57
9 (9)	Canada	55	60	64	46	33	48
10 (9)	Portugal	54	56	61	43	51	45
11 (11)	Ireland	52	57	58	57	28	47
12 (12)	Greece	51	53	57	42	56	42
13 (12)	Australia	50	51	54	42	54	46
13 (14)	Sweden	50	52	52	51	35	55
15 (15)	Netherlands	46	49	50	49	37	40

- Electricity market regulatory risk – 29%: Markets that are fully deregulated score higher, as they have experienced the 'market shock' on underlying wholesale prices that this transition may exert. While this may not affect current projects, these effects are particularly important when considering long-term investment prospects.
- Planning and grid connection issues – 42%: Favorable planning environments (low failure rates and strong adherence to national targets) score highly. Grid connection scoring is based on the ease of obtaining a grid connection in a cost-effective manner. The score also takes account of the degree of grid saturation for intermittent technologies.
- Power offtake attractiveness – 19%: This includes the price received, the potential price variation, and length of PPAs granted. Higher scores are also achievable if the government guarantees the power offtake rather than merchant offtakers.
- Tax climate – 11%: Favorable, high-scoring tax climates that incentivize renewable energy generation can exist in a variety of forms and/or structures. The most successful incentives and structures have been direct RE tax breaks or brown energy penalties, accelerated tax depreciation on RE assets, and tax-efficient equity investment vehicles for individuals.
- Grant/soft loan availability – 9%: Grants can be available at local, regional, national, and international levels; and may depend on the maturity of a technology as well as the geographical location of the generating capacity. Soft loans have historically been used in pioneering countries of RE technologies to kick-start the industry. High scores are achieved through an array of grants and soft loans.
- Market growth potential – 18.5%: This considers current capacity compared to published targets. Higher scores are given if ambitious targets have been made and policy framework is in place to accelerate development. The realism of targets is also taken into account as well as the seriousness with which they are being pursued (e.g., penalties in place for non-compliance).
- Current installed base – 8%: High installed bases demonstrate that the country has an established infrastructure and supply chain in place, which will facilitate continued growth and in particular encourage the re-powering of older projects.
- Resource quality – 19%: For example wind speeds and solar intensity.
- Project size – 15.5%: Large projects provide economies of scale and a generally favorable planning environment, which facilitates project development financing.



# Conclusions

- Bioenergy and the NEM
  - Wholesale electricity prices currently showing significant variation by region, and considerable volatility in particular regions
  - Considerable potential value in dispatchability – relatively assured generation at times of higher demand and prices. *Some evidence that high penetrations of intermittent wind generation might reduce energy market returns to wind projects*
  - Unclear if and how CPRS may impact electricity prices; seems likely that much of the existing fossil fuel generation will remain highly competitive in the short to medium term – *an apparent CPRS design criterion*
  
- Bioenergy and eRET
  - eRET facing some significant challenges for driving investment
  - Inappropriate inclusion of technologies (SHW and heat pumps) seem likely to significantly reduce 'real' target for new renewable electricity generation
  - No clear consensus in projections of the role of bioenergy in meeting the target – surprises quite possible
  - Bioenergy roadmap target for 2020 electricity generation challenging
  - Need targets but more – a coherent and comprehensive policy framework that appropriately addresses other challenges for bioenergy