Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



Australian energy and climate policy: challenges and opportunities for regional Australia

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CRCCS + ESM Seminar

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Growing Energy and Environmental Challenges

Complex, multi-dimensional & interacting drivers

Possible Conflicts

eg. Coal vs. Gas?

Equitable supply

Energy Security

- Oil, gas & coal prices increasing & more volatile, emerging stresses on energy industries worldwide
- Australia: 'energy rich' yet emerging challenges

Climate Change

- Growing global emissions and climate change concerns yet little evidence of an effective international or national policy response to date
- Australia: High & growing per-capita emissions, significant market-based policies (CPRS, eRET) coming yet coherent & comprehensive?

Societal welfare

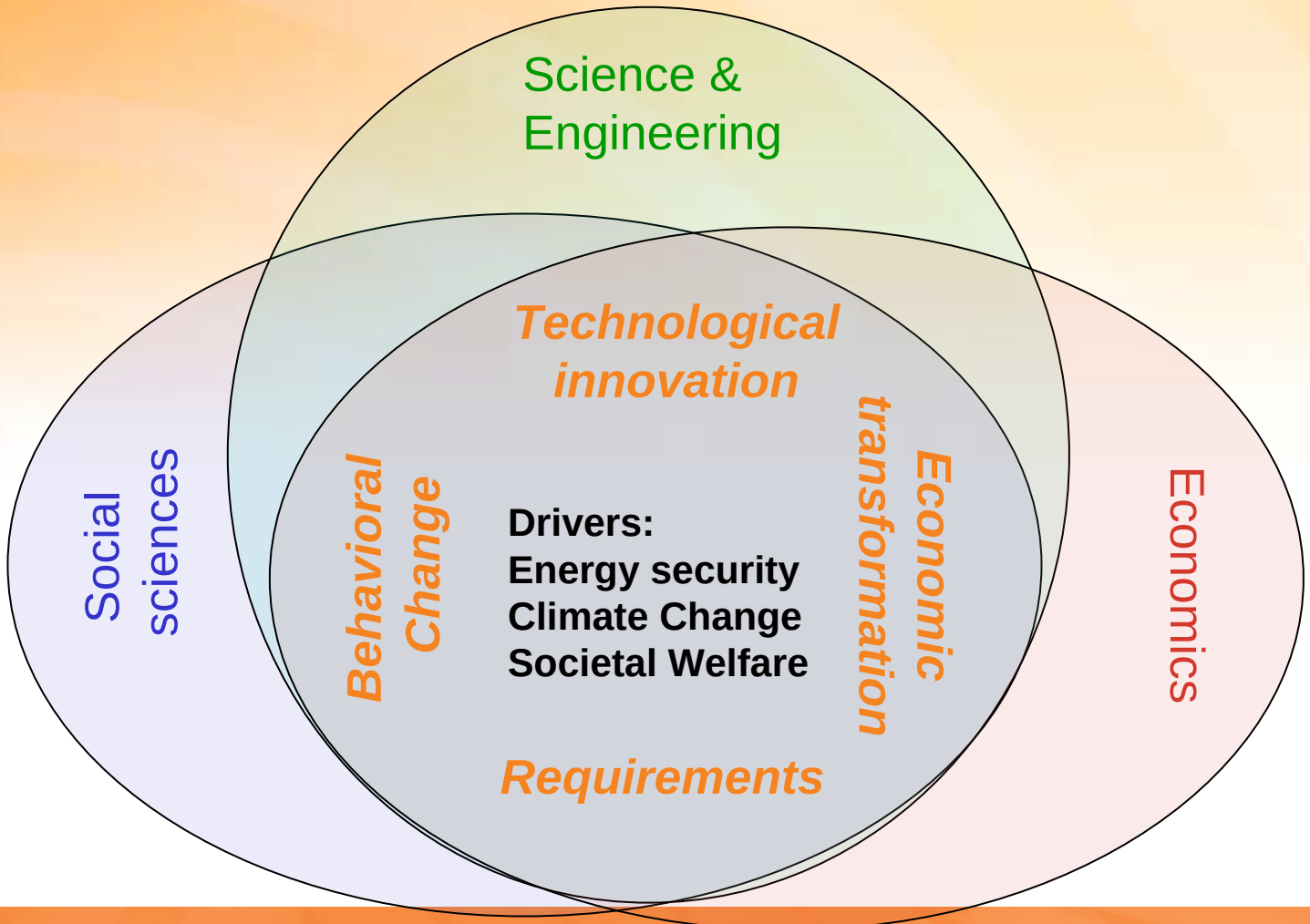
- Unsustainable energy use & emissions in industrialised world, unsustainable growth in emerging economies & unsustainable lack of energy services in developing countries

Possible Synergies

Renewable Energy

Cost-effective Energy Efficiency

Key interdisciplinary perspectives & tools required to address our energy challenges



CEEM established …

- *A formal collaboration between the* **Faculties of Engineering, Business (Economics and Management),** also Arts and Social Sciences, Science, Law
- *through UNSW Centre* aiming to provide Australian research leadership in interdisciplinary analysis + design of energy and environmental markets
- *focussing in the areas* of
  - Energy markets within restructured electricity industries
  - Related environmental markets – emissions trading, renewable obligations, energy efficiency certificate trading, Greenpower…
  - Wider policy frameworks and instruments for achieving overall energy and environmental objectives including technology innovation, infrastructure, energy efficiency, behavioural change…

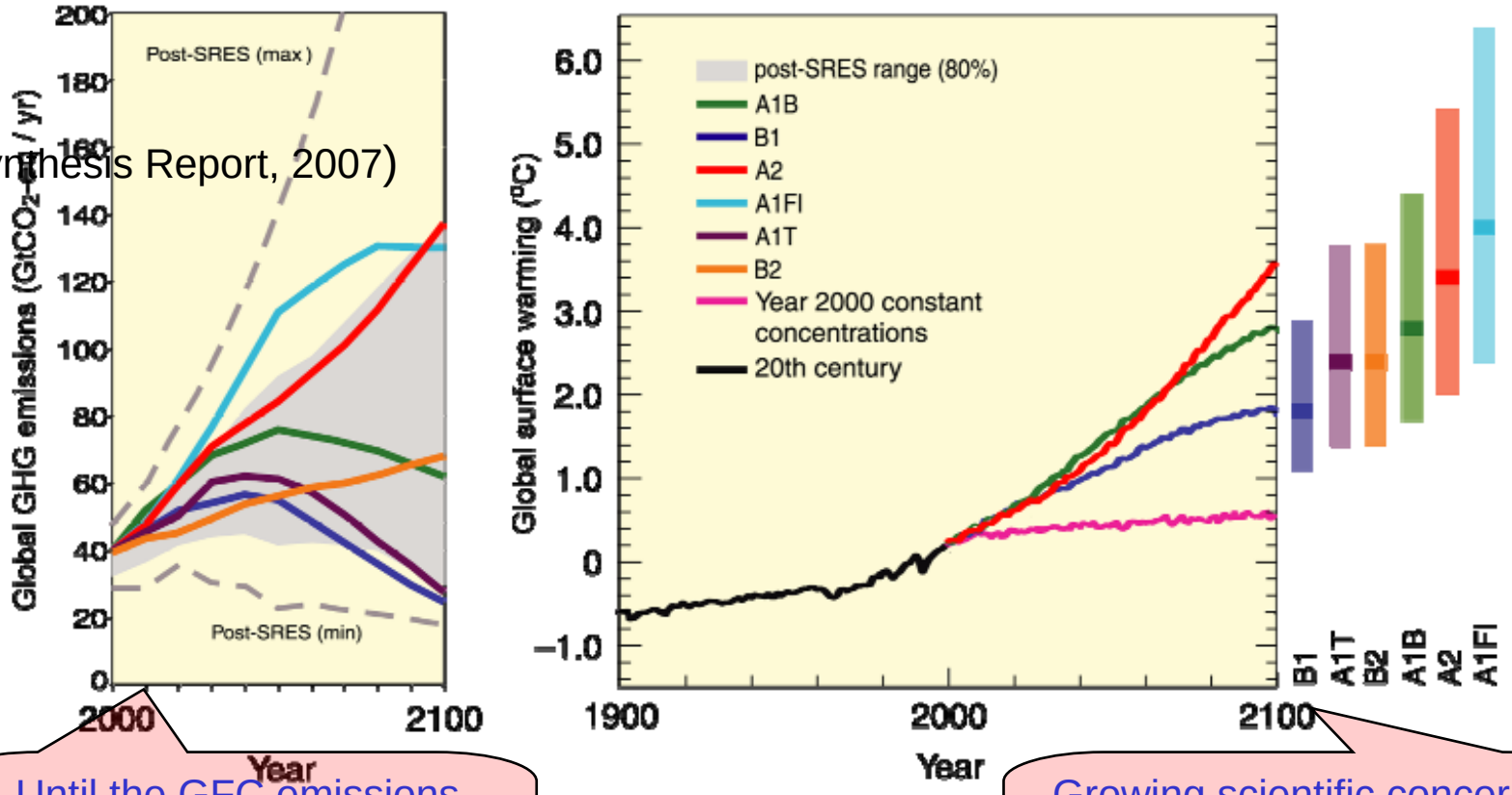
Some current CEEM research efforts

- **Renewable energy policy support options in restructured electricity industries**
  - **expanded Renewable Energy Target, feed-in tariffs**
- **Emissions Trading Schemes + options for Australia**
- Facilitating wind and PV integration in the NEM
  - Energy market design, forecasting and operation
- Modelling participant behaviour in energy + environmental markets
  - Interactions between spot and derivative markets
- Technology assessment for sustainable energy policy frameworks
  - Energy efficiency, gas + cogeneration, renewables, CCS, nuclear
- Economic modelling of Distributed Energy
- Energy efficiency policy – regulation, financial mechanisms
- Policy frameworks for technology innovation
- Sustainable energy services in the developing world

Global warming scenarios from IPCC FAR

Scenarios for GHG emissions from 2000 to 2100 (in the absence of additional climate policies) and projections of surface temperatures

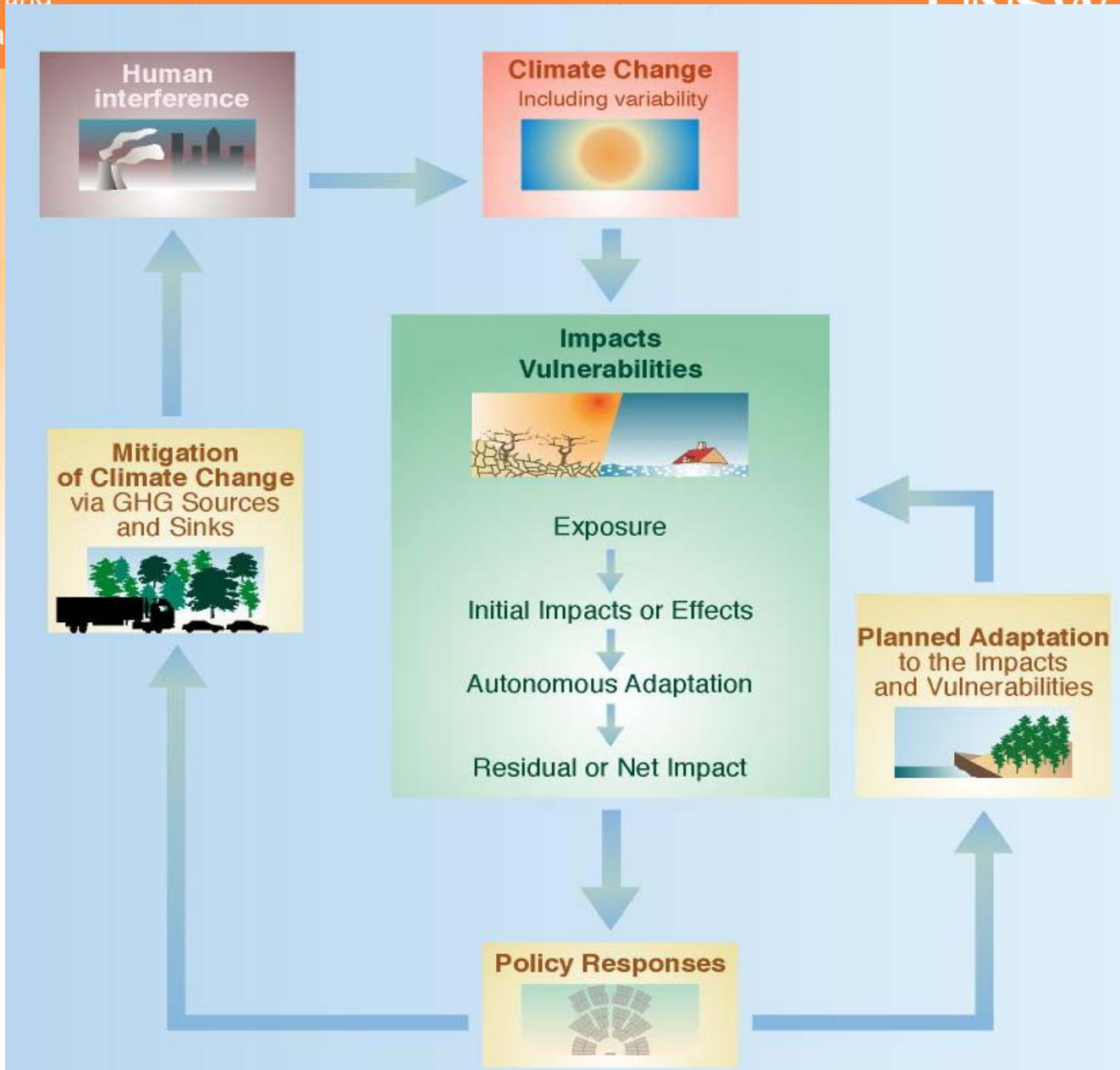
(FAR Synthesis Report, 2007)



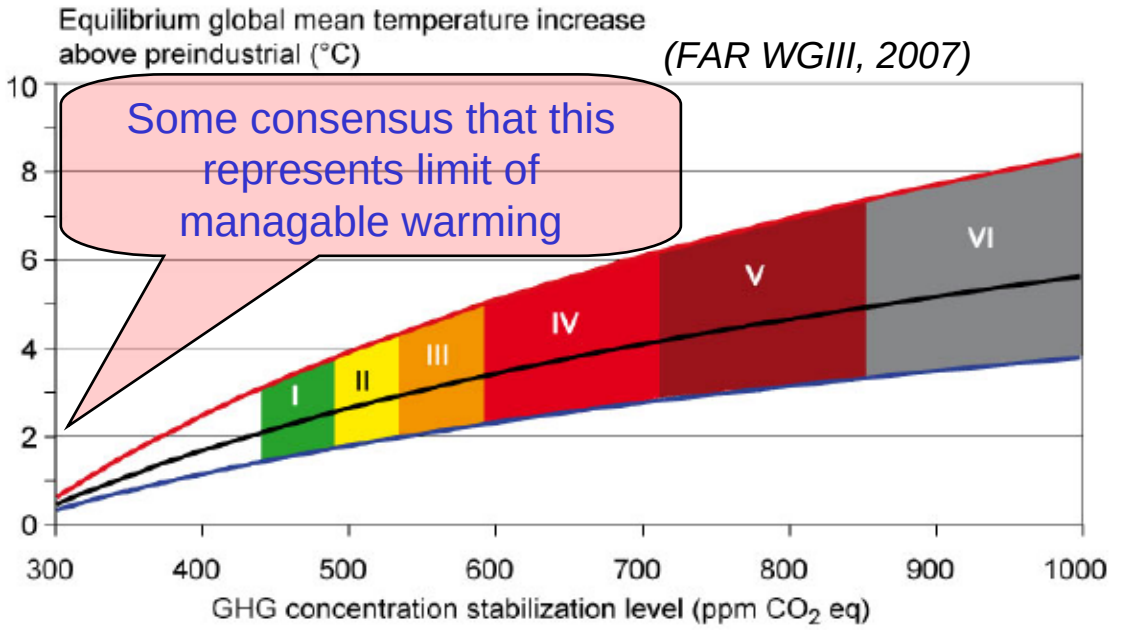
Until the GFC emissions had been tracking above 'worst case' IPCC scenario

Growing scientific concerns that FAR significantly under-estimates potential warming

Our challenge *and/or* opportunity – adapt and/or mitigate



The mitigation challenge



Some scientists calling for lower levels (eg. Hansen, 2008)

Phenomenon	Target CO_2 (ppm)
1. Arctic Sea Ice	300-325
2. Ice Sheets/Sea Level	300-350
3. Shifting Climatic Zones	300-350
4. Alpine Water Supplies	300-350
5. Avoid Ocean Acidification	300-350

→ **Initial Target CO_2 = 350* ppm**

***assumes CH_4, O_3, Black Soot decrease**

Table SPM.5: *Characteristics of post-TAR stabilization scenarios [Table TS 2, 3.10][a)]*

Category	Radiative Forcing ($W/m^{2)}$)	CO_2 Concentration[c)] (ppm)	CO_2-eq Concentration[c)] (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity[b), c)] (°C)	Peaking year for CO_2 emissions[d)] (year)	Change in global CO_2 emissions in 2050 (% of 2000 emissions)[d)] (%)	No. of assessed scenarios
I	2.5 – 3.0	350 – 400	445 – 490	2.0 – 2.4	2000 - 2015	-85 to -50	6
II	3.0 – 3.5	400 – 440	490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30	18
III	3.5 – 4.0	440 – 485	535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5	21

Another viewpoint – the carbon budget…

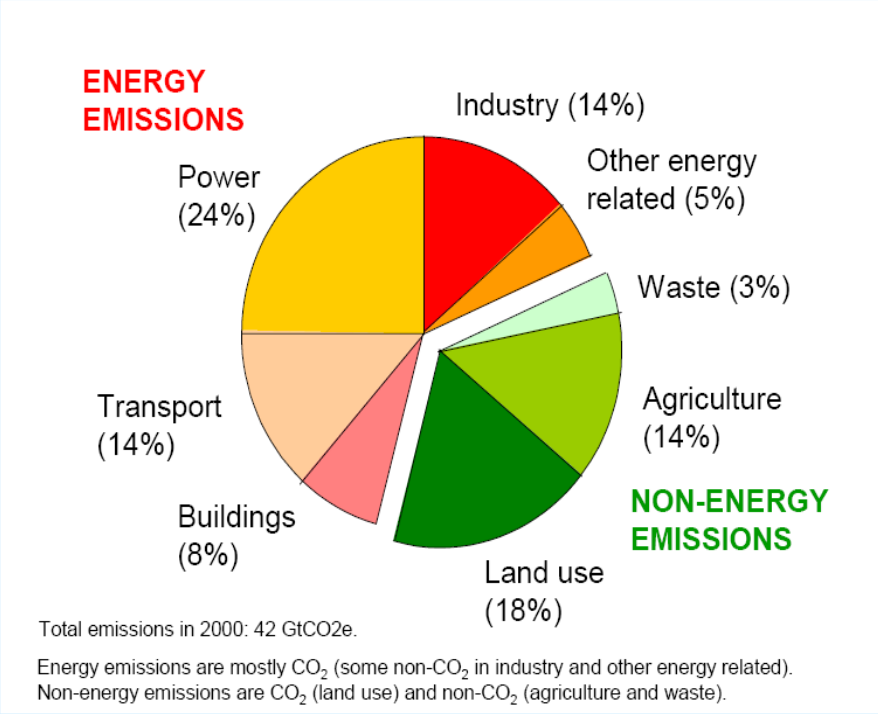
- "Applying [Potsdam Institute Director Hans Joachim Schellnhuber in The Guardian of 10 September: Developed countries are 'carbon insolvent] logic to Australia...
  - The total carbon budget 2050 to have a 2-in-3 chance staying below a 2-degree temperature increase is 750 billion tCO2.
  - If you take the world population now at 6.9 billion people … and
  - then assume that the world's population has an equal right to emit carbon (a starting point which ignores historic carbon debt and responsibility), then...
  - The carbon budget per person to 2050 is 110 tCO2...
  - Australian emissions today are 20.58 tCO2 per person per year, the world's highest per capita emissions from energy use.
  - Divide that budget of 110 tonnes by the yearly figure of 20.58 and the result is :
  - The carbon budget for Australians to 2050 for a 2-degree target runs out in 5 and a bit years!
  - Or do we reckon that we have some inherent right to pour more CO2 into the air that the billions in the developing world who lack the infrastructure and standard of living that our historically high emissions have bought us?"

(David Spratt, http://climatecodered.blogspot.com, September 2009)

Abatement options (Stern, 2006)

- Reducing demand for emissions-intensive goods + services
  - Energy conservation / frugality
- Increased efficiency
  - Particularly end-use efficiency, but also in supply + distribution
  - Can save both money and emissions
- Action on non-energy emissions
  - Land-use, agriculture, waste
  - non-CO2 industrial emissions
- Switching to lower-carbon technologies for power, heat and transport
  - Renewables, Nuclear, Carbon Capture and Storage

Figure 1 Greenhouse-gas emissions in 2000, by source



Source: Prepared by Stern Review, from data drawn from World Resources Institute Climate Analysis Indicators Tool (CAIT) on-line database version 3.0.

How much of which options maximises our chances of success in meeting societal objectives, and
how best to drive such changes?

…. **is** the policy challenge

A key objective for sustainable energy policy development – comprehensiveness + coherence

Adapted from (Grubb, 2006)	**Voluntary, regulatory and systemic instruments**	**Economic instruments**	**Innovation instruments**
Behaviour			
Substitution			
Technical innovation			

Australia's energy + climate context

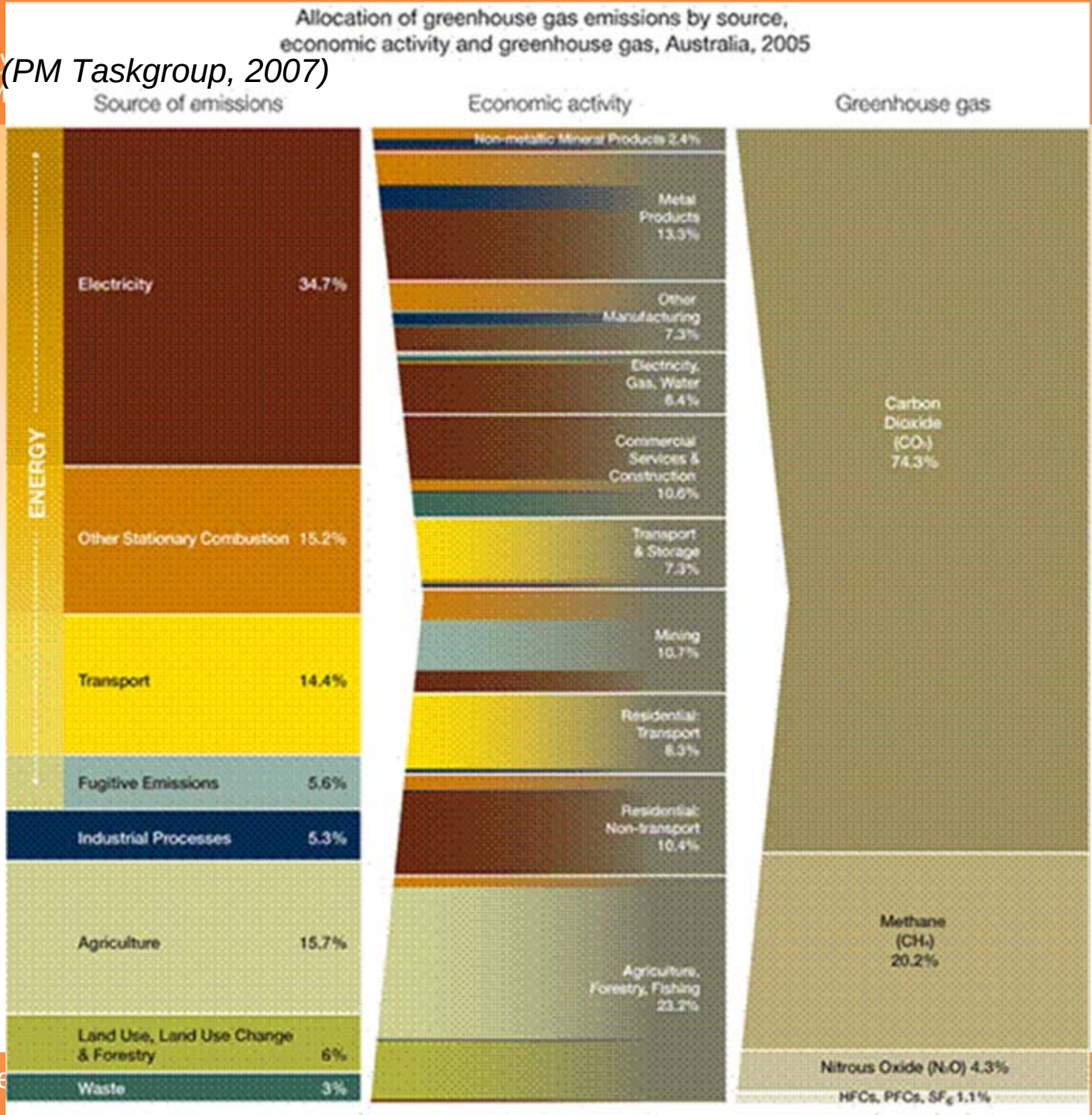
Amongst the world's highest per-capita emissions

An energy + emissions intensive economy

Continuing emissions growth in most sectors including all energy

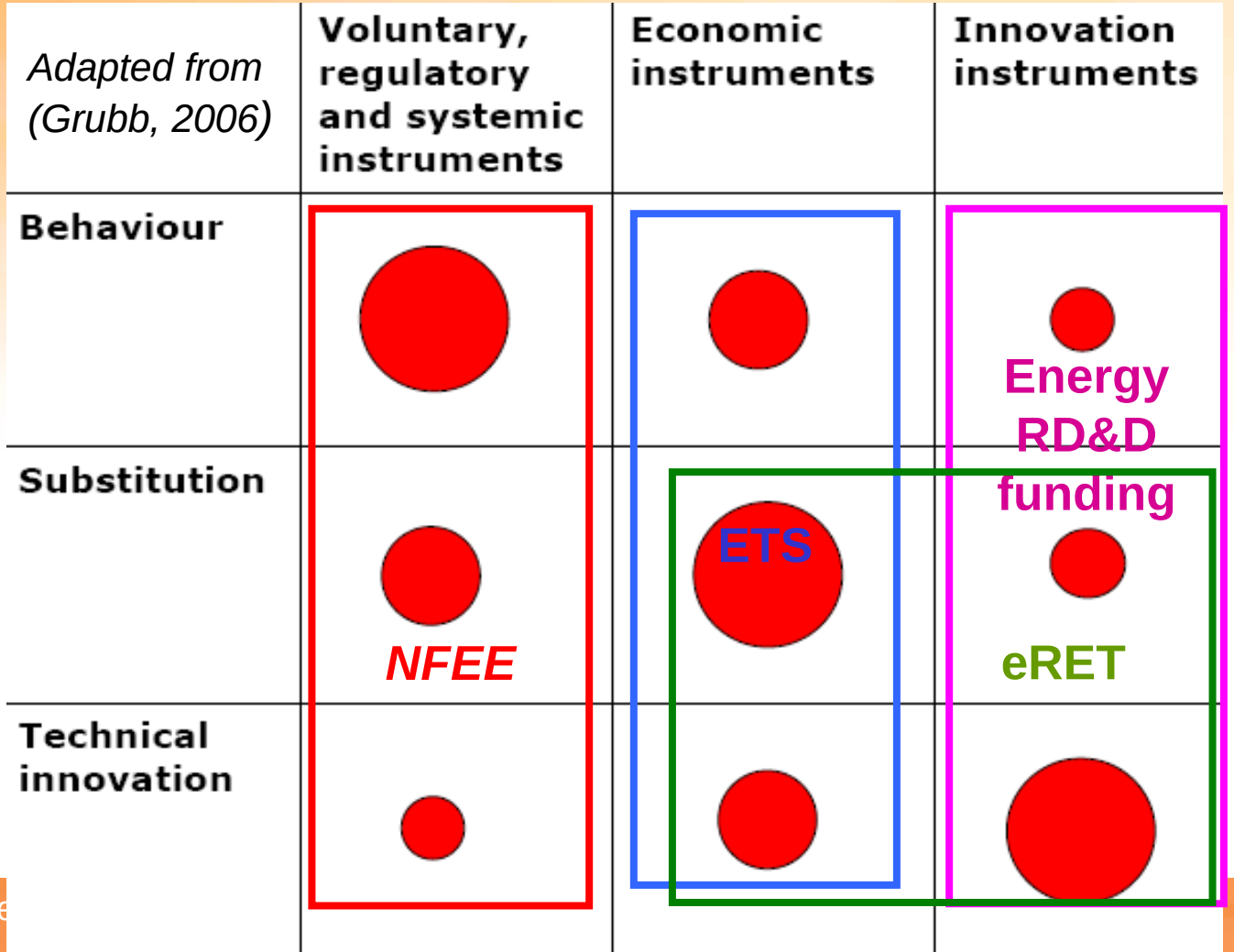
High agricultural and LULUCF emissions for a 'developed' country

(PM Taskgroup, 2007)



Key current Australian energy + climate policy efforts

- Significant reliance on economic instruments with proposed CPRS, implemented eRET



How does emissions trading work?

Mechanics of a cap and trade scheme

Emitters of greenhouse gases need to acquire a permit for every tonne of greenhouse gas that they emit.

The quantity of emissions produced by firms will be monitored, reported and audited.

At the end of each year, each liable entity will need to surrender a permit for every tonne of emissions that they produced in that year.

The number of permits issued by the Government in each year will be limited.

Firms will compete to purchase the number of permits that they require. Firms that value the permits most highly will be prepared to pay most for them, either at auction or on a secondary trading market. For some firms, it will be cheaper to reduce emissions than to buy permits.

Certain categories of firms will receive an administrative allocation of permits, as a transitional assistance measure. Those firms could use the permits or sell them.

What policy role can ETS play?

- *Nothing new about a price on carbon – some carbon already highly valuable: change is to add an additional price reflecting climate externality*
- ETS only effective wrt its ability to drive changes, operational but especially investment, in markets that drive physical emissions
- In theory, assuming idealised markets,
  - universal ETS only policy required
  - any additional climate change policies can only increase the cost of meeting the cap while not changing its environmental effectiveness
- In practice, emissions trading markets + the markets they have to drive
  - suffer from wide range of market failures
  - may struggle to appropriately 'price' uncertainties about future
  - Established by political process inevitably involving adverse compromises
- ETS contribution to policy mix
  - Major role is for driving substitution – ***if it can't do this, try another approach***
    - Will still require other policies to drive behaviour + technology innovation
  - In theory, highly compatible with other policies including market-based
    - Prices of ETS and/or other policies adjust wrt changing marginal costs

Potential policy challenges

- Share many of usual policy challenges with any regulatory approach + potentially add new ones
  - Novel – learning likely required + mistakes will be made: do we have time?
  - Key decision making is investment: have to establish 'markets' that drive this appropriately
  - Inevitable complexity in attempting to match commercial market with physical actions that reduce emissions
  - Potential loss of control on decision making might see adverse impacts with other policy objectives….
  - ***These are designer markets:*** *Greatest competitive advantage for participants may lie in gaming rules and especially design process*
  - Growing appreciation of the limitations of markets? eg. GFC
  - *However, emissions trading appears to be the key policy of choice for much of the developed world – at least in part, due to its 'politics'*

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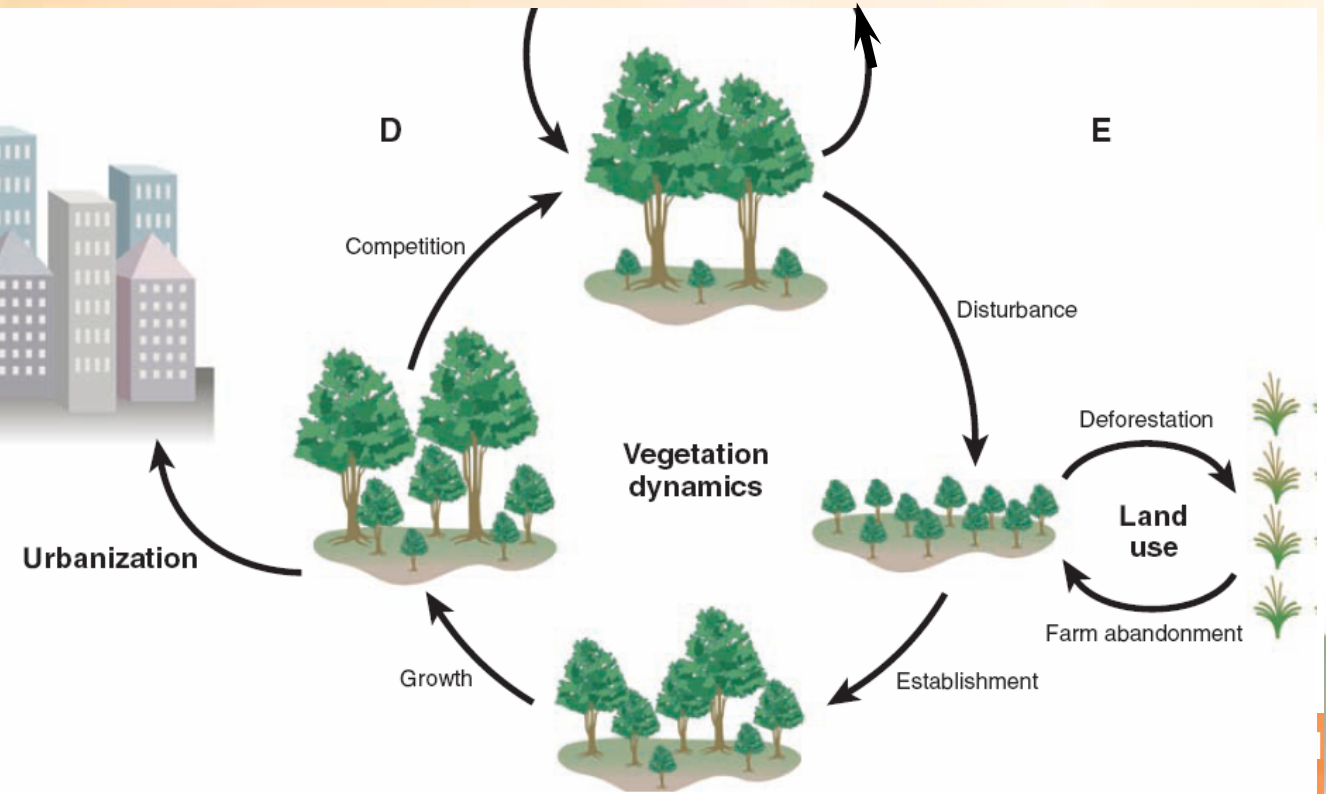
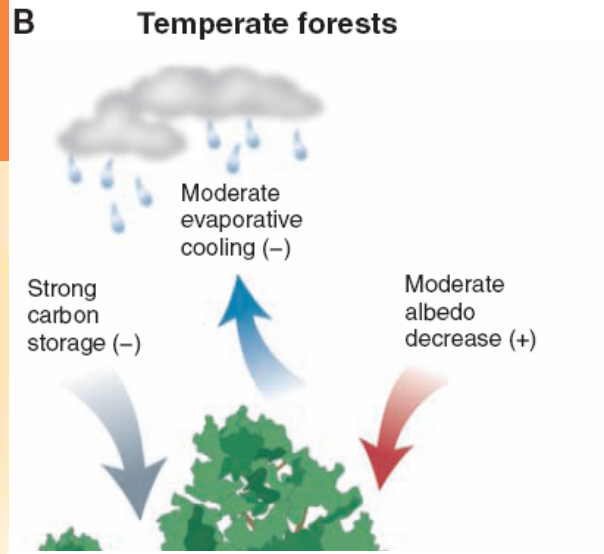
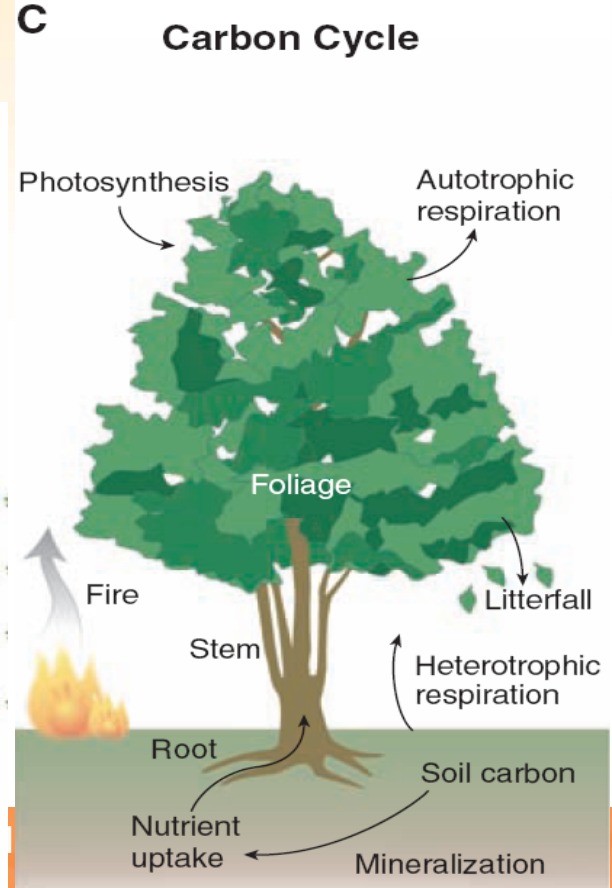
Land-use and carbon complexities

- Wider climate services
- Complex carbon cycle
- Complex human/natural dynamics

(Science, Future of Forests, 2008)







Carbon markets and Land-use

- Agriculture, Forestry and Other Land Use (AFOLU)
  - ~ 30% of global GHG emissions & cost effective reduction options
- Complex challenges and opportunities
  - Deforestation ~20% of emissions
  - Response of ecosystems to climate change
  - Potential renewable energy sources offsetting fossil-fuel use
  - Potential low-emission materials
  - Significant opportunities for carbon sequestration
  - Many related issues in land-use: water, biodiversity, livelihoods
- Key issues for market approaches – integrity and credibility
  - Verifiability: measurement, monitoring and enforcement
  - Project additionality: inevitably counter-factual
  - Leakage: of emissions via shifted projects, products via alternatives
  - Permanence: sequestration impacts by human or natural occurrence
  - Timing of sequestration

Adapted from (CRS, Report to Congress, 2008)

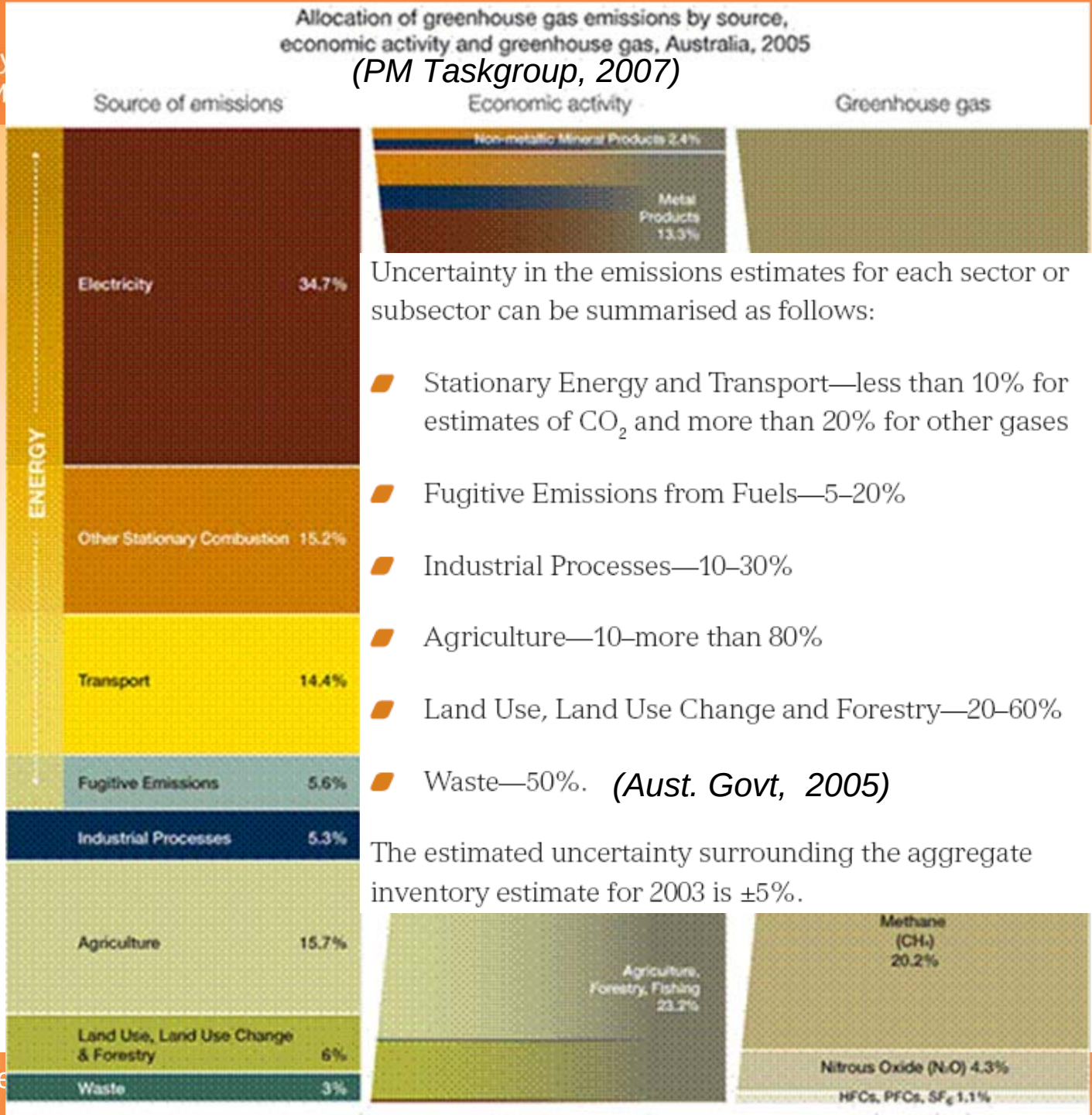
Australia's proposed CPRS

- Emissions Trading for Australia first proposed in late 1990s, have seen State-based efforts (GGAS) and proposals (NETT), fomer Federal Government task group design
- Federal Govt's primary proposed climate policy response
  - Wide coverage: 70%+ of emissions
  - Carbon price intended to impact right across the economy
  - A set of existing and promised other policies for renewable energy, technology innovation but intention is such policies will be increasingly unnecessary as CPRS expands scope and influence
- Implementation closely linked to national emissions targets because CPRS covers and therefore caps most Australian emissions closely linked to national emission targets

Carbon Pollution Reduction Scheme

- Proposed Coverage
  - 6 Kyoto gases, ~75% national emissions
  - ~1000 firms with mandatory obligations, otherwise upstream liability on liquid fuels and gas will see carbon price delivered through energy prices
  - Mandatory participation by all sectors other than Agriculture (coverage not before 2015), forestry (voluntary opt-in) and potentially some waste activities
  - Very limited scope for domestic offsets (depending on agriculture)
- International linking
  - Unlimited use of some international kyoto units including CDM
  - Some initial restrictions on transfer of permits outside Australia
  - Provide five years certainty to market on types and quantities of international units allowed

Emissions measurement a key challenge for carbon markets



Uncertainty in the emissions estimates for each sector or subsector can be summarised as follows:

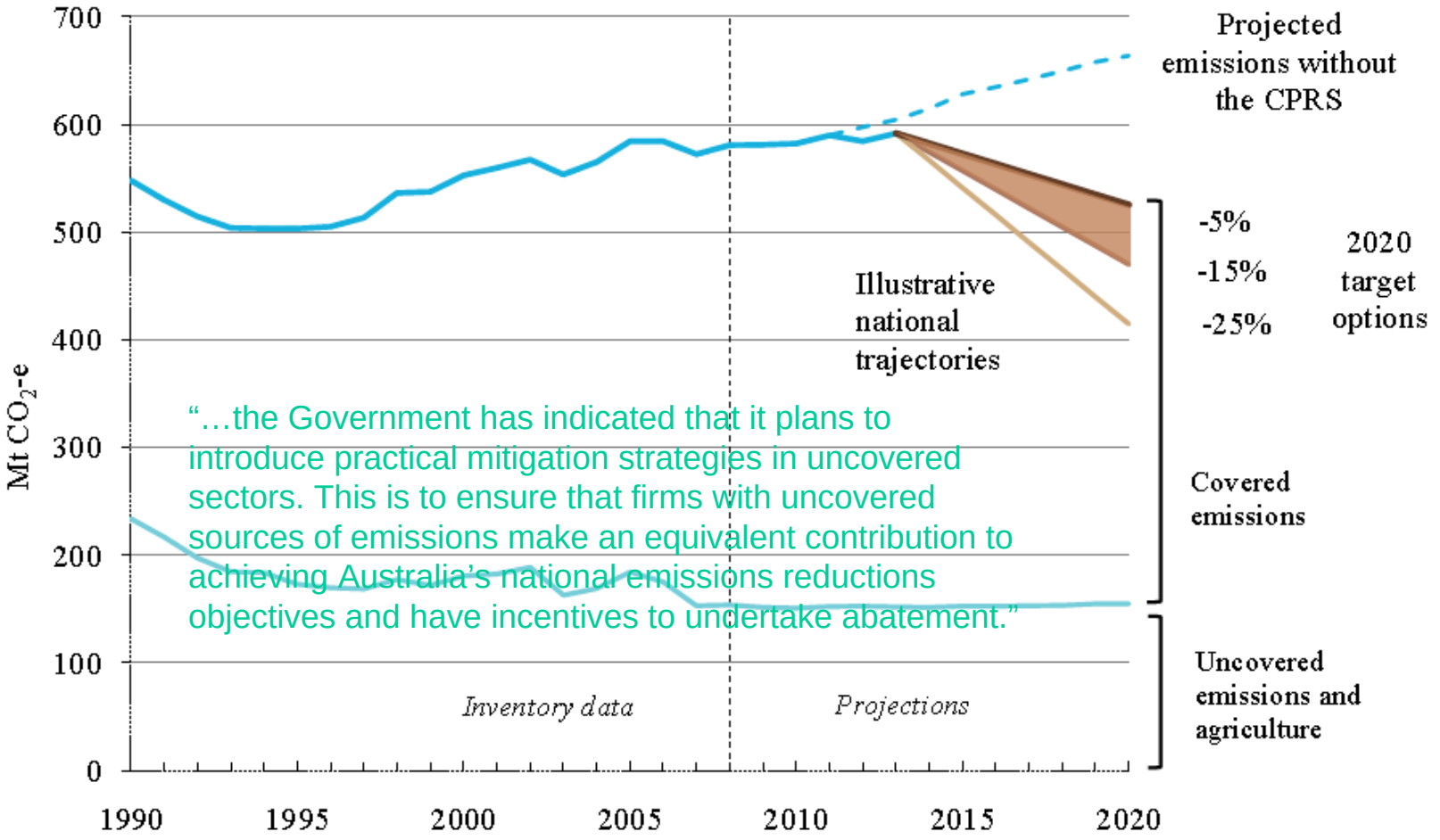
- Stationary Energy and Transport—less than 10% for estimates of CO_2 and more than 20% for other gases
- Fugitive Emissions from Fuels—5–20%
- Industrial Processes—10–30%
- Agriculture—10–more than 80%
- Land Use, Land Use Change and Forestry—20–60%
- Waste—50%. *(Aust. Govt, 2005)*

The estimated uncertainty surrounding the aggregate inventory estimate for 2003 is ±5%.

Greenhouse inventory and projections

(Australian Government, *Tracking to Kyoto and 2020*, 2009)

Figure 3: Projected emissions from covered and uncovered sectors to 2020



CPRS and agriculture

- CPRS coverage
  - Key design principle is to maximise coverage as far as is practical to lower costs and ensure all Australian businesses contribute… emissions sources can be included if:
    - scheme obligations can be applied cost-effectively — compliance costs will be reduced if Scheme obligations apply to a relatively small number of large emitters; and
    - emissions can be estimated in an unbiased manner and with an acceptable degree of accuracy.
- Government White Paper (2008) position
  - "The Government is disposed to include agriculture emissions in the Scheme by 2015;
  - Commencing in 2009, the Government will undertake a work program in consultation with the agriculture industry to enable a decision in 2013, on coverage of agriculture emissions in 2015."

CPRS options for agricultural coverage

- Direct (on farm) liability
  - The key decision makers for emissions…
  - however ~130,000 enterprises in Australian land use sector with individual small emissions so high transaction costs & complexity

(Australian Government, Agenda Paper: options for coverage of agriculture, 2008; ABARE, 2009)

		threshold (000 t CO_2-e) per year				
		1	2	3	5	25
Australia wide	number of farms covered by threshold	18 383	4 507	2 723	2 273	47
(65 359 farms in Australia including	proportion of agricultural emissions covered b	52%	26%	21%	18%	2%

- Indirect liability
  - Potentially imposed on upstream inputs (eg. fertilizer) or downstream outputs (eg. food processors) means far fewer liable parties…
  - However, fairly weak relationship between on-farm emissions and upstream and downstream activities
- Hybrid
  - eg. Indirect default liabilities with voluntary direct farm opt-in

Proposed work program

- **Stage 1:** Data collection, analysis and stakeholder consultation to develop frameworks for voluntary reporting under the CPRS and possible policy alternatives to the CPRS – 2009-2010;
- **Stage 2:** Voluntary reporting trial – commences 2011;
- **Stage 3:** Decision on mitigation policy options for agriculture, 2012-13 (including a comparison of cost-effectiveness of coverage with alternative measures)

(Australian Government, Forward work program to determine appropriate carbon pollution mitigation policies for agriculture, 2009)

CPRS and forestry

(Green Air Ltd, The Potential Role for Forestry in the CPRS and ETS, 2009)

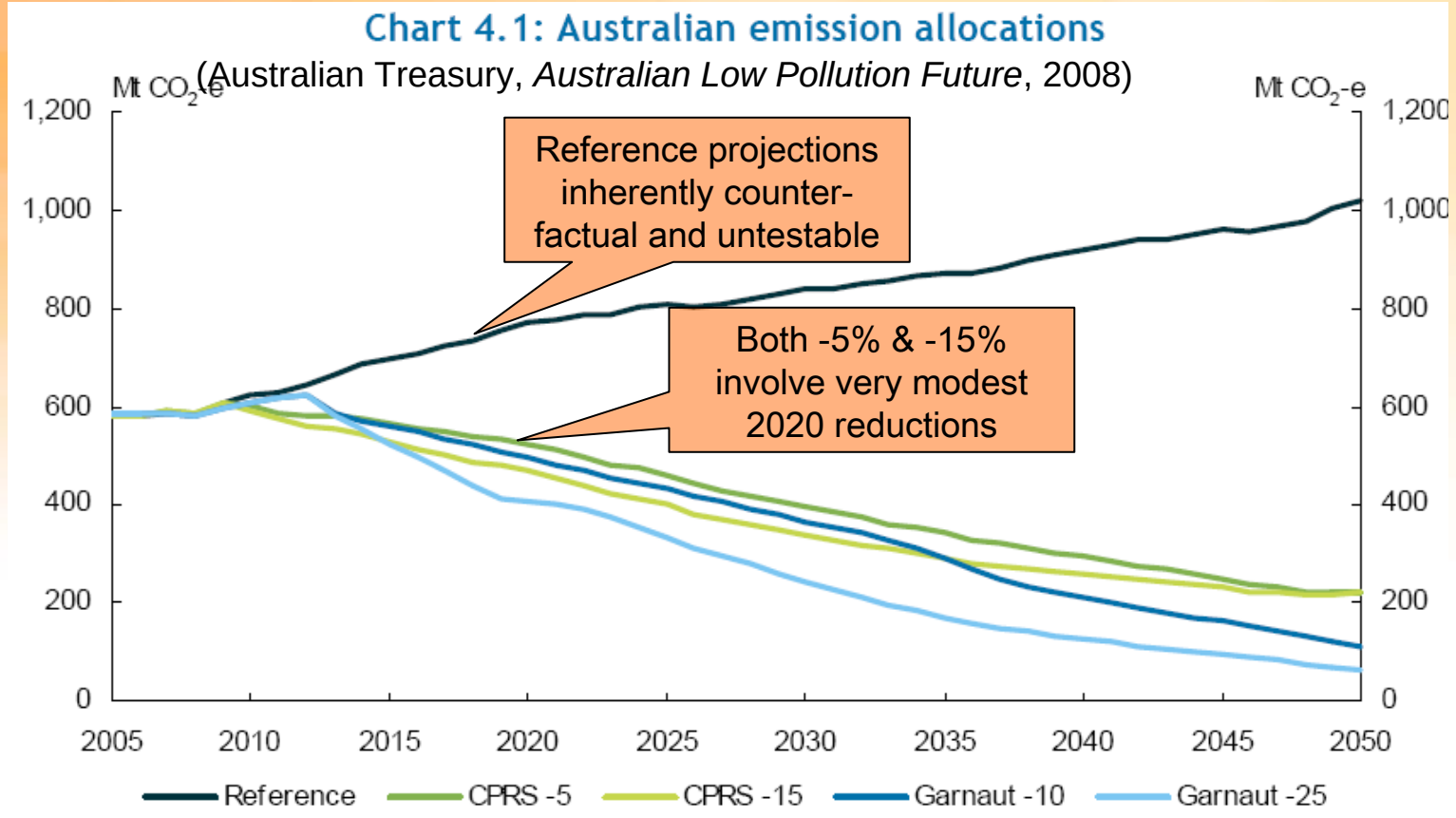
	Australia CPRS
Effective Date	1 July 2011
Opt-in	Voluntary
Eligible Forestry	Post-89 (reforestation/afforestation)
Offsets	Eligible for AEUs from July 2011
Tradability of Offsets	• AEUs can be traded in domestic market • Initial year AEUs fixed price of A$10 • Subsequent years, market trading
Liability for carbon Losses	Liability equal to CO2 emitted (limited to permits issued if replanting)

Government 'view' that opt-in approach has similar outcomes to offset scheme, but is less complex to administer

However, ".. offset projects should be additional, permanent, measurable, transparent and independently verified" (Australian Government, National Offsets Discussion Paper, 2008)

Does voluntary opt-in also ensure these requirements?

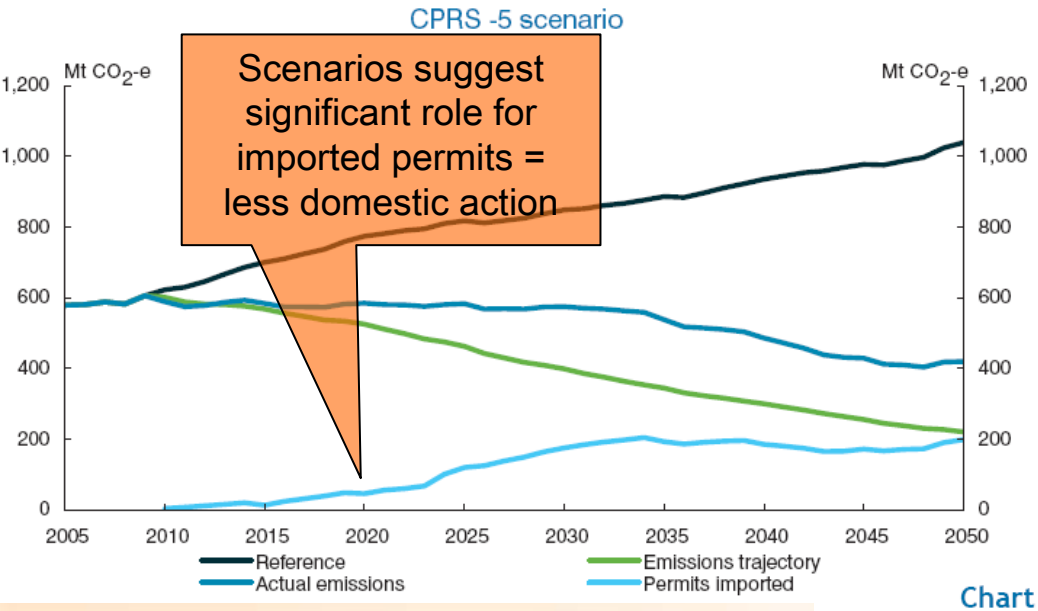
Australian Treasury modelling: National targets



Stabilisation goal (ppm)	550	510	550	450
Emissions change 2000 in 2020/2050 (%)	-5/-60	-15/-60	-10/-80	-25/-90

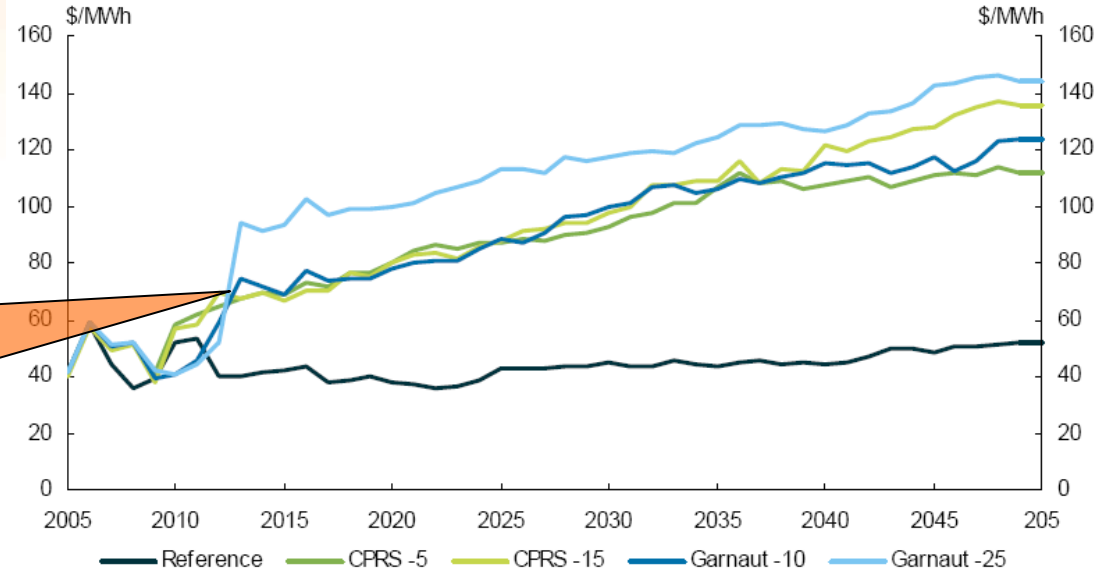
Treasury modelling: international permit trade, elec. prices

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



Scenarios suggest significant role for imported permits = less domestic action

Chart 6.27: Average Australian wholesale electricity prices



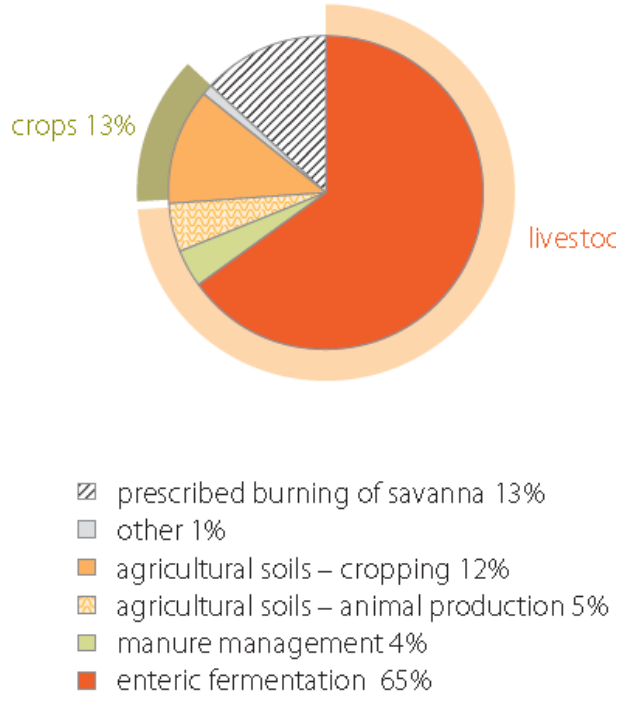
Scenarios suggest significant carbon and energy price cashflows … but what do they actually achieve?

(Australian Treasury, *Australian Low Pollution Future*, 2008)

Agricultural emissions and potential impacts

(ABARE, *Agriculture and the CPRS: economic issues andimplications*, 2009)

a Composition of greenhouse gas emissions from the Australian agriculture sector, 2006

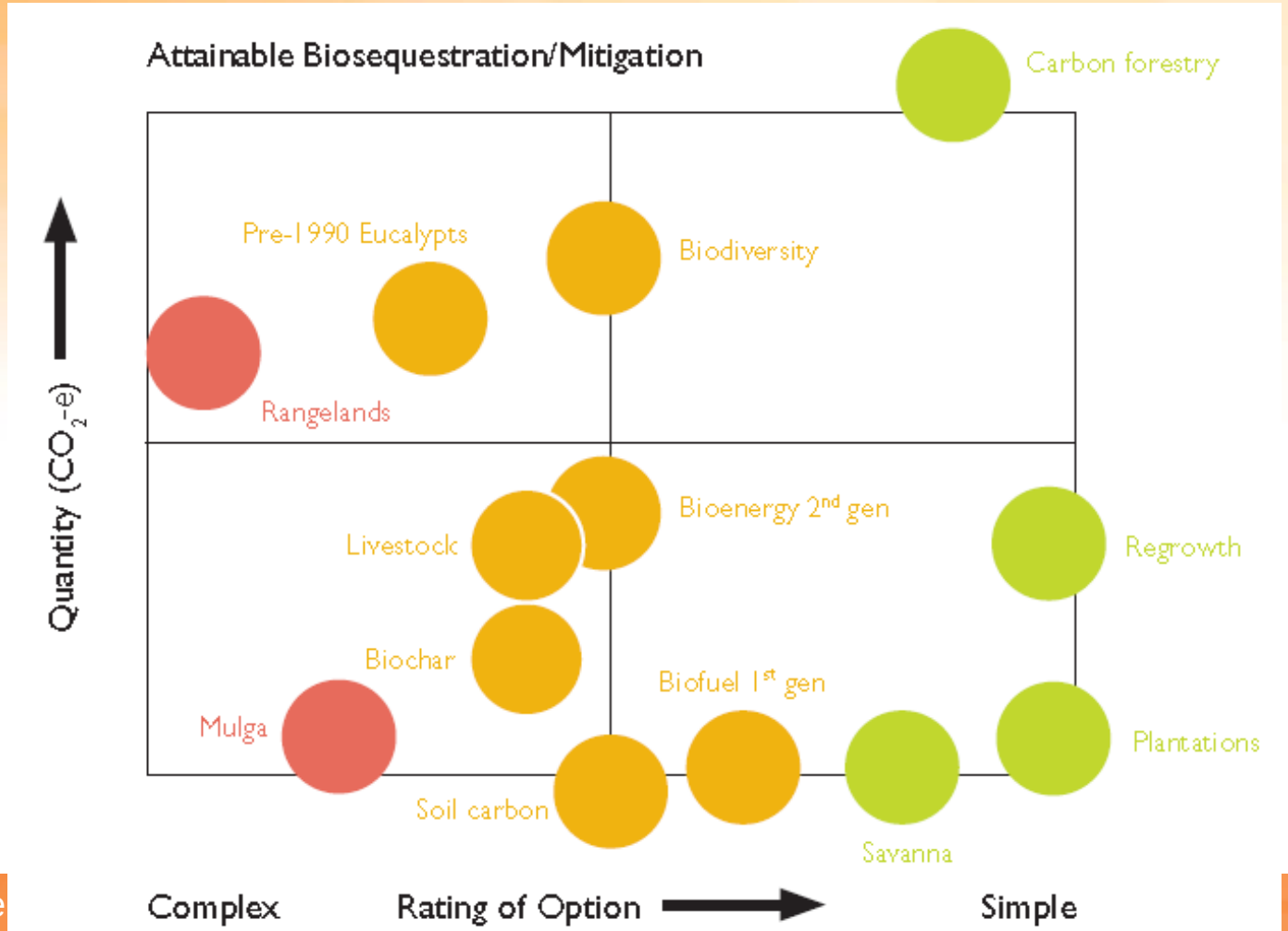


1 Potential agriculture activities eligible for EITE sector assistance

emissions threshold	initial rate of assistance in 2015-16 (as % of activity's emissions)	potential activities
≥ 2000 tonnes CO_2-e/$million revenue or 6000 tonnes CO_2-e/ $million value added	84.4	beef production sheep production dairy cattle production rice production
1000-1999 tonnes CO_2-e/$million revenue or 3000 – 5999 tonnes CO_2-e/ $million value added	56.2	pig production sugar cane production

Source: DCC 2008a, 2008b.

However, potentially major opportunities for rural land-use to deliver mitigation (CSIRO, An Analysis of Greenhouse Gas Mitigation and Carbon Biosequestration Opportunities from Rural Land Use, 2009)



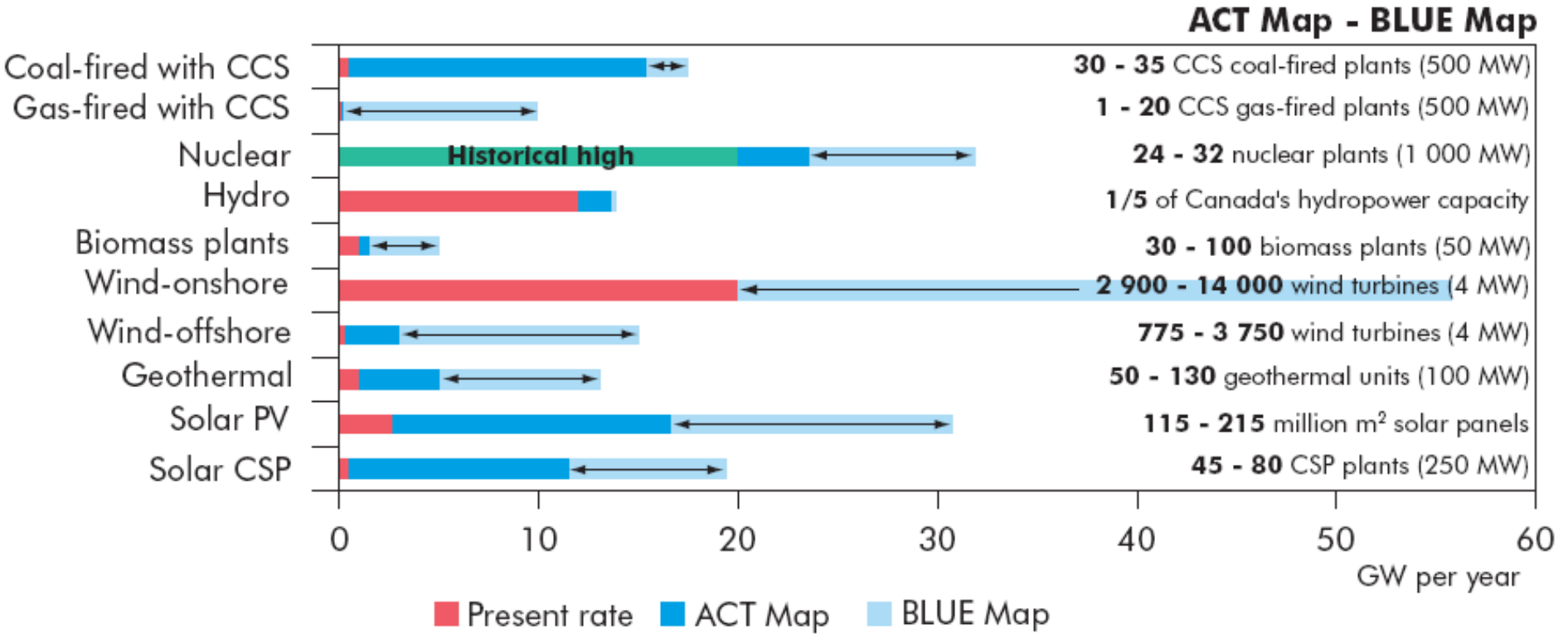
Possible CPRS impacts on Australian economy

- 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, 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?
  - Uncertain impacts of global economic crisis on economic growth, emissions

Renewables – a likely key role in low-carbon futures

- Eg. IEA *Energy Perspectives Scenarios* (BLUE = 450ppm for 2050) suggest wind, geothermal, PV and solar CSP could each make a greater contribution than coal-fired generation with CCS

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



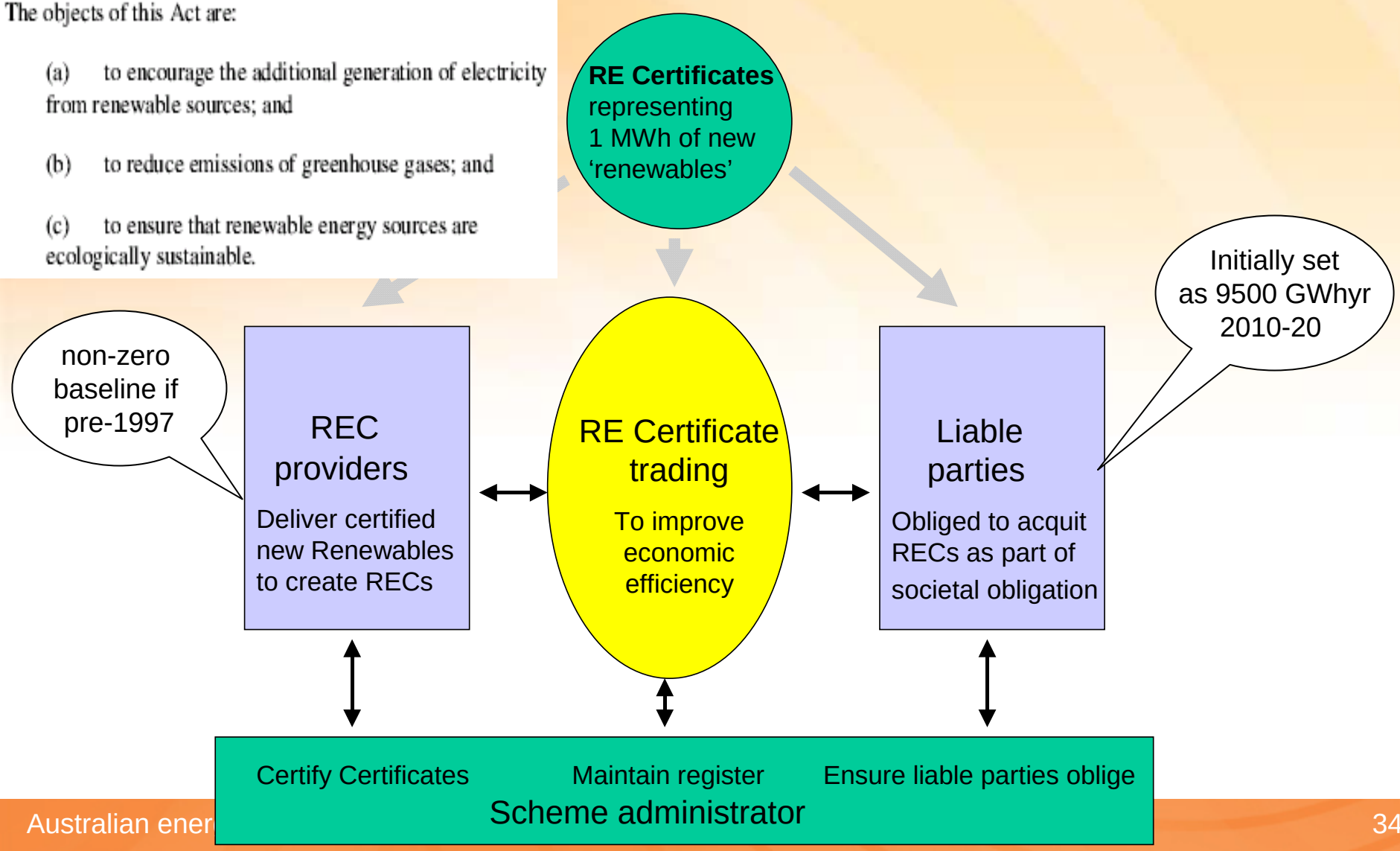
MRET – a 'designer' market

The objects of this Act are:

(a) to encourage the additional generation of electricity from renewable sources; and

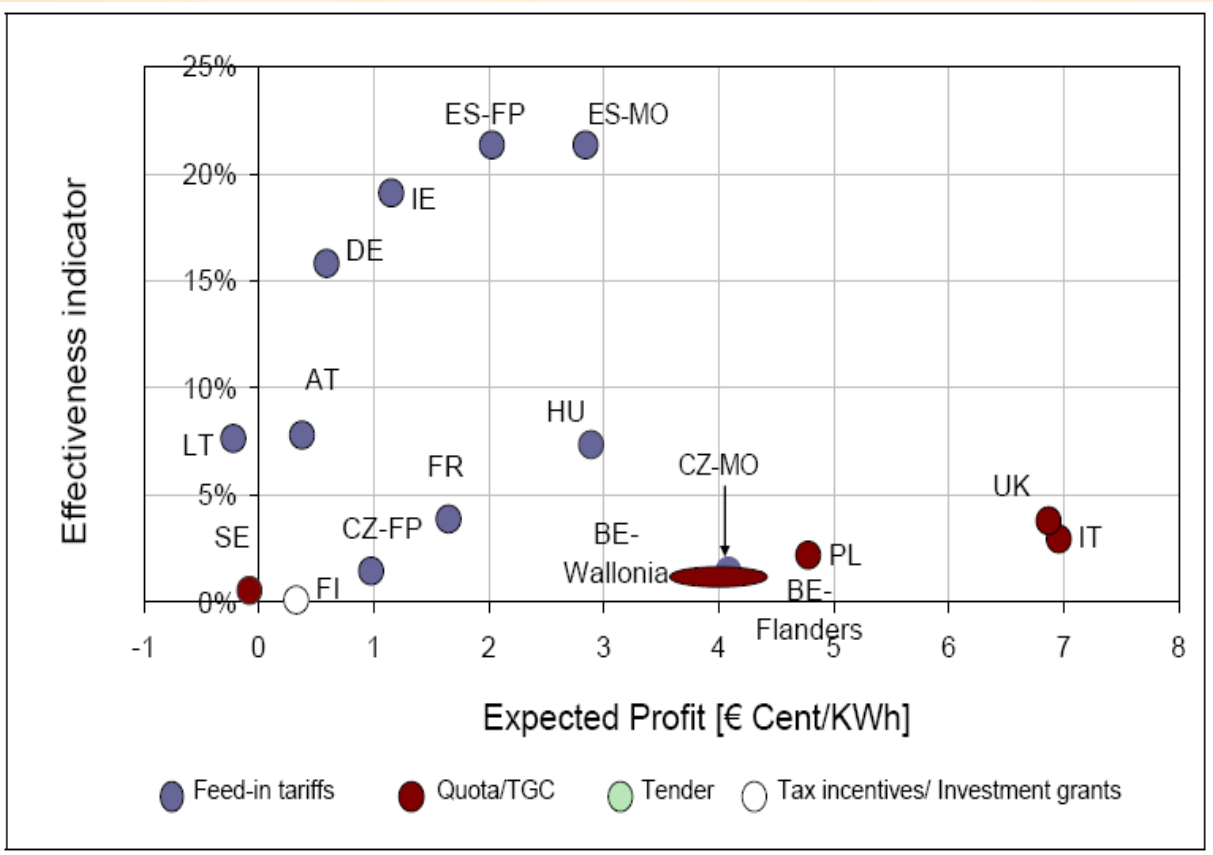
(b) to reduce emissions of greenhouse gases; and

(c) to ensure that renewable energy sources are ecologically sustainable.

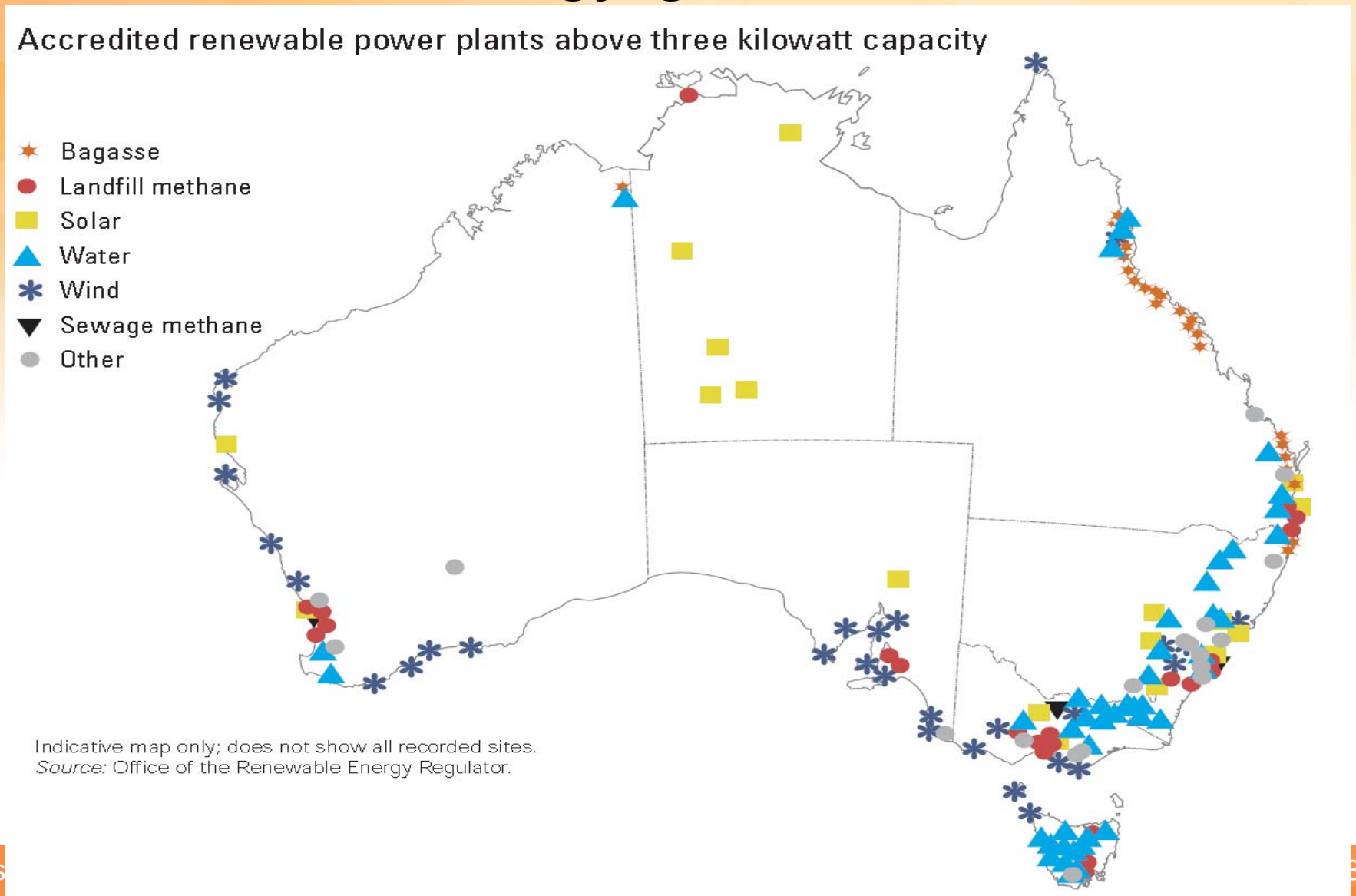


MRET performance to date… and for 2020?

- **To date:** modest ramping target easily met + considerable new investment with apparent efficiency – low subsidy $/MWh by international standards
- **However:** internat'l 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

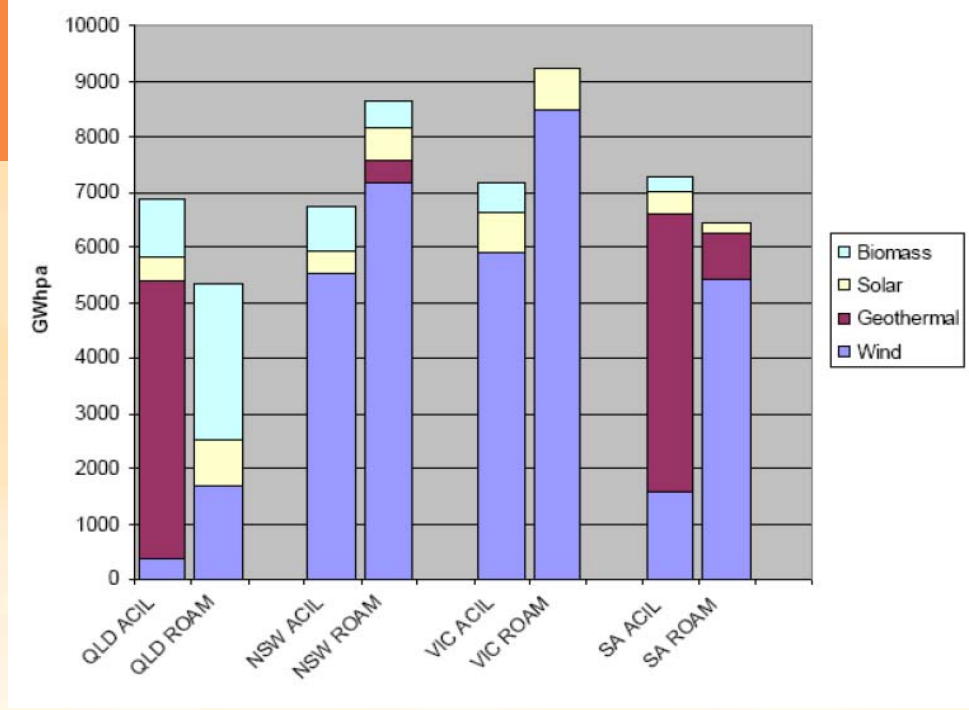


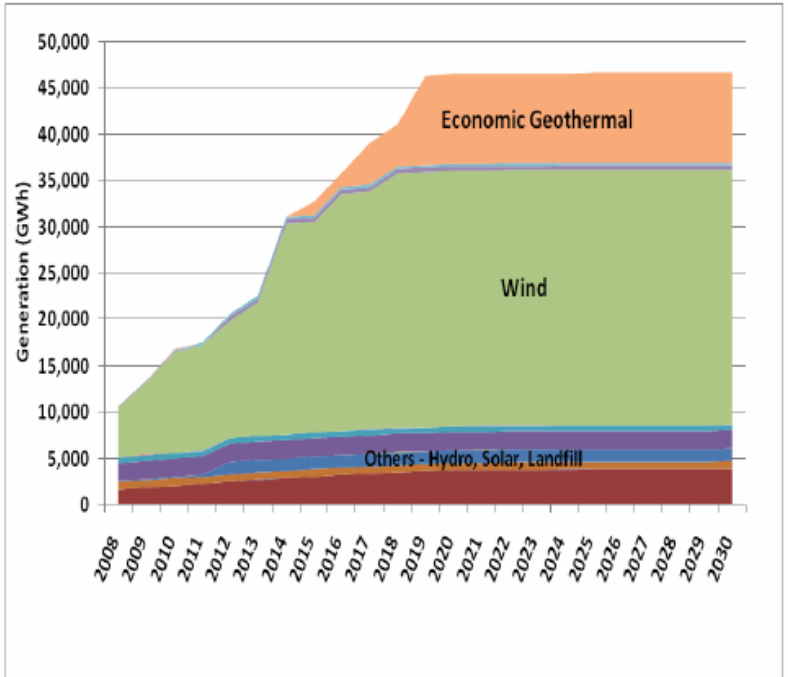
Renewable Energy generation locations



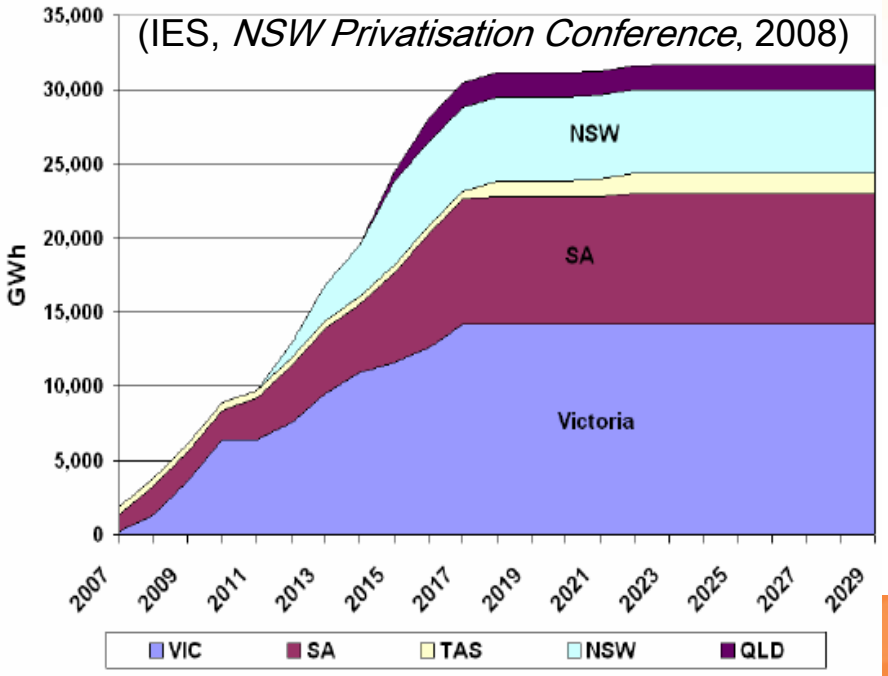
Expanded RET

- 45,000 GWh of new renewables in 2020, phased out in 2030, however, impact lessened by SHW, pre-existing plants – *outcomes of poor governance*
- Only limited consensus on which technologies, where

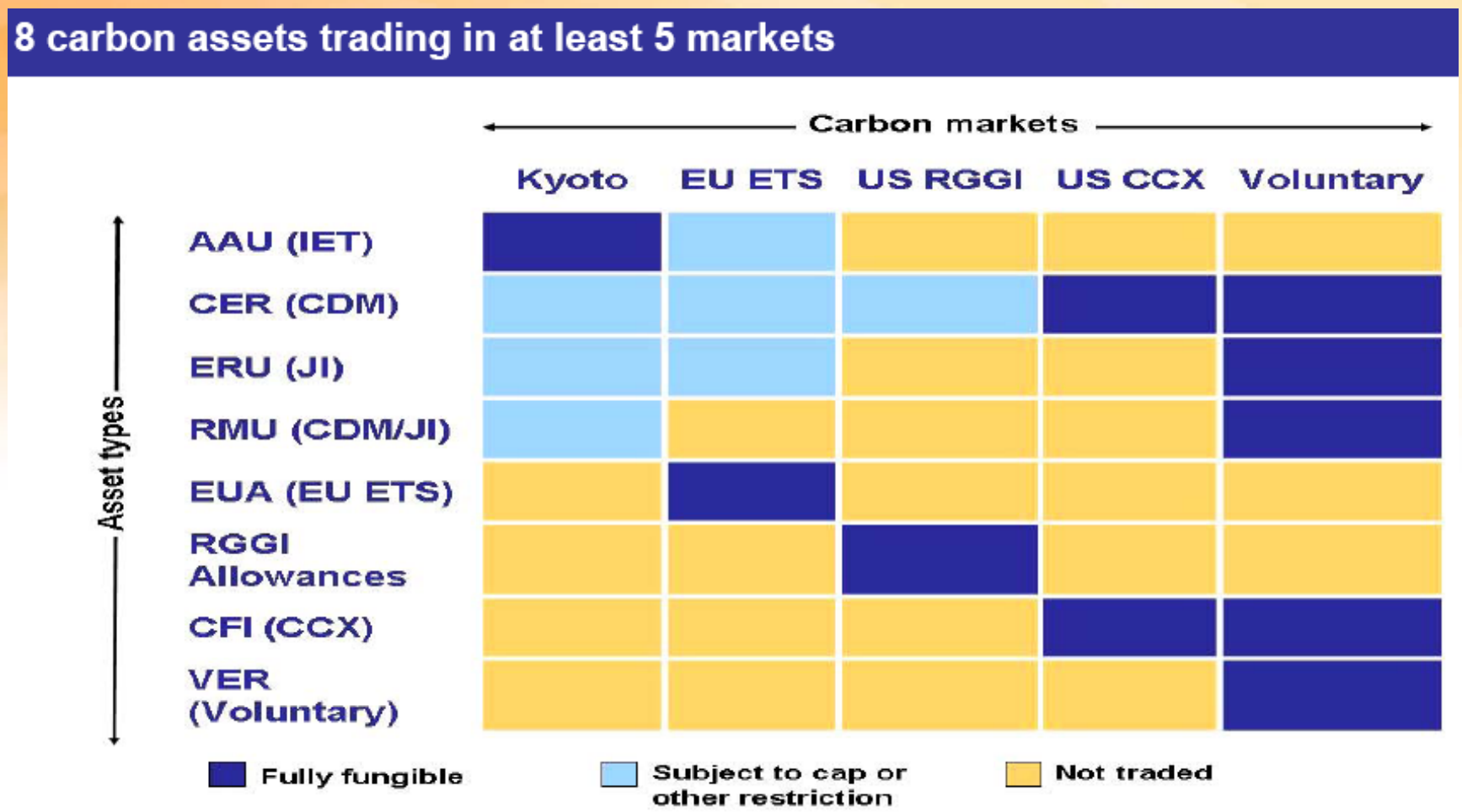




(IES, *NSW Privatisation Conference*, 2008)

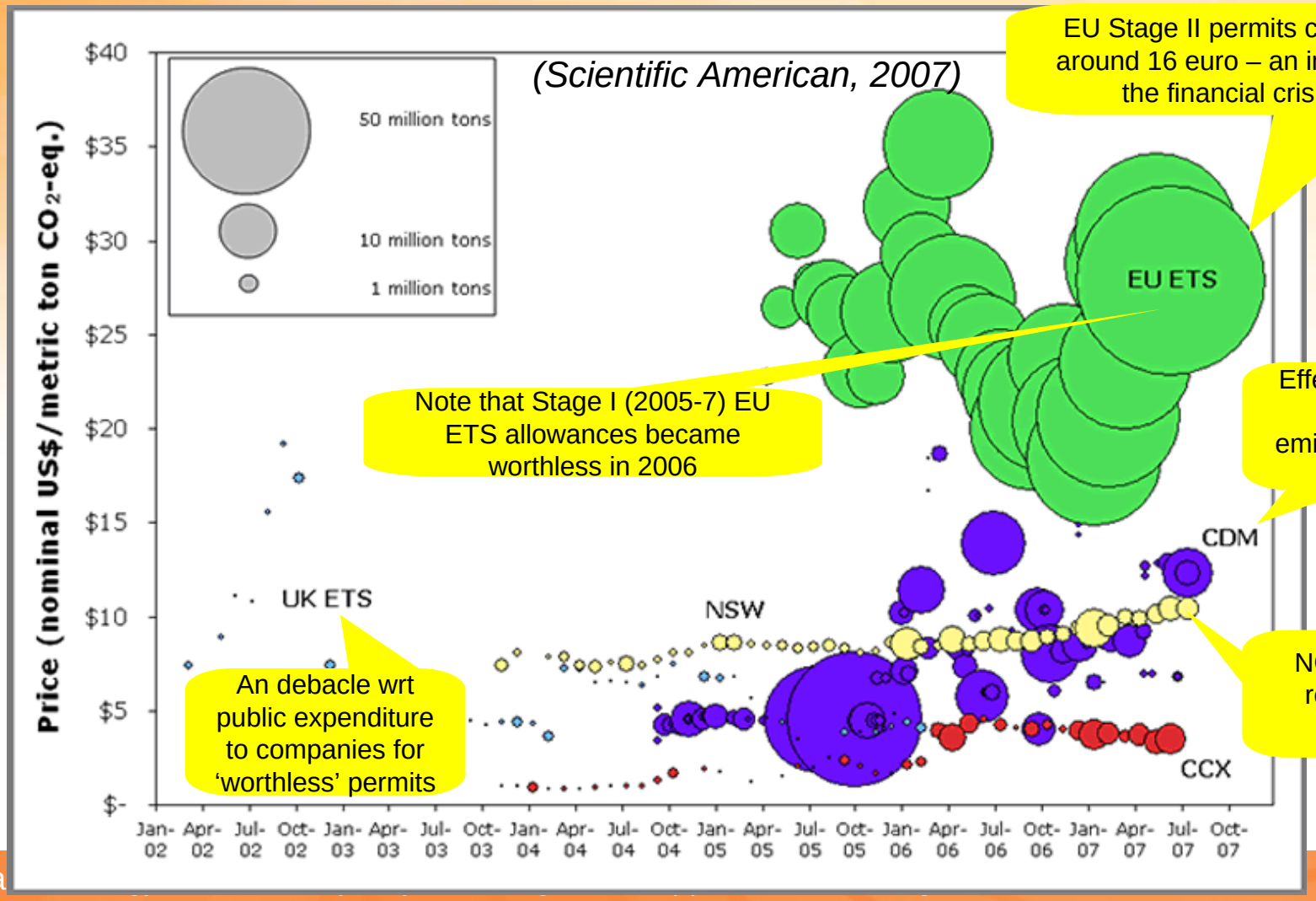


To conclude - complex mix of markets & instruments



(World Bank, Carbon Markets Report, 2008)

Carbon market performance to date mixed



EU Stage II permits currently around 16 euro – an impact of the financial crisis?

Note that Stage I (2005-7) EU ETS allowances became worthless in 2006

Effectiveness in reducing emissions under question

An debacle wrt public expenditure to companies for 'worthless' permits

NGAC prices recently fell 50+%

Current market status

(Ecosystem Market Place and New Carbon Finance, 2009)

Transaction Volumes and Values, Global Carbon Market, 2007 and 2008

Markets	Volume ($MtCO_2e$)		Value (US$ million)	
	2007	2008	2007	2008
Voluntary OTC	43.1	54.0	262.9	396.7
CCX	22.9	69.2	72.4	306.7
Other exchanges	0	0.2	0	1.3
Total Voluntary Markets	**66.0**	**123.4**	**335.3**	**704.8**
EU ETS	2,061.0	2,982.0	50,097.0	94,971.7
Primary CDM	551.0	400.3	7,426.0	6,118.2
Secondary CDM	240.0	622.4	5,451.0	15,584.5
Joint Implementation	41.0	8.0	499.0	2,339.8
Kyoto [AAU]	0.0	16.0	0.0	177.1
New South Wales	25.0	30.6	224.0	151.9
RGGI	-	27.4	-	108.9
Alberta's SGER[(a)]	1.5	3.3	13.7	31.3
Total Regulated Markets	**2,919.5**	**4,090.0**	**63,710.7**	**119,483.4**
Total Global Markets	**2,985.5**	**4,213.5**	**64,046.0**	**120,188.2**

A role for AFOLU in international carbon markets

What is traded?	Units = tons of carbon dioxide (or equivalent) allocated as part of an emission cap or "reduced" by a project or program activity. These units are labeled based on the market segment in which they are traded : AAUs, CERs, ERUs, EUAs, VERs, etc.
What is the underlying principle?	Cost-effectiveness: a ton of CO_2 emitted anywhere in the world has exactly the same impact on climate change and should therefore be reduced/mitigated where the cost of doing so is lowest.
What are the benefits of the carbon market?	• Lowers compliance costs in countries with obligations to reduce emissions; • Catalyzes financial and technology flows to developing countries to facilitate low-carbon growth; • Creates a global and long-term price signal to lower carbon intensity.

- However,
  - Questionable fungibility between AFOLU & energy-sector emissions
  - Wider externalities of AFOLU activities
  - Very significant transaction (measurement, verification) costs for AFOLU inclusion in trading arrangements
- *And wider questions of post 2012 action … hence many challenges*

Diagram from (World Bank, Carbon Markets Report, 2008)

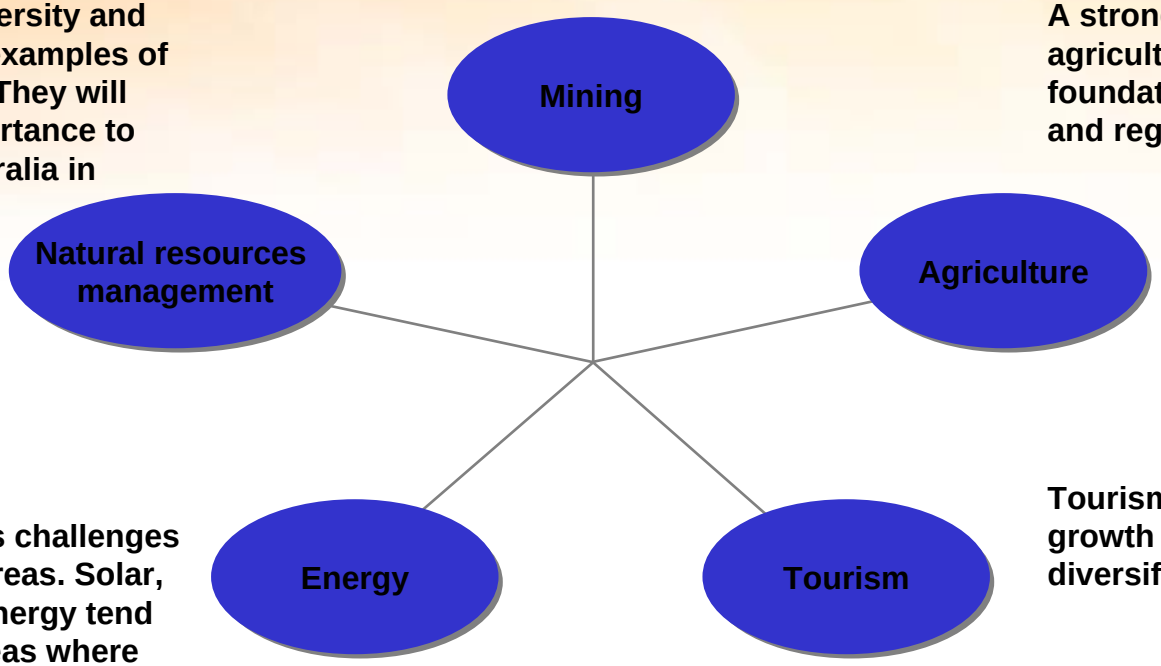
Australia 2020 Summit, Future Of Rural And Regional Australia, 2008

The future success of rural and regional Australia will depend on a strong and diversified economic foundation

As Australia is a major commodity exporter, the mining industry will continue to underpin the growth of many of our rural communities

The provision of biodiversity and carbon abatement are examples of "ecosystem services". They will grow in economic importance to rural and regional Australia in the future

A strong and sustainable agricultural sector is the foundation of many of our rural and regional communities



Climate change creates opportunities as well as challenges for rural and regional areas. Solar, wind and geothermal energy tend to locate in regional areas where large quantities of land are relatively inexpensive

Tourism offers enormous growth potential as well as diversification benefits

Centre for Energy and Environmental Markets

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Thank you… and *questions*

Comments, suggestions and corrections for this presentation are all welcome. Please contact Iain at i.macgill@unsw.edu.au

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