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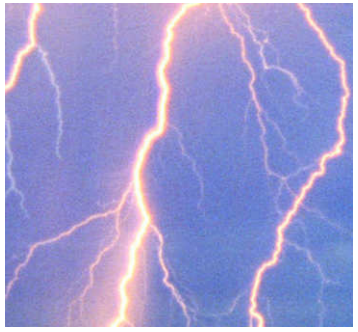

Research Opportunities in Regional Australia on Climate Change and a Low-Carbon Economy

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CRCCS / Regional Futures Institute Workshop

Southern Cross University
Lismore, 7 December 2009

Climate change just one of regional Australia's current challenges and opportunities

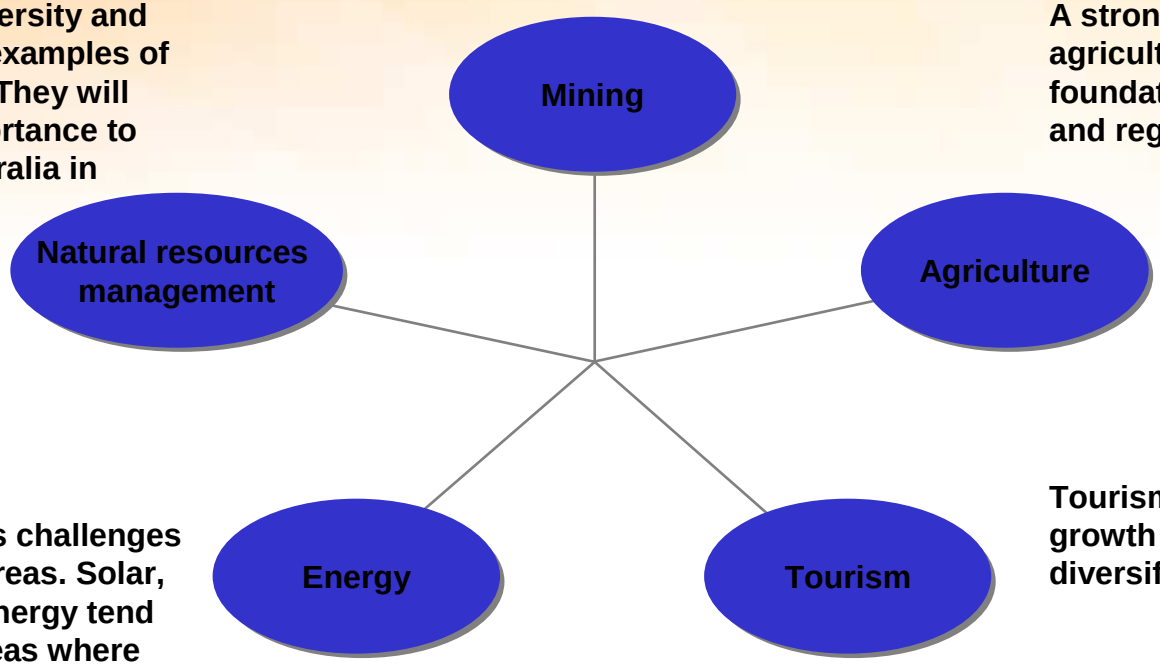
Australia 2020 Summit, Future Of Rural And Regional Australia, 2008

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

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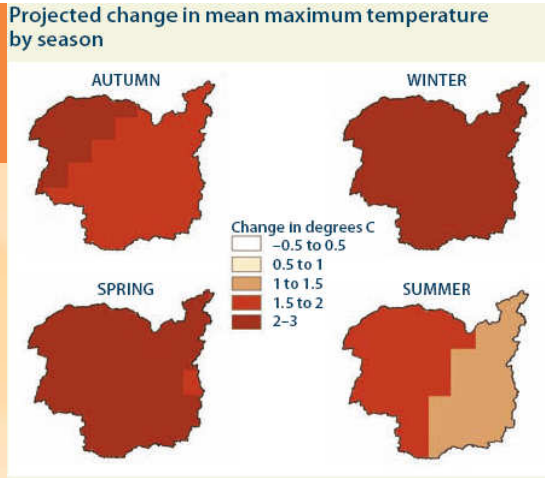
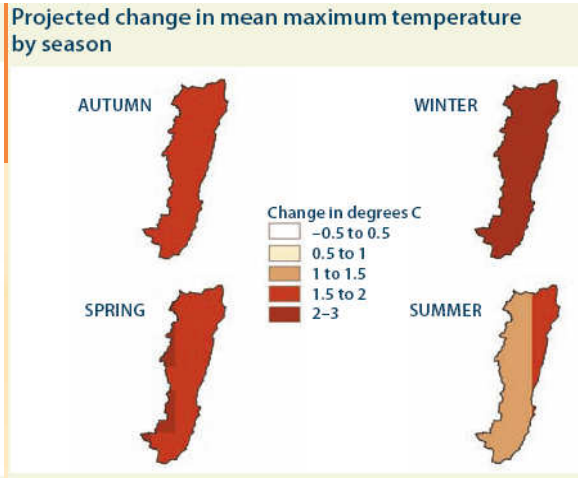
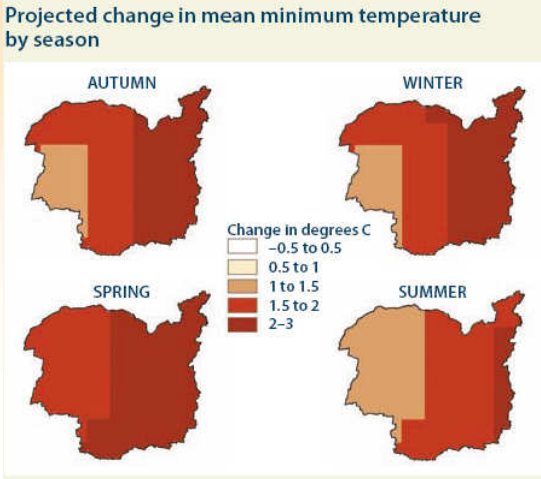
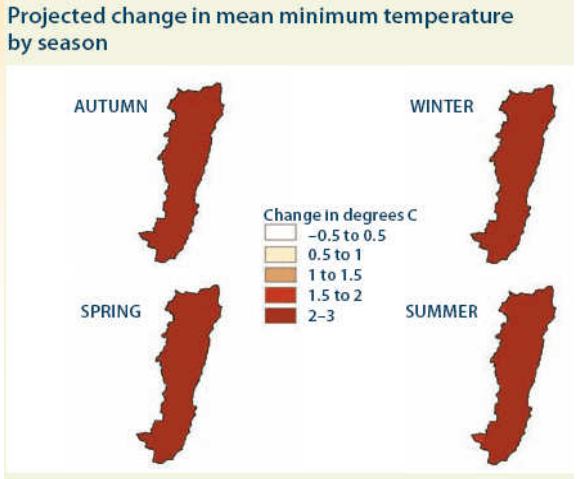
Expected Climate change impacts…

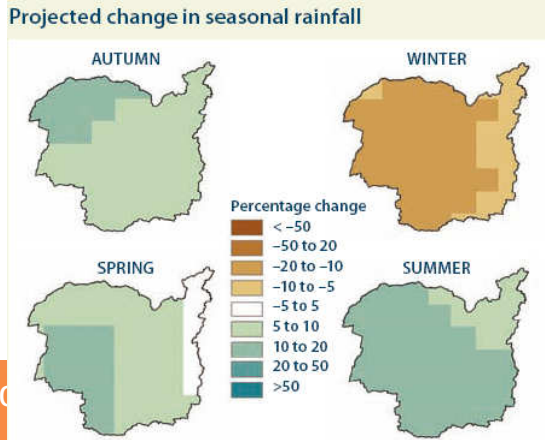
- invariably have to be considered on a regional basis

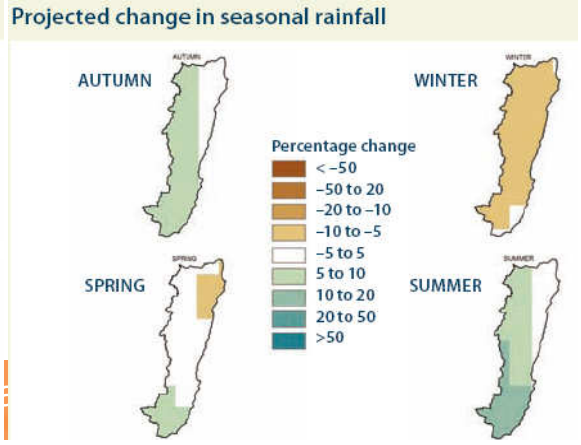








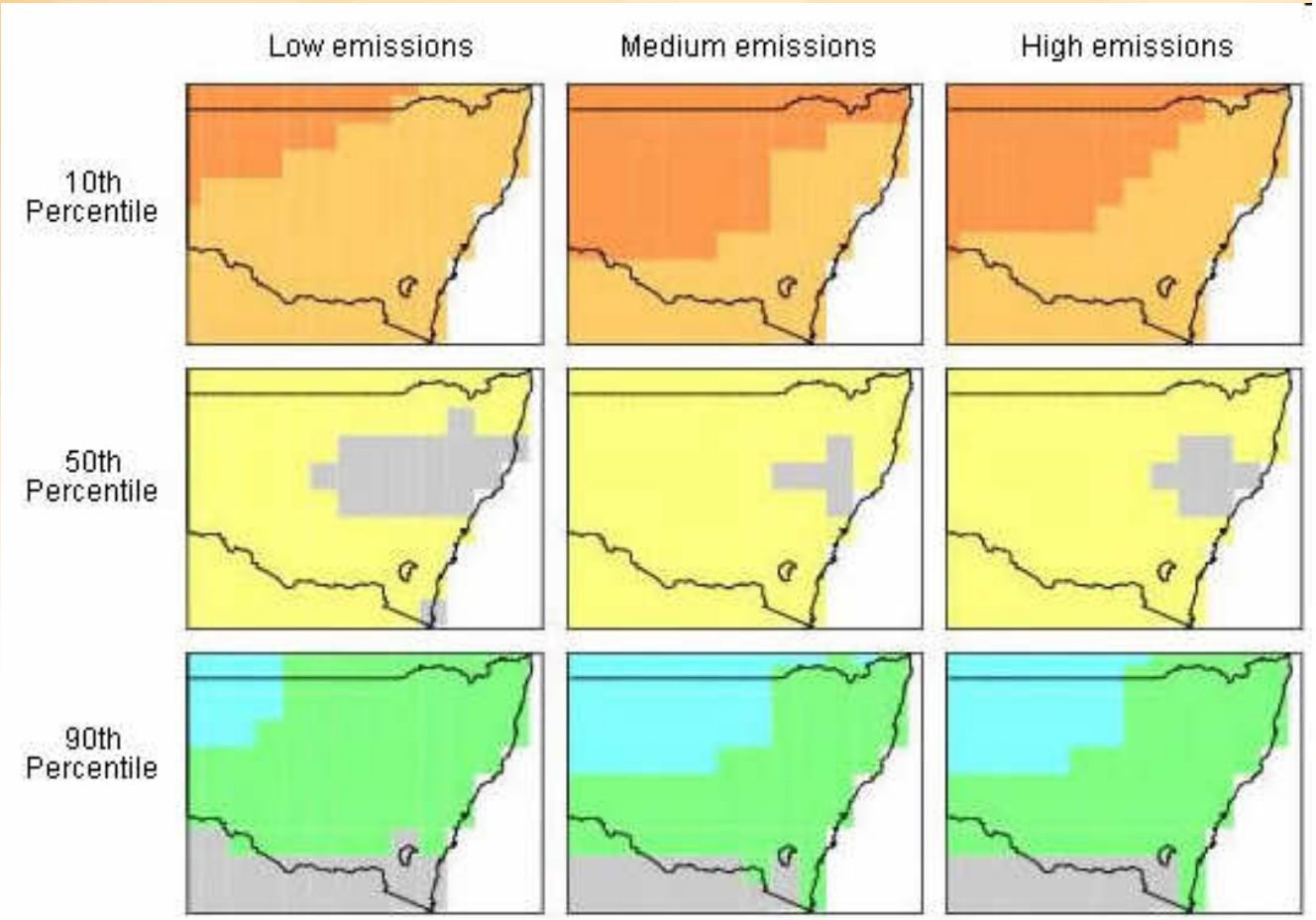




(NSW Govt, *Summary of Climate Change Impacts: NSW Climate Change Action Plan*, 2008)

… and

- Have significant uncertainties (that don't seem to greatly depend on emissions in the short-medium term)

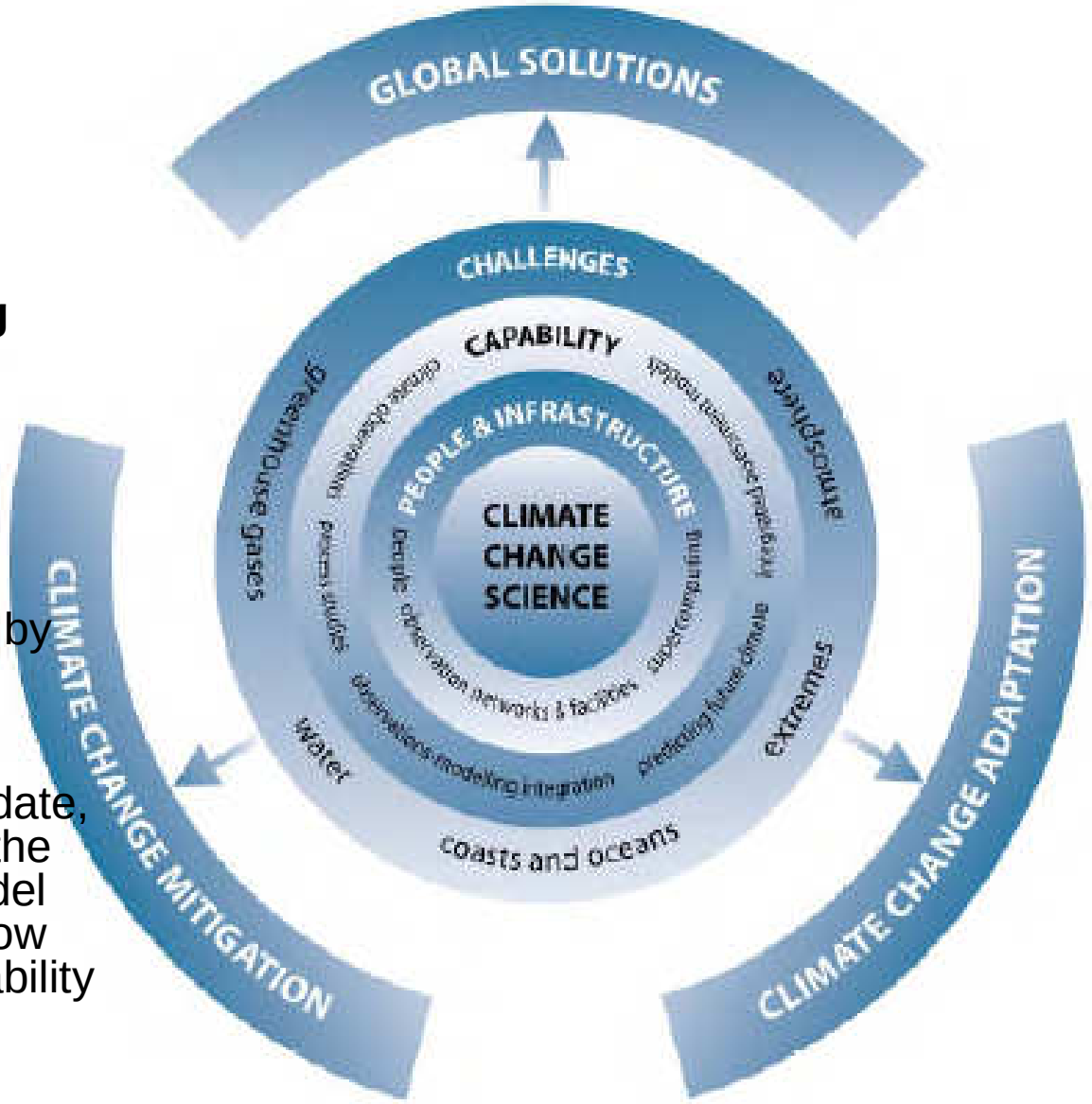


(Projected NSW annual rainfall in 2030, *http://www.climatechangeinaustralia.gov.au/*)

Australian climate change science framework (May, 2009)

- **Considerable progress being made.. and required**

  ".. a scientific community with limited capacity to meet the demand for information and understanding of the potential impacts on a regional scale… The global-scale assessments by the GCMs are generally not appropriate for assessing the impact of climate change at regional and local levels… To date, the large differences between the various models in regional-model climate projections suggest a low level of confidence in their reliability for producing realistic climate projections." (Bureau of Meteorology, 2003)



Federal Govt Climate Change Adaptation Program

"The Government's up to $126 million CC Adaptation Program"

- **Supporting research**
  - National Climate Change Adaptation Research Facility investment of up to $20m over 4 years
- **Grants programs for local councils and professionals**
  - Local Adaptation Pathways Program.
  - Integrated Assessment of Human Settlements sub-program
  - Climate Change Adaptation Skills for Professionals Program.
- **Major national vulnerability assessments**
  - National Coastal Risk Assessment
  - Biodiversity Vulnerability Assessment
  - Implications of climate change for Australia's World Heritage properties
    Implications of Climate Change for Australia's National Reserve System

Possible management frameworks

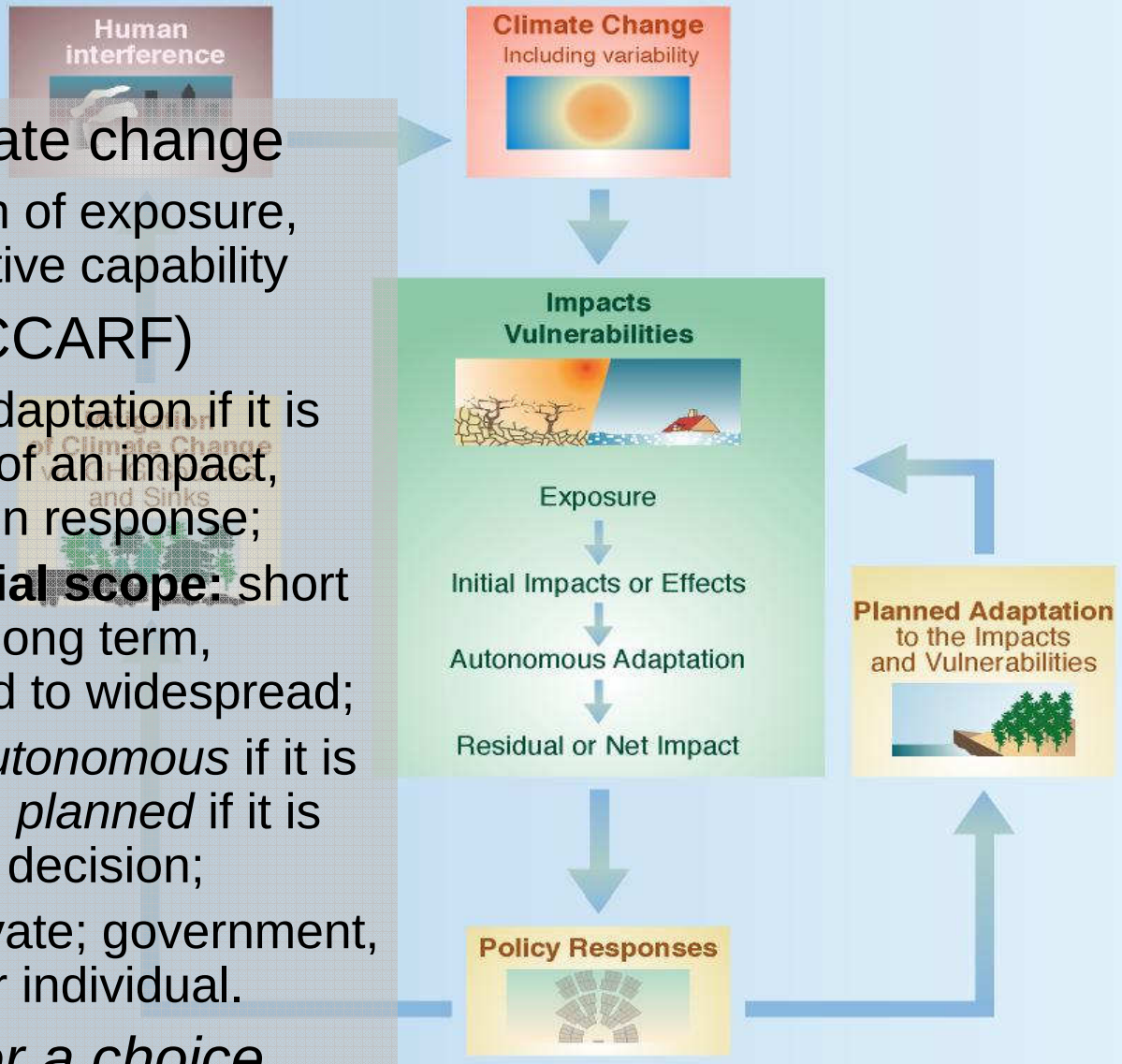
(Walker, *A resilience perspective on regional sustainability*, 2008)

- **"Two paradigms for use and management of natural resource systems:**
  - Maximum Sustainable Yield
  - Resilience management and governance
- **Resilience approach assumptions**
  - limits to how much social-ecological systems) can change and still recover
  - If limits are exceeded they function in a different way (they can exist in alternate states)

- **Resilience**
  - capacity of a system to absorb disturbance and re-organise so as to retain essentially the same function, structure and feedbacks – to have the same identity / system regime
- **Adaptability**
  - capacity to manage resilience; to avoid, or to engineer, regime shifts (determined by leadership, trust, social networks, 'social capital', governance) if a shift into a "bad" regime is inevitable the only option is transformation
- **Transformability**
  - capacity to transform into a different kind of system; different scales, new state variables - a new way of making living"

Adaptation

- Vulnerability to climate change
  - a key driver; function of exposure, sensitivity and adaptive capability
- Key distinctions (NCCARF)
  - **Timing:** *proactive* adaptation if it is done in anticipation of an impact, *reactive* if it is done in response;
  - **Temporal and spatial scope:** short term as opposed to long term, localised as opposed to widespread;
  - **Purposefulness:** *autonomous* if it is done unconsciously, *planned* if it is the result of a policy decision;
  - **Agent:** public or private; government, industry, business or individual.
- *Adaptation no longer a choice*



NSW Climate Change Action Plan

- "…In particular, the NSW Government will give greater attention to adapting to the unavoidable impacts of climate change… areas where NSW needs to focus its efforts include:
  - working with the building industry to consider whether current design standards for homes in storm and flood prone areas are strong enough to withstand harsher weather events in the future
  - working with local councils and planners to respond to the impacts of long term sea level rise
  - readying ourselves for more intense and frequent bushfires
  - planning to support the elderly and vulnerable - particularly those with chronic heart and lung disease - to cope with the expected increase in heatwaves.
  - preparing our economy for the challenges and opportunities that will come in a carbon-constrained economy
  - ensuring we look after our natural environment as the climate changes, especially vulnerable areas like the alpine region
  - ensuring that our agricultural communities have the technology and science they need to adapt to changing weather patterns."

(Plan under development - http://www.environment.nsw.gov.au/climateChange/actionplan.htm)

Growing Australian + International research efforts

NCCARF
National Climate Change Adaptation Research Facility

National Research FLAGSHIPS
Climate Adaptation
CSIRO

Priority themes

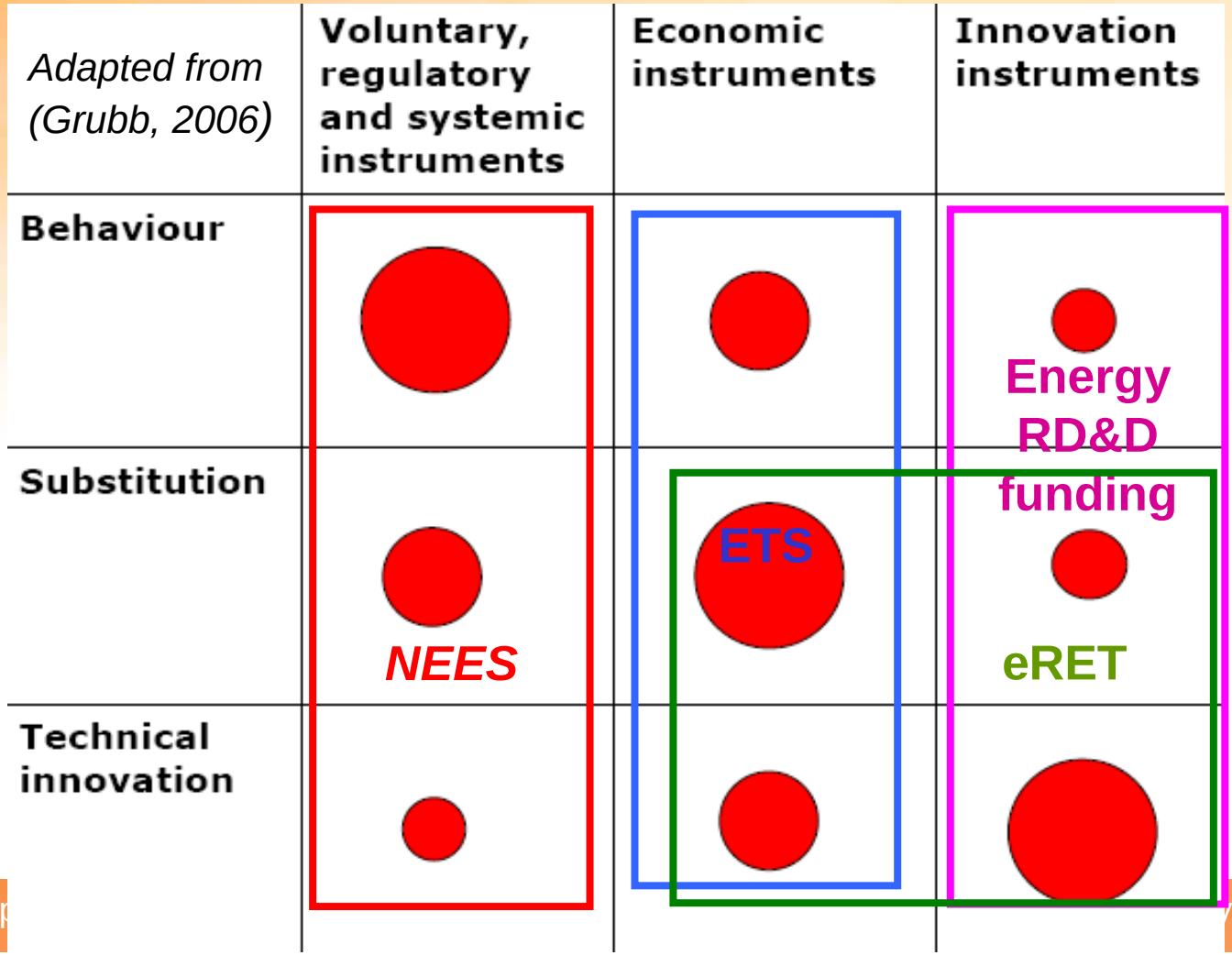
- Terrestrial Biodiversity
- Human Health
- Marine Biodiversity & Resources
- Water Resources & Freshwater Biodiversity
- Settlements and Infrastructure
- Social, Economic & Institutional Dimensions
- Emergency Management
- Primary Industries

Research Themes

- Pathways to adaptation: positioning Australia to deal effectively with climate change
- Sustainable cities and coasts
- Managing species and natural ecosystems in a changing climate
- Adaptive primary industries, enterprises and communities

Key current Australian energy + climate policy efforts

- Significant reliance on economic instruments with proposed CPRS, implemented eRET… *growing appreciation of need for additional policies*



Carbon markets and Land-use

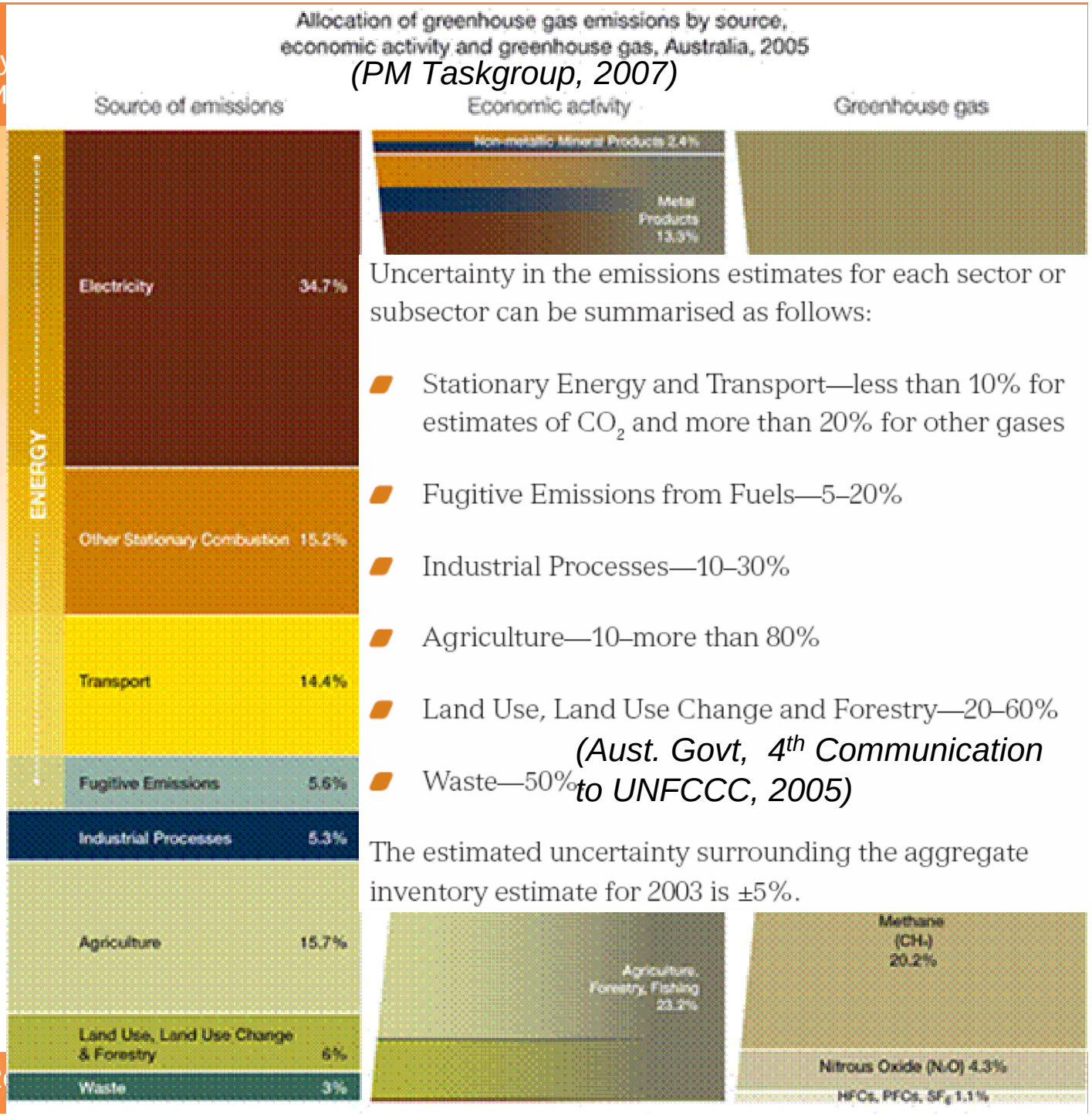
- Agriculture, Forestry and Other Land Use (AFOLU)
  - ~ 30% of global GHG emissions & cost effective reduction options
- Complex challenges and opportunities
  - Deforestation ~20% of emissions
  - Response of ecosystems to climate change
  - Potential renewable energy sources offsetting fossil-fuel 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)

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 ***and perhaps now excluded***), 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%

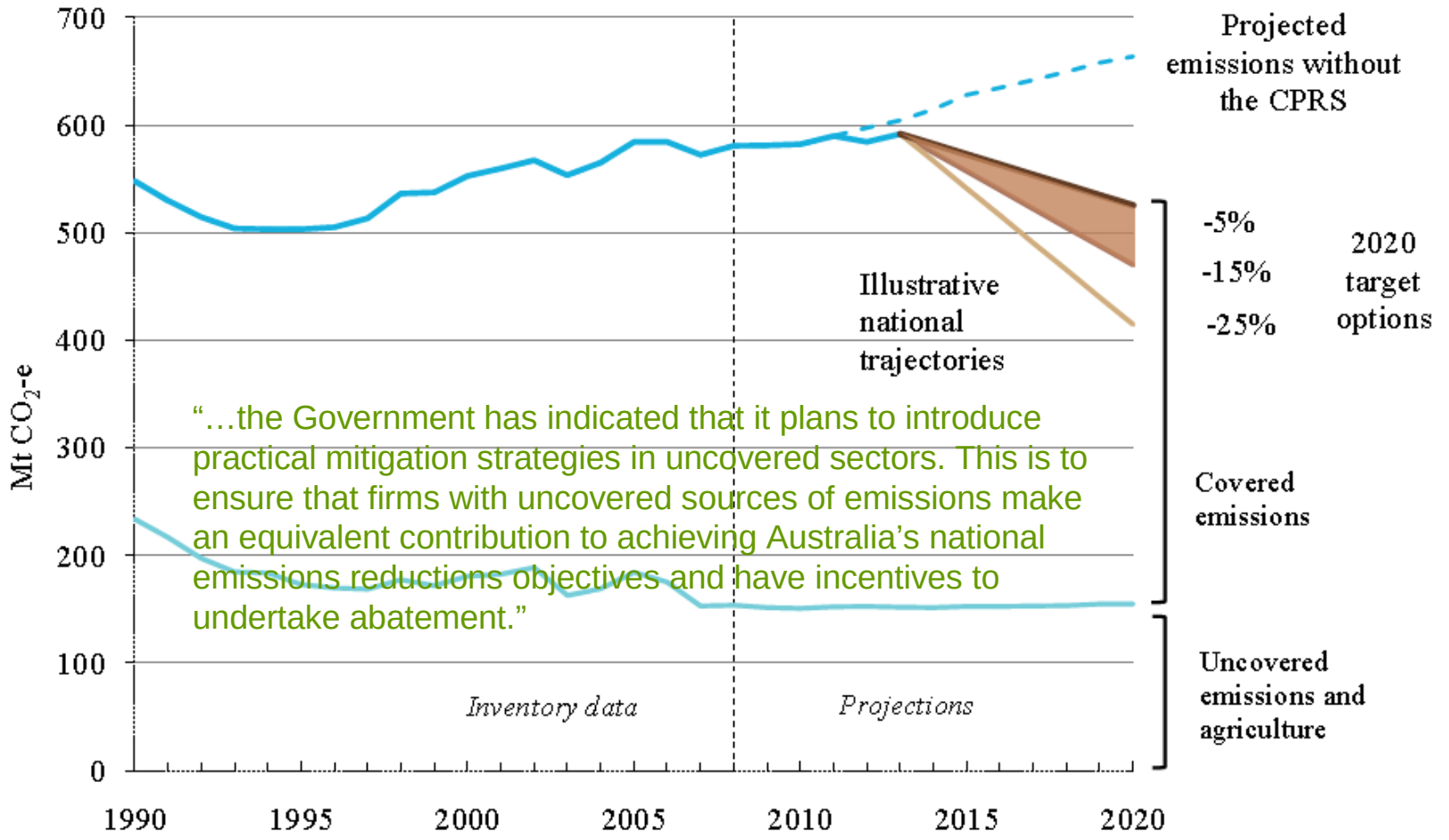
(Aust. Govt, 4th Communication to UNFCCC, 2005)

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



"…the Government has indicated that it plans to introduce practical mitigation strategies in uncovered sectors. This is to ensure that firms with uncovered sources of emissions make an equivalent contribution to achieving Australia's national emissions reductions objectives and have incentives to undertake abatement."

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

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)

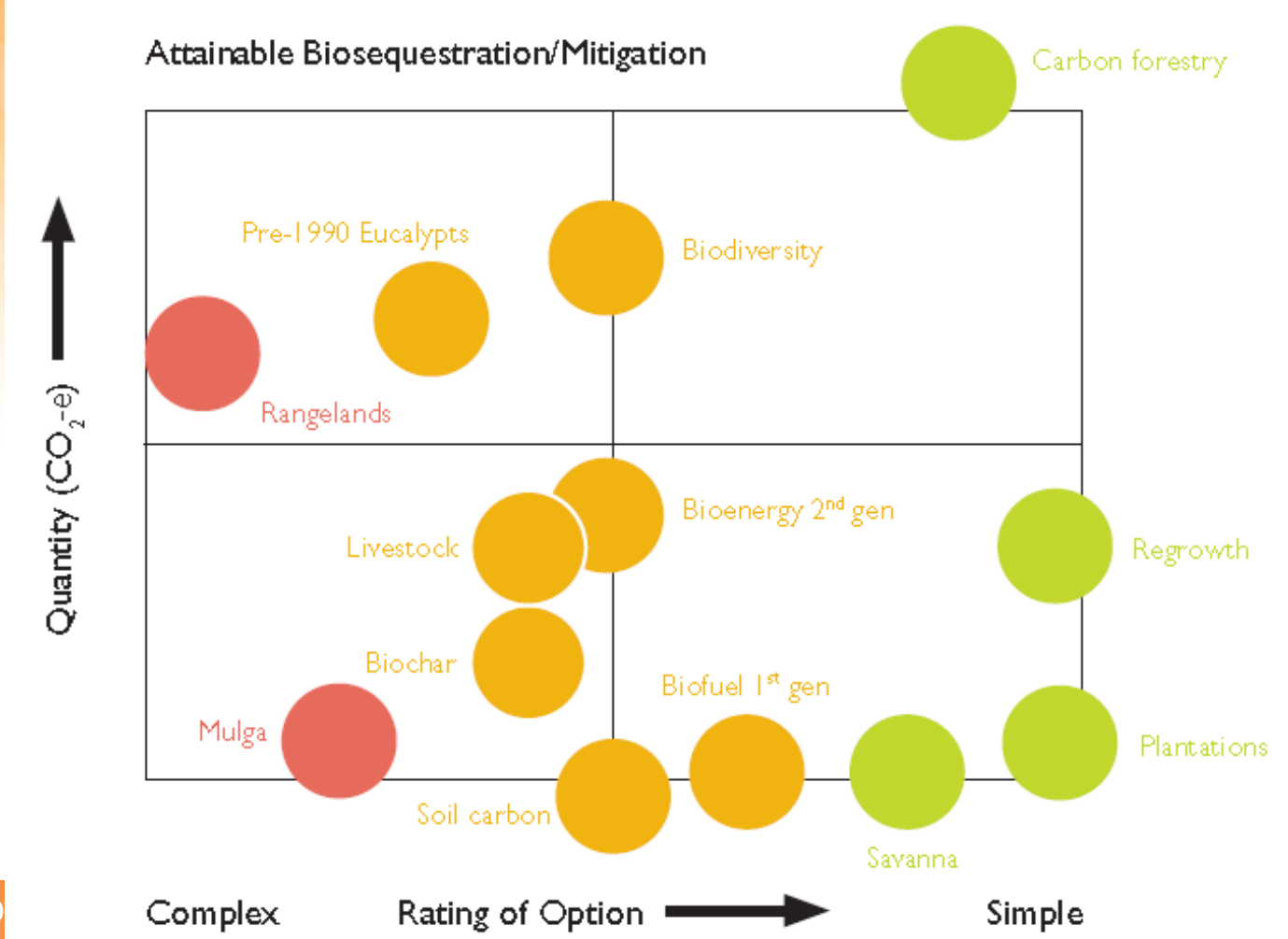
Government 'view' that opt-in approach has similar outcomes to offset scheme, but is less complex to administer

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?

***note potential opt-in for agriculture under proposed new CPRS arrangements*

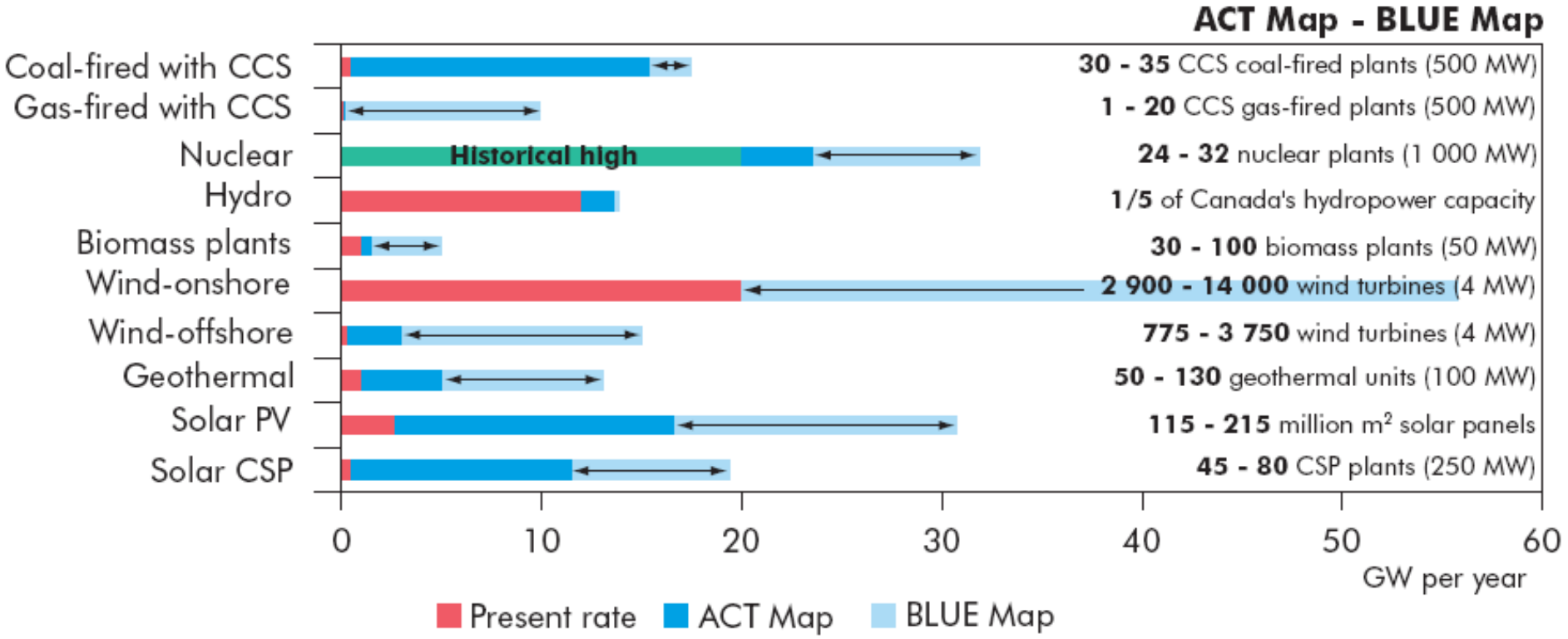
However, potentially major opportunities for rural land-use to deliver mitigation (CSIRO, *An Analysis of Greenhouse Gas Mitigation and Carbon Biosequestration Opportunities from Rural Land Use*, 2009)



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

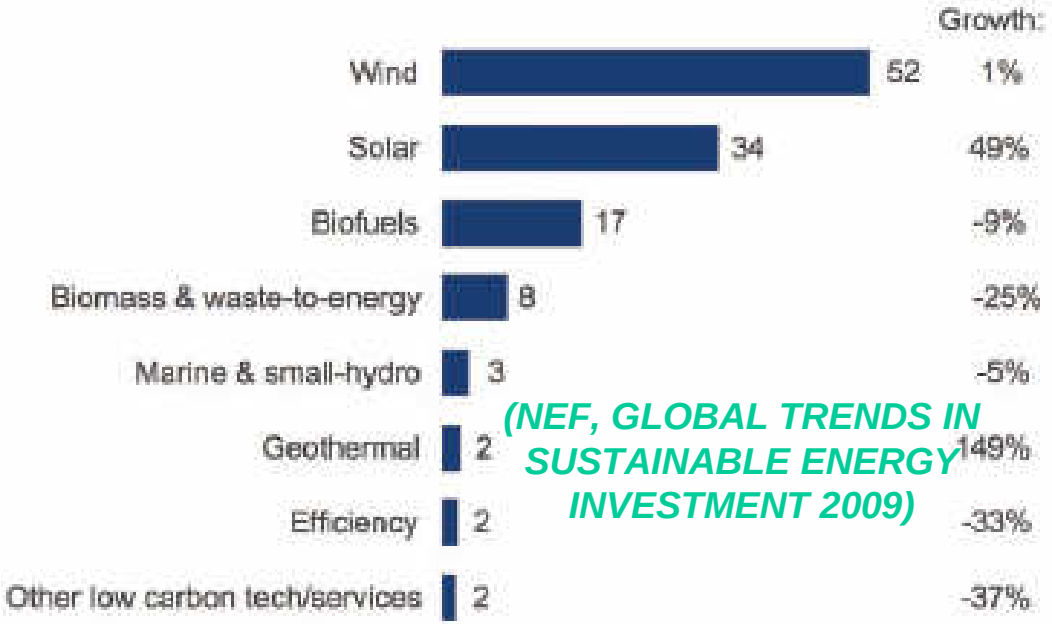
Figure ES.3 ▶ **Additional investment in the electricity sector in the ACT Map and BLUE Map scenarios (compared to the Baseline, 2005-2050)**



Renewable energy markets worldwide taking off

2008 was the first year that new power generation investment in renewables was greater than investment in fossil-fueled technologies

Figure 8: Financial new investment by technology, 2008, and growth on 2007, $ billions



(NEF, GLOBAL TRENDS IN SUSTAINABLE ENERGY INVESTMENT 2009)

China launches green power revolution to catch up on west

- Plan to hit 20% renewable target by 2020
- $30bn for low-carbon projects

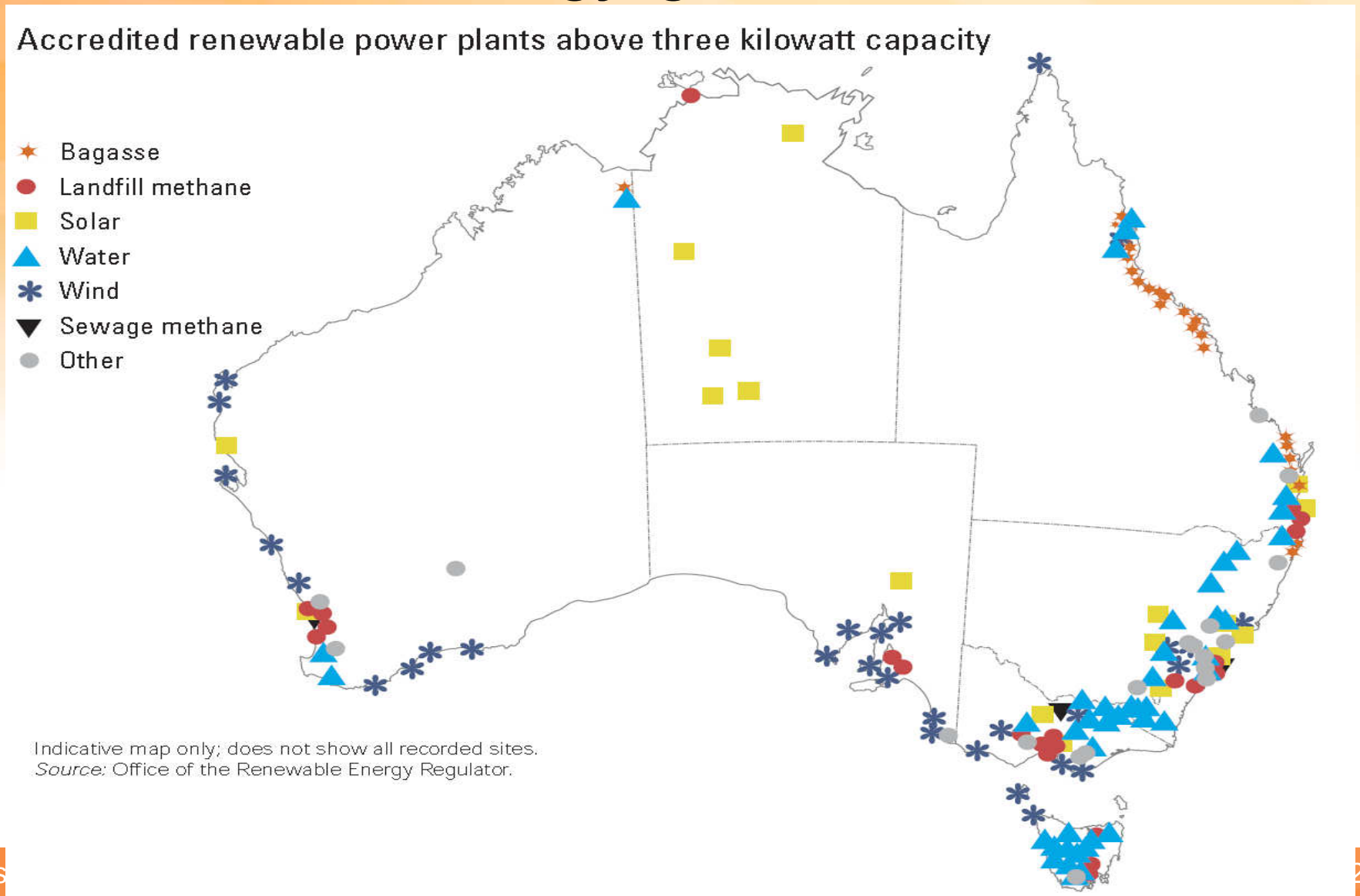
阅读中文 | Read this in Chinese

Julian Borger and **Jonathan Watts** in Beijing
The Guardian, Wednesday 10 June 2009

China's ambitious wind and solar plans represent a direct challenge to Europe's claims of world leadership on cutting carbon emissions. Photograph: Keren Su/Getty

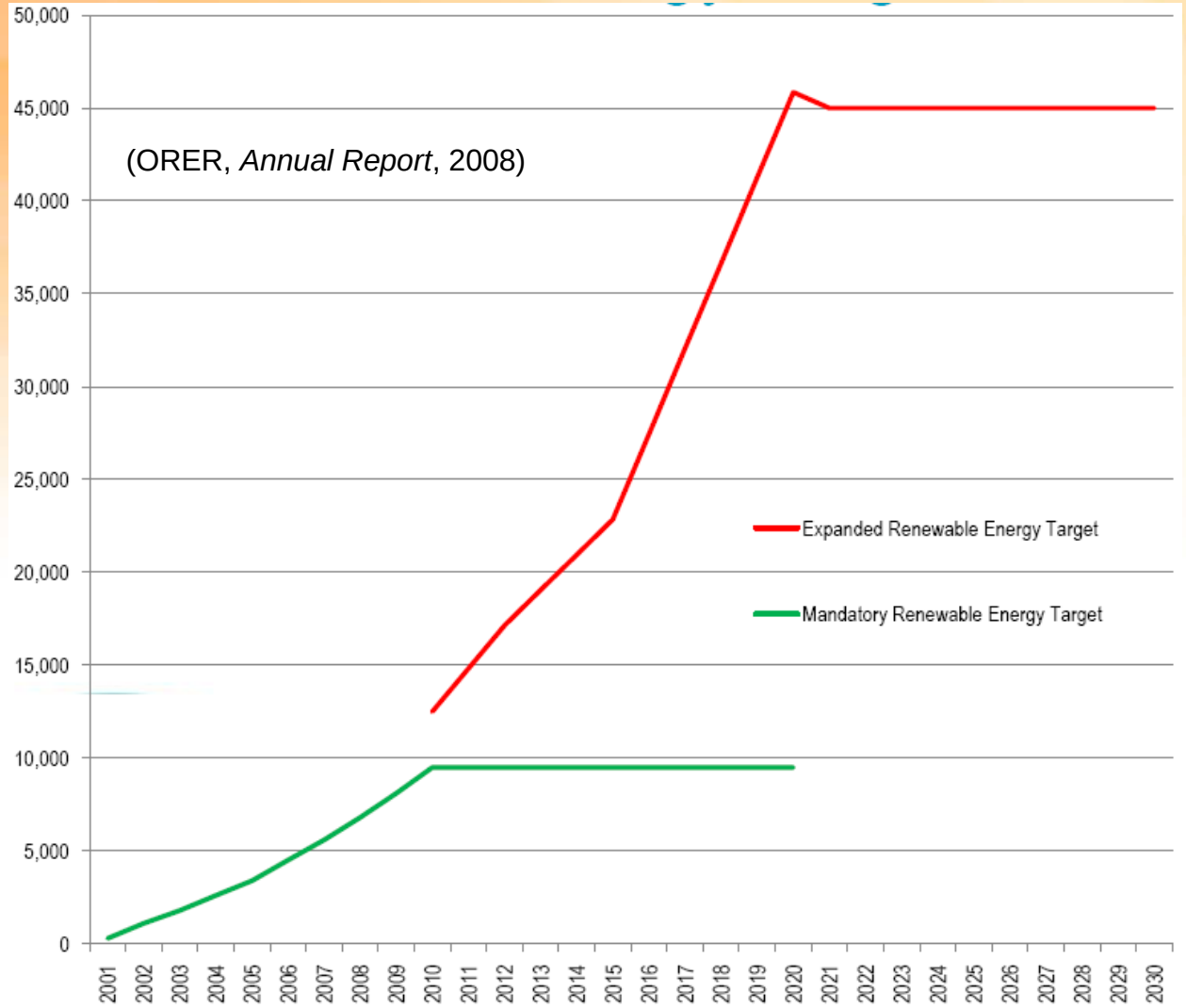
China is planning a vast increase in its use of wind and solar power over the next decade and believes it can match Europe by 2020, producing a fifth of its energy needs from renewable sources, a senior Chinese official said yesterday.

Renewable Energy generation locations



Indicative map only; does not show all recorded sites.
Source: Office of the Renewable Energy Regulator.

The eRET opportunity

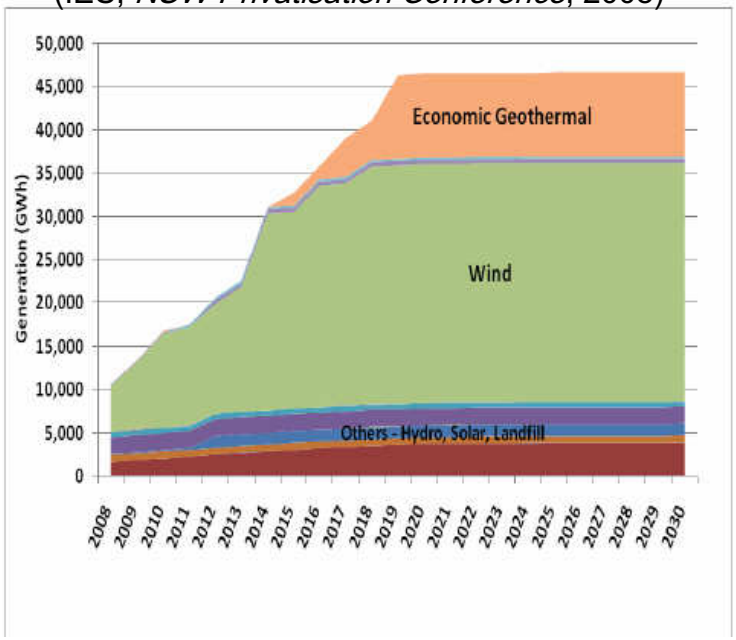


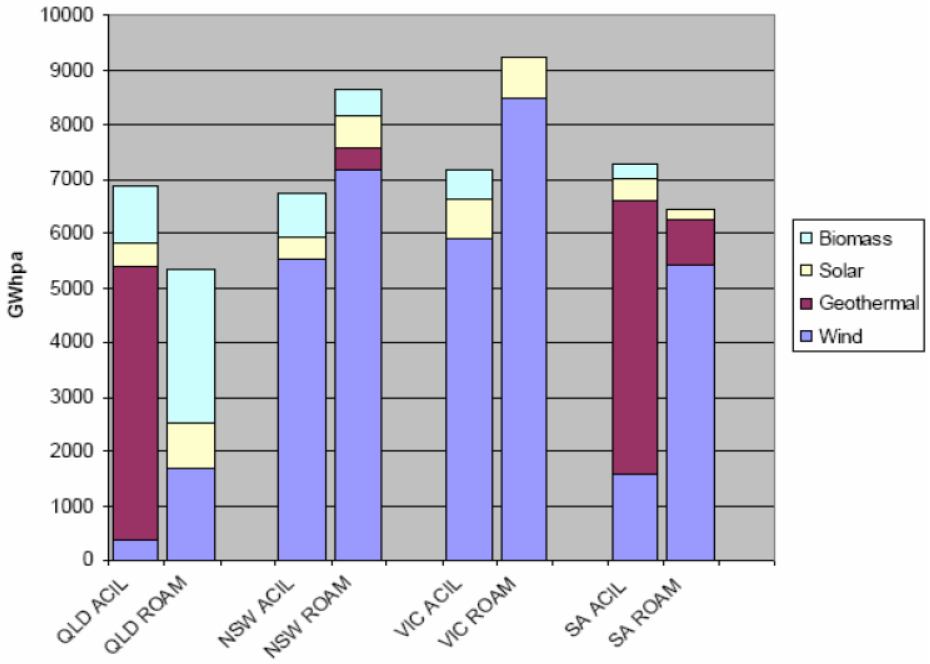
(ORER, *Annual Report*, 2008)

eRET projections

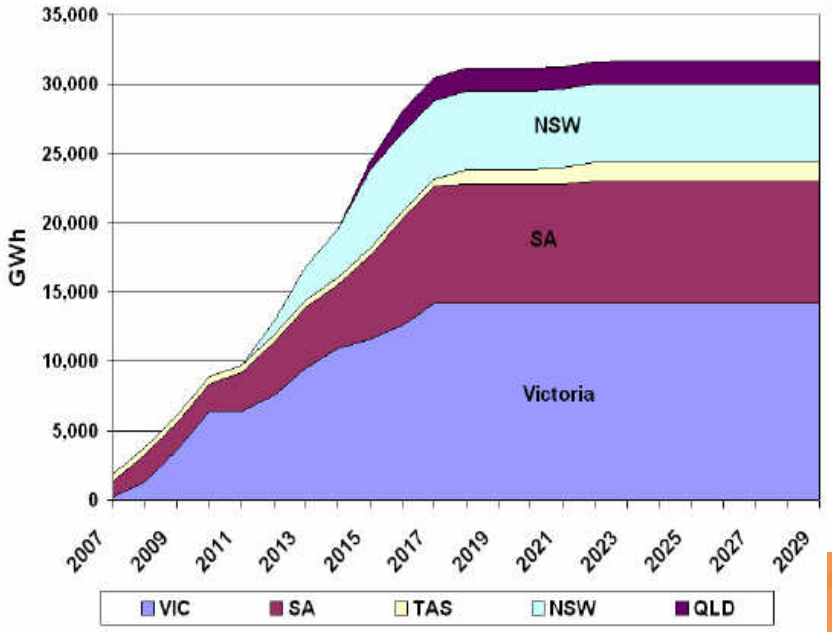
- A wide range to choose from
- Work to date generally doesn't appear to have captured all aspects of some key poor design choices
- Limited consensus on which technologies, where and when

(IES, *NSW Privatisation Conference*, 2008)





(AEMC, *Survey of climate change policy impacts*, 2008)



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Need policy targets.. but much more

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

Rank[1]		Country	All renewables	Wind index	Onshore wind	Offshore wind	Solar	Biomass/ other
1	(1)	US[3]	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.

Current carbon 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**

Where next for carbon markets?

- CPRS in Australia
- Internationally…

Carbon trade on brink of boom - or backwater

Wed Nov 18, 2009 8:44am EST

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Fiscal/political risk in Australia

ETS debate: report

By Nina Chestney - Analysis

LONDON (Reuters) - Emissions trading stands at a crossroads -- a future as a $2 trillion market if the United States bolsters it, or as a modest sideline to energy and commodities trade if a new climate treaty is not agreed.

Some players have bet on the growth of the $126 billion global carbon market after 2012 but regulatory uncertainty will be drawn out for another year as a deadline for a binding treaty on greenhouse gas emissions was pushed back to 2010 this week.

Voluntary Carbon Markets eg. VCS

(VCS, *Guidance for AFOLU Projects*, 2008)

- Covered AFOLU activities
  - Afforestation, Reforestation and Revegetation (ARR)
  - Agricultural Land Management (ALM)
    - Improved cropland management
    - Improved grassland management
  - Improved Forest Management (IFM)
    - Conversion from conventional logging to reduced impact logging
    - Conversion of logged forests to protected forests
    - Extending rotation age of evenly aged managed forests
    - Conversion of low-productive forests to productive forests
  - Reducing Emissions from Deforestation (RED)
- Process
  - Verification
  - Validation of methodologies
  - Approval of Tools
  - Community and/or environmental impacts
  - *Non-permanence risk analysis & buffers*

Australian National Offsets Standard (Nov. 2009)

- Voluntary retirement of the following units accepted under Standard:
  - (a) Australian Emissions Units (AEUs);
  - (b) Certified Emissions Reductions (CERs) except long term (lCERs) and temporary (tCERs);
  - (c) Emission Reduction Units (ERUs);
  - (d) Removal Units (RMUs);
  - (e) Voluntary Emissions Reductions (VERs) issued by the Gold Standard*;
  - (f) Voluntary Carbon Units (VCUs) issued by the Voluntary Carbon Standard*;
    - Where credits are issued for reduced emissions from deforestation and degradation (REDD) and other agriculture forestry and land use (AFOLU) projects, they must apply methodologies approved under the Standard.
  - (g) Offsets from emissions sources in Australia not counted toward Kyoto target, where they meet eligibility criteria and use methodology approved under Standard.
    - Forest management (forests established before 1990);
    - Revegetation (establishment of woody biomass that does not meet forest criteria);
    - Cropland and grazing land management (net GHG from soil, crops and vegetation).

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Thank you… and *questions*

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

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