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Emissions Trading, Renewable Energy Targets and the Way Ahead

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Sustainable Energy in a Carbon Constrained World

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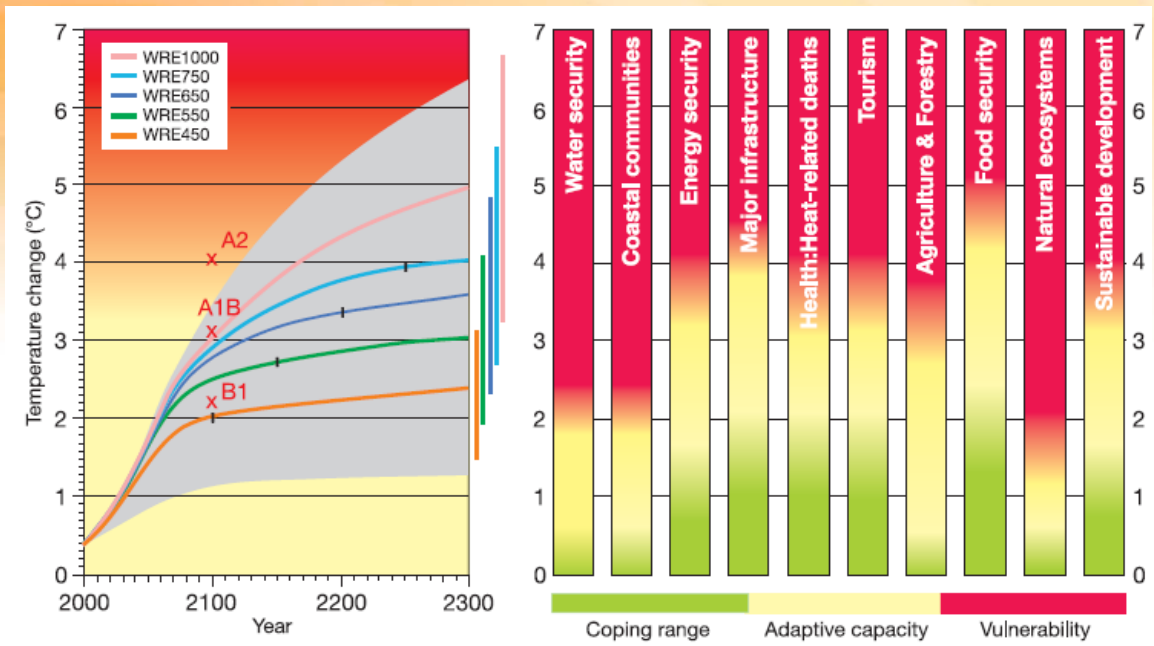
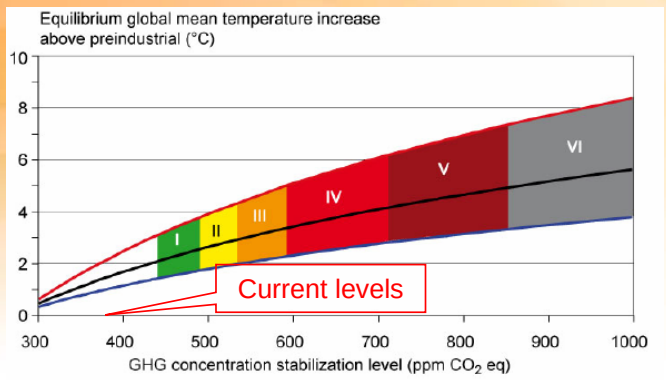
The climate change challenge

Australian and NZ vulnerability (IPCC WGII, 2007)



Avoiding dangerous warming - stabilisation



(FAR WGIII, 2007)

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

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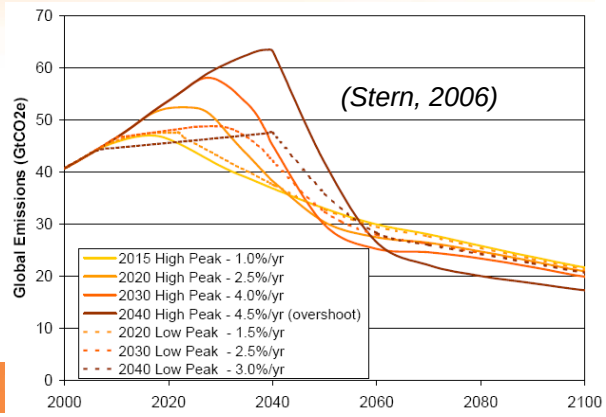
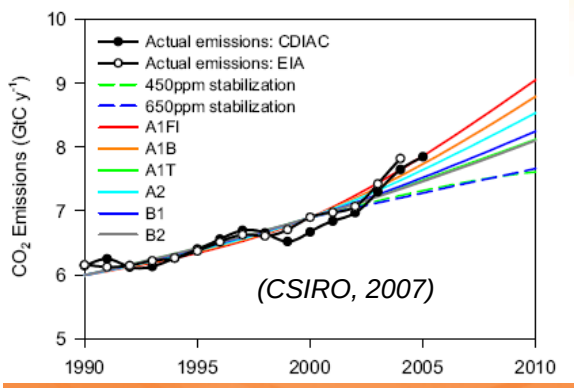
…. and possible emission trajectories

- Note high 'price' of delay
  - Waiting 20 years to act requires emissions to fall 3-7 times faster to a lower level
- *… current trajectory exceeds the 'worst case' IPCC scenarios from TAR*

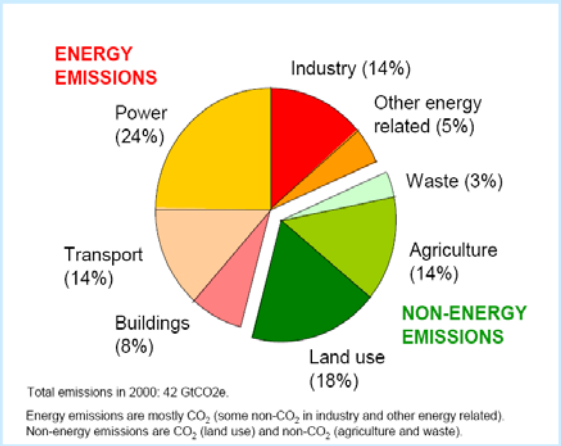




Abatement options *(Stern, 2006)*

- Reducing demand for emissions-intensive goods + services
  - Energy conservation / frugality
- Increased efficiency
  - Particularly end-use efficiency, but also in supply + distribution
- 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, Gas 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.

ETS & Clean Energy Targets in a coherent climate and energy policy framework

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

ETS

Renewable targets

What policy role can ETS play?

- 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 + energy markets they interact with
  - suffer from wide range of market failures
  - may struggle to appropriately 'price' uncertainties about future
  - Established by political process inevitably involving compromises that reduce effectiveness
- ETS contribution to policy mix
  - Major role is for driving substitution
    - 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

Current Australian ETS & renew target commitments

Table 5.1.1: Greenhouse gas reduction and renewable/low emission targets, by Australian Jurisdiction

Jurisdiction	Long-term (2050) economy-wide targets	Intermediate economy-wide targets	Renewable or low emission targets
Commonwealth Government	No policy. (To be announced in 2008.)	Annual caps for period up to 2020 for an emission trading scheme to be announced in 2010.	2% extra renewable energy target by 2010 (legislated)
New South Wales	60% reduction on 2000 levels	Return to 2000 levels b[illegible]	10% renewable energy target by 2010 and 15% by 2020
Victoria	60% reduction on 2000 levels		10% renewable energy target by 2016 (legislated)
Queensland	60% reduction on 2000 levels		18% gas generation by 2020 and 10% low emission target by 2020
South Australia	60% reduction on 1990 levels (legislated)		20% renewable energy target by 2014 (legislated)
Western Australia	60% reduction on 2000 levels		15% renewable energy target by 2020 and 20% by 2025
Tasmania	60% reduction on 2000 levels		
Australian Capital Territory	60% reduction on 2000 levels	Return to 2000 levels by 2025	Implement a renewable energy target in line with NSW.

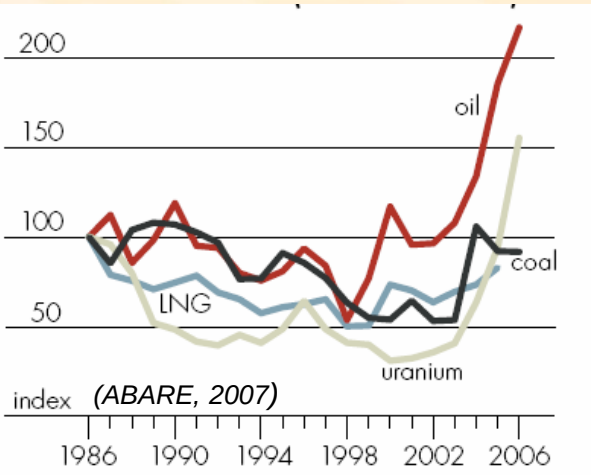
Labor 60% reduction by 2050, intermediate target announced 2008

Labor 20% Renewable Energy Target for 2020

Now 15% Clean Energy Target for 2020 including CCS, nuclear?

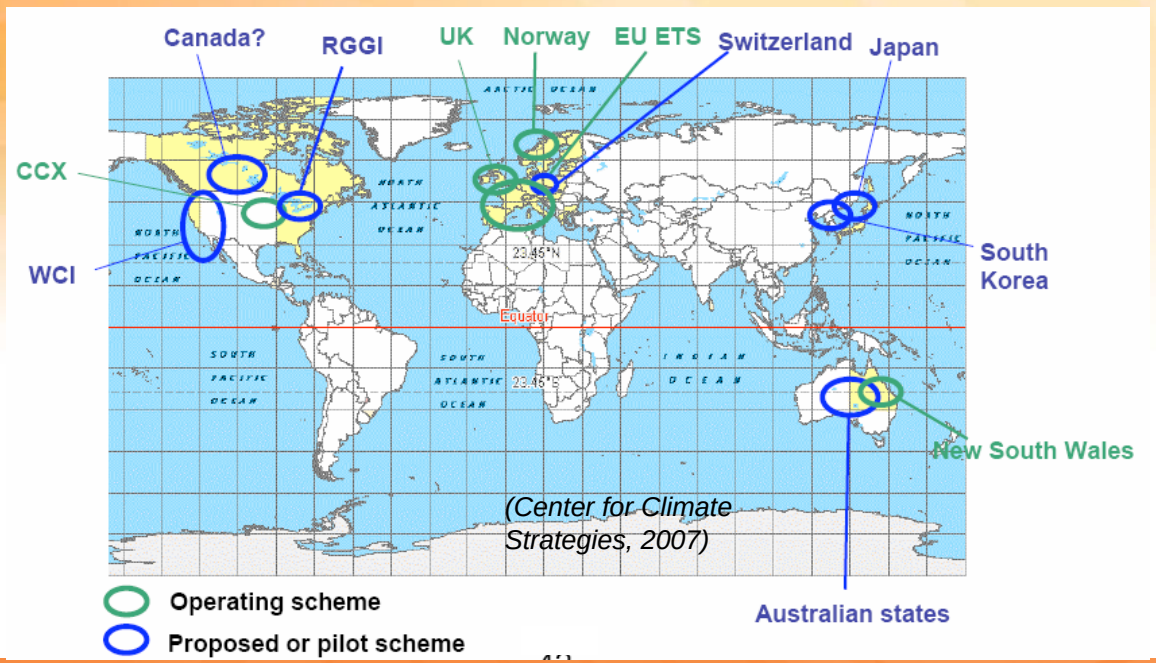
Putting a price on carbon

- Energy highly valuable so already a price on carbon
  - Production costs, royalties, economic rents… also subsidies
  - *Many costs/benefits are externalities unless addressed by govt*
- Greenhouse emissions the latest externality
  - Underlying prices wrt CO2 variable but generally low
  - US$60/Barrel oil
    => ~400kgCO2 = ~$150/tCO2
  - US$50/t Coal
    => ~2.5tCO2 = ~$20/tCO2
  - US$3/GJ Gas
    => ~50kgCO2 = ~$60/tCO2
- Adding a greenhouse 'cost' on Carbon to reflect its env. costs changes prices
  - *Eg. US$50/tCO2 emitted => oil +33%, coal +250%, gas +80%*



(ABARE, 2007)

Existing and proposed ETS around world



(Center for Climate Strategies, 2007)

Scheme	Emissions covered	Geographical reach	Emission sources targeted	Number of sources	Absolute or relative targets?	Start
EU ETS	CO_2	European Union	Large industrial and energy-intensive installations	~10,000 units	Absolute targets	2005
NSW GGAS	CO_2, CH_4, N_2O, PFCs, HFCs, SF_6	New South Wales (Australia)	Power generation, energy efficiency, industrial processes and carbon sequestration in forests	>160 projects so far and 32 benchmark participants	Relative targets	2003 (NSW) & 2005 (ACT)
JVETS	CO_2	Japan	Direct emissions from combustion of fuels and waste materials; direct emissions from processing chemicals and materials; and indirect emissions (e.g. use of grid-electricity)	90 entities	Absolute targets	2006/2007 (participant-dependent)
RGGI	CO_2	A group of Northeast and Mid-Atlantic US states	Electricity generating units that have a nameplate capacity equal to or larger than 25 MW and burn more than 50 per cent fossil fuels	Between a few and a few hundred units per state	Absolute targets	Compliance starts in 2009
CCX	CO_2, CH_4, N_2O, PFCs, HFCs, SF_6	US, Canada, Mexico, Brazil	Sources in the electric power sector and fossil fuel combustion and process emissions in the manufacturing sectors	43 entities ("Members")	Absolute targets	2003
CDM & JI	CO_2, CH_4, N_2O, PFCs, HFCs, SF_6	Global involvement	A wide range of activities	467 registered CDM projects, >100 JI projects in the pipeline	No targets	2005 (CDM) & 2008 (JI)

(PWC/IETA, 2007)

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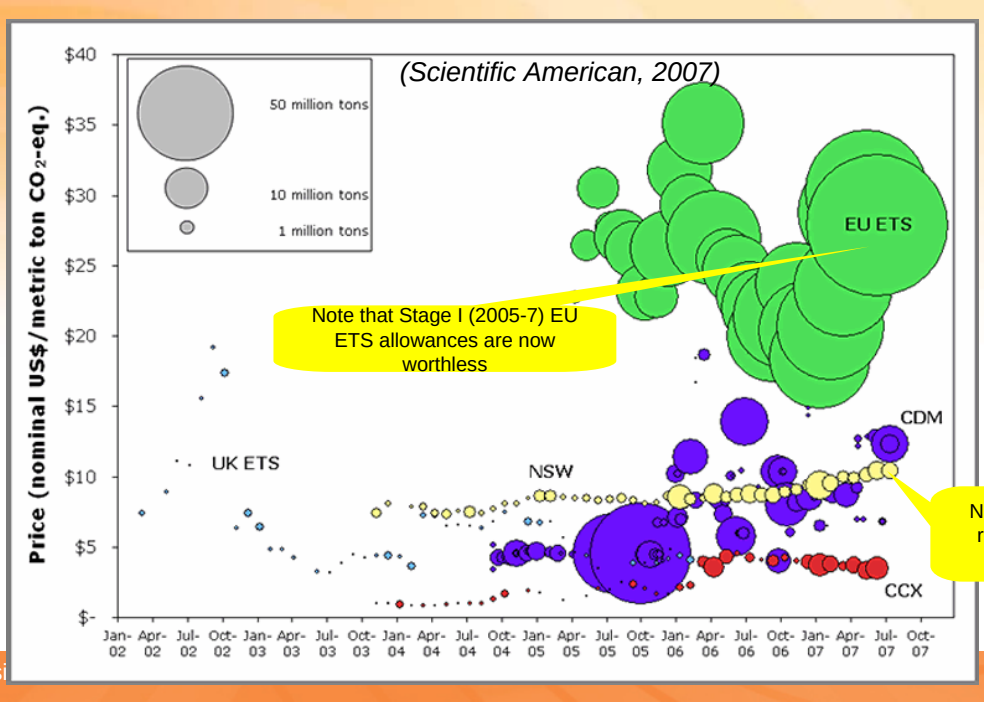
Performance to date has been mixed



(Scientific American, 2007)

Note that Stage I (2005-7) EU ETS allowances are now worthless

NGAC prices recently fell 50+%

Australian ETS proposals – PM Taskgroup

(largely mirroring State Govts NETT proposal)

- Cap and Trade scheme introduced 2010/12
- Broad coverage– 6 GHGs, all energy related and some waste emissions (70-75% total emissions)
  - *Comment: measurability key issue for coverage and offsets; current (2003) inventory uncertainty is +/-3%* *(Aust. Govt. 4th Comm. to UNFCCC)*
- Likely modest early cap trajectory (10 years out) with low price cap & no 'makegood', wide range of offsets
  - *Comment: current energy emissions trajectory +85% in 2020; a poor investment signal unlikely to drive early significant change; offsets & price caps difficult to 'police' & can reduce environmental effectiveness & market performance*
- Compensation for large emitters & energy intensive industry
  - Large, free once-off up-front permit allocations; Credit for 'early action'
  - *Comment: difficult to justify (possible exception of energy intensive industry); reflects 'stakeholder' clout' rather than good policy*
- Encourage international linkages where possible
  - *Comment: unlikely effective schemes would want links; unilateral CDM possible*
- Other policies - energy efficiency & innovation but not clean energy targets
  - *Comment: has proven politically unpalatable => Clean Energy Target*

Comparing PM Task Group and NETT models

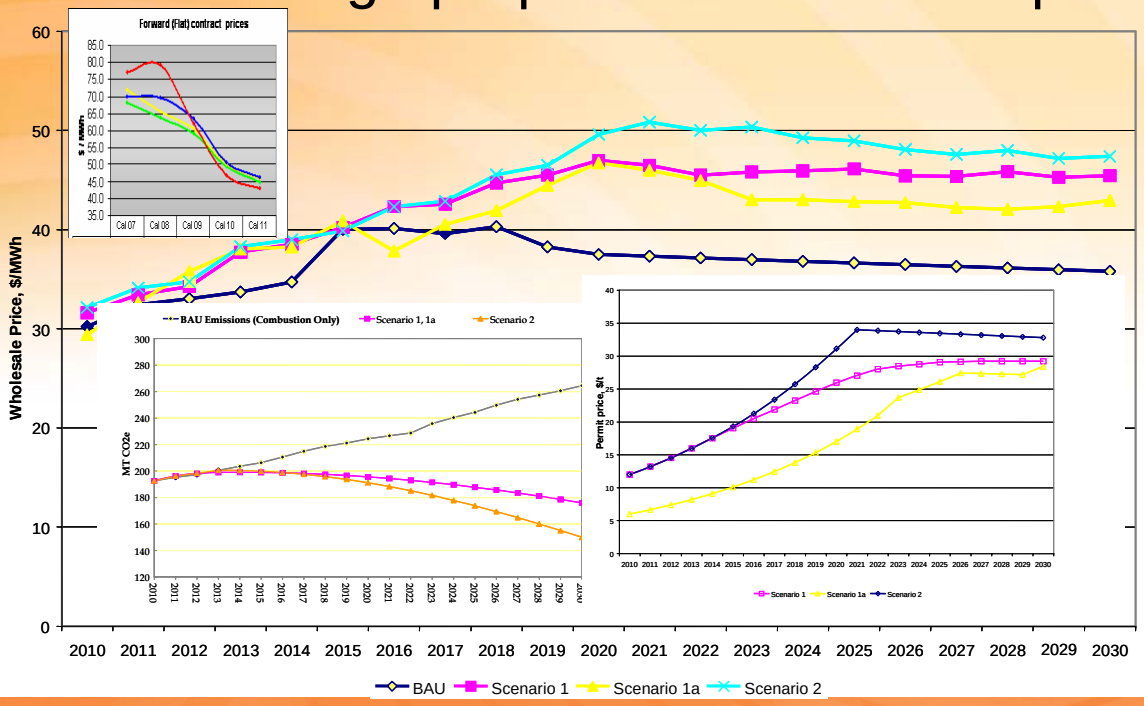
(Blake Dawson Waldron, 2007)

	Federal Task Group model	State NETS model
Timing	To commence by 2012.	To commence by 2010 (if no commitment by Commonwealth Government to introduce a scheme).
Overall design	Cap and trade.	Cap and trade.
Jurisdiction	Single national scheme administered by the Commonwealth Government.	Preferred option: Commonwealth Government to pass legislation to enact the scheme, with complementary legislation passed by State/Territory Governments as required.
Target	Long-term aspirational target should be set. Need for further detailed modelling and analysis to determine a credible goal.	Long-term target suggested: reduce economy-wide emissions by 60% compared to 2000 levels by 2050.
Coverage – liable parties	Broad coverage – all energy, industrial and fugitive emissions from the beginning (except those from agriculture and land use). Liable parties: • large facilities with direct emissions above a specific threshold. Threshold to be determined (25 kt CO2-e per annum may be appropriate). Approx 900 facilities accounting for 55% of Australia's total GHG emissions; and	Limited coverage – stationary energy sources and fugitive emissions from gas pipelines. Liable parties: • first 5 years: electricity generators • •30 MWe. Approx 100 facilities accounting for 35% of Australia's total GHG emissions.
Coverage – liable parties (continued)	• upstream fuel suppliers for other energy emissions (to capture smaller individual sources of emissions). • Proposed coverage: 70 – 75% of Australia's total GHG emissions.	• subsequent expansion to include stationary energy sources which emit more than 25 kt CO2-e a year; and upstream gas suppliers and distributors. • Proposed coverage: approx 45% of Australia's total GHG emissions.

	Federal Task Group model	State NETS model
Coverage – gases	Sources: all 6 greenhouse gases. Sinks (offsets): all 6 greenhouse gases.	Sources: combustion-related or fugitive emissions of carbon dioxide, methane and nitrous oxide. Sinks (offsets): all 6 greenhouse gases.
Specific exclusions from coverage	Initial exclusion of agriculture, land use and (potentially) waste sectors, but with potential future inclusion when practical measurement issues are resolved.	All other sectors outside stationary energy and fugitive emissions from pipelines are excluded initially.
Overall caps	No specific caps proposed at this stage of design. Series of short-term annual quantity caps for overall emissions to be set for first 10 years. Guidance on moving from annual caps to the long-term target to be provided. Overall trajectory should commence moderately below "business as usual" projections (so that the market establishes a low initial price for carbon), progressively stabilise and then allow for deeper emissions reductions over time.	No specific caps proposed at this stage of design. Possible caps for first 5 years for electricity generation emissions include: • capped at 2000 levels by 2030 (33% reduction from Business as usual (BAU) in 2030); or • capped at 1997 levels by 2030 (43% reduction from BAU in 2030).
Cap periods	A mix of short-term caps and medium-term gateways for future caps, combined with periodic reviews.	A mix of short-term caps and medium-term gateways for future caps, combined with periodic reviews.
Nature of permit	Time-dated single-year emissions permits which would permit emission of 1 t CO2-e per year. A small number of future-dated permits, beyond 2020, would be periodically auctioned to promote forward markets.	Annual permit which would permit emission of 1 t CO2-e per year. Some permits may be allocated some years in advance to provide greater certainty. Permits to grant secure property rights.
Permit allocation	Mixture of free allocation and auctioning. Existing businesses requiring permits – "one off" allocation based on amount of loss above average economy wide losses. Trade exposed, emissions-intensive industries – allocations to avoid damaging international competitiveness.	Mixture of free allocation and auctioning. Existing businesses requiring permits – "one off" allocation based on estimated negative effects on profitability. Trade exposed, emissions-intensive industries – allocations to avoid damaging international competitiveness.

	Federal Task Group model	State NETS model
Penalties	An "emissions fee" to be paid if a liable party does not hold sufficient permits to cover its emissions during a compliance period. No specific fee level proposed at this stage. Fee to be set at a relatively low level during the initial phase, then move further away from expected permit prices.	Civil penalty (fee) to be paid if a liable party does not hold sufficient permits to cover its emissions during a compliance period. No specific penalty level proposed at this stage. Penalty to be set at a level that caps the cost of the scheme at an acceptable level but also encourages compliance.
Banking/ borrowing of permits	Banking permitted (with some potential limitations during the initial phase because of lower emissions fee). Borrowing not permitted.	Banking permitted. Borrowing not permitted.
Offsets/ credits	A wide range of offsets from sectors not covered by the scheme should be permitted. Scheme should provide incentives for firms to undertake early abatement.	Proposed priority sectors eligible to create offset credits in the initial phase: forestry, CCS, reductions in industrial process emissions, and destruction of methane in the waste sector.
International links	Scheme to enhance the scope for links, both formal and informal, with as many different systems as possible.	Unilateral linking with the CDM to be established from the outset. Bilateral linking should be considered only after extensive assessment of the costs and benefits.

NETTS design proposal: Indicative caps



Renewables markets world-wide performing better

Figure 5. Global Investment in Sustainable Energy by Technology, 2006

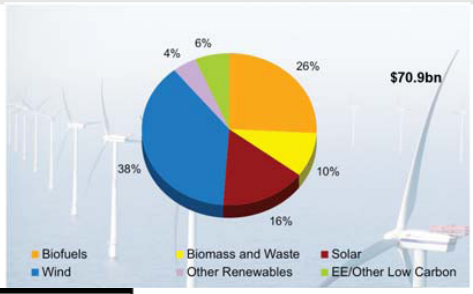
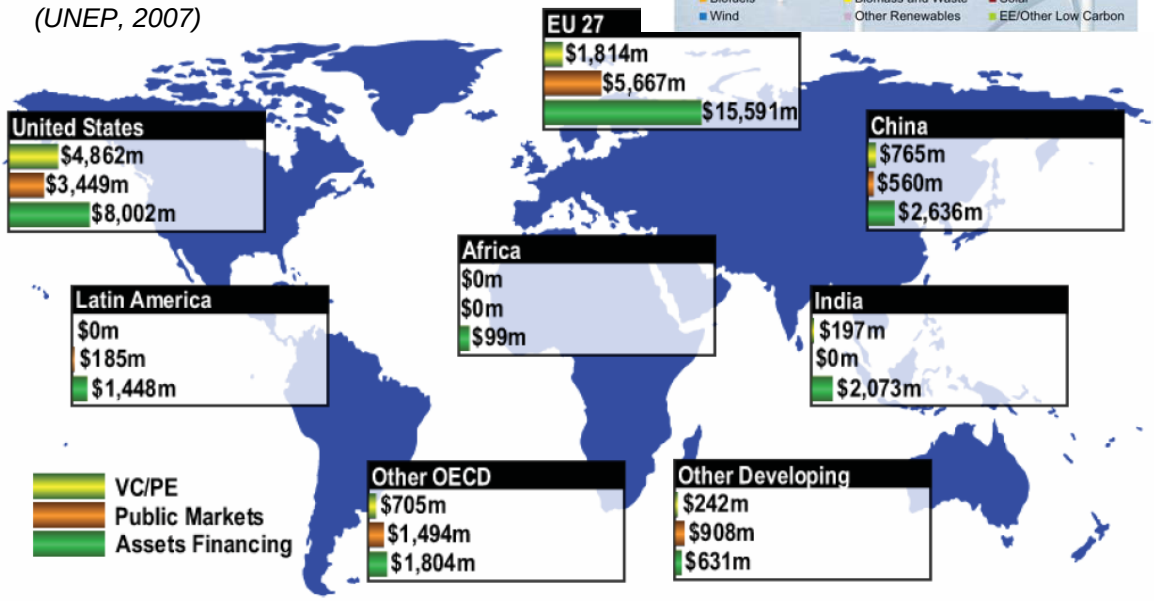


Figure 11. Global Investment in Sustainable Energy, by Type and Region, 20

(UNEP, 2007)



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Need targets … but much more

(Ernst & Young, Renewable Markets Country Attractiveness Index, 2007)

Ranking**		Country	All Renewable	Wind index	Onshore Wind	Offshore Wind	Solar	Biomass/ Other
1	(1)	US*	72	73	80	58	75	64
2	(2)	India	64	65	75	43	61	55
2	(2)	Spain	64	64	71	48	72	58
2	(5)	UK	64	65	63	69	50	58
5	(4)	Germany	63	63	62	64	73	61
6	(6)	China	61	64	67	56	45	42
7	(7)	Canada	58	61	66	48	42	47
8	(8)	Italy	57	57	63	43	68	53
8	(8)	France	57	57	59	53	59	54
8	(8)	Portugal	57	58	63	46	62	49
8	(8)	Greece	57	59	63	49	59	44
12	(12)	Ireland	55	57	58	55	36	46
13	(13)	Sweden	52	52	52	52	44	53
14	(14)	Australia	50	50	53	42	59	45
14	(14)	Denmark	50	51	47	60	44	46
14	(14)	Belgium	50	52	50	57	36	36

- 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.

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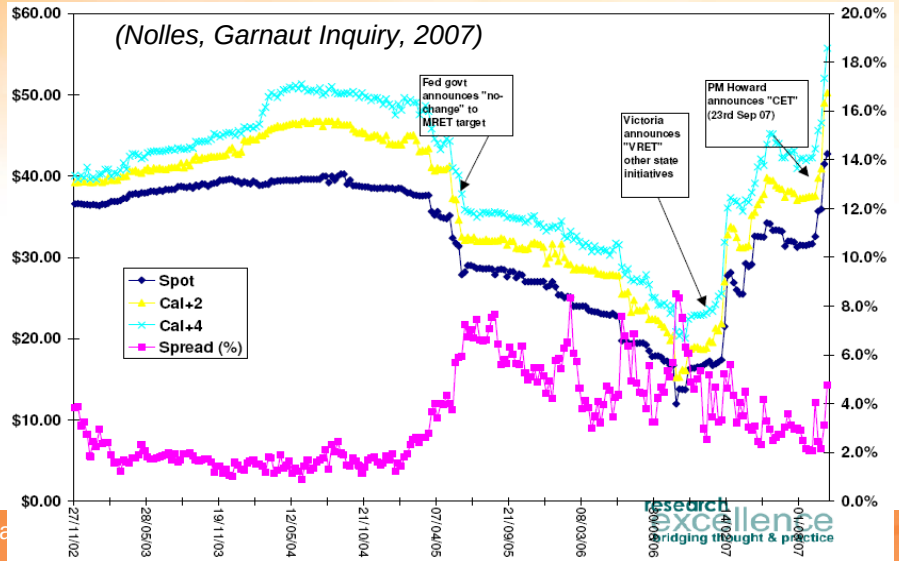
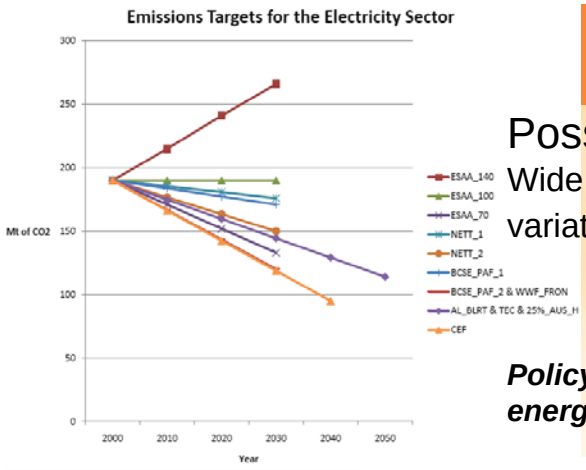
Renewable energy markets

- Little liquidity (+ hence price discovery) for forward prices in some mkts
- Prices vulnerable to regulatory change
  => potential challenges in driving investment & industry development
- *Large, loud legislated targets with supporting policy framework required*

(Nolles, Garnaut Inquiry, 2007)

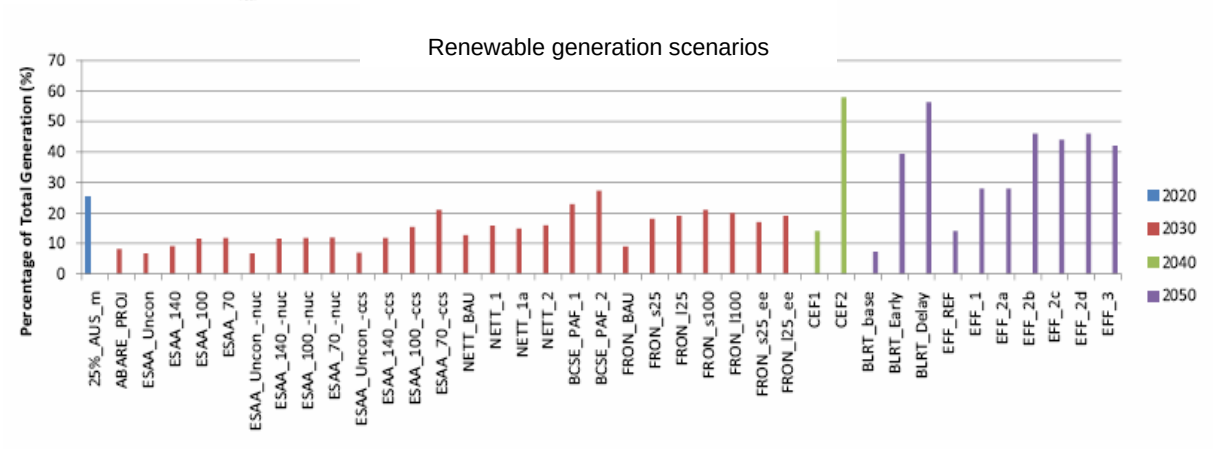




Possible Australian energy futures

Wide range of scenarios with considerable variations (Morris, 2007)

Policy is a key determinant of renewable energy's future role



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Policy conclusions

- ETS should play a key role however performance of schemes to date generally poor wrt effectiveness, efficiency + equity (carbon tax better?)
- Renewable energy policy support has proven successful in countries with serious intent and supporting policy frameworks
- Market-based approaches offer great flexibility to 'designers' **however**
  - Hard to predict performance of designs
  - Poor design choices can greatly impact effectiveness + efficiency
- Rigorous + transparent design process required wrt stakeholders
  - Incumbency, information asymmetry + potential gaming of design
- Interactions b/n measures can reduce effectiveness or support each other
  - economy-wide schemes will have many interactions so careful design required
- Need transparent, liquid + efficient markets for appropriate price discovery + risk management
  - derivative mkts have vital role in bridging short to longer term decision making
  - **Key uncertainty at present appears to be 'governance risk': poor government policy making clearly inadequate to scale & urgency of the climate change challenge**