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Environmental sustainability and the climate change debate

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ELC Economics Teachers' Conference

Sydney, 9 March 2012

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CEEM established …

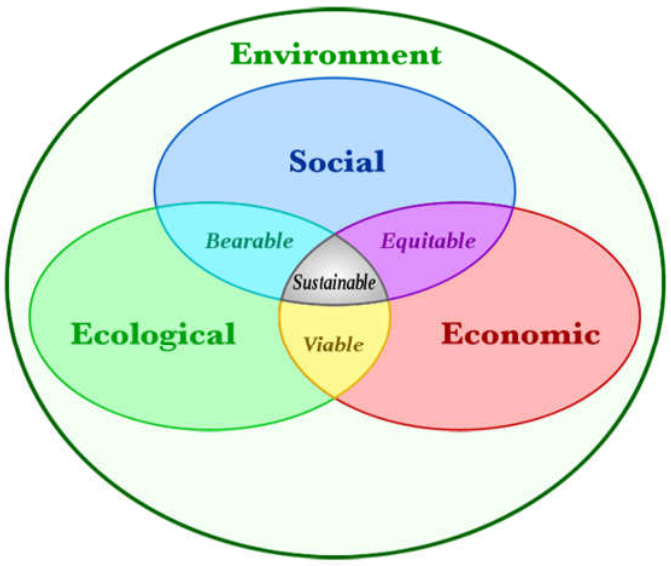
- *A formal collaboration between the* **Faculties of Engineering, Business (Economics and Management),** also Arts and Social Sciences, Science, Law
- *through UNSW Centre* aiming to provide Australian research leadership in interdisciplinary analysis + design of energy and environmental markets
- *focussing 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

- Facilitating renewable energy integration in the NEM
  - Market design, resource characterisation, forecasting, high penetration 'issues'
- Facilitating electric vehicle integration into electricity networks
- Renewable energy policy support options in restructured industries
  - eRET, feed-in tariffs
- Modelling participant behaviour in electricity markets
  - Interactions between spot and derivative markets
- Climate and energy policy mixes
  - Establishing robust policy responses to these challenges
- Technology assessment for sustainable energy policy frameworks
  - **Energy efficiency**, gas and cogeneration, renewables, CCS, nuclear options
- **Economic modelling of Distributed Energy**
- **Energy efficiency policy – regulation, financial mechanisms**
- Policy frameworks for technology innovation
  - Emerging renewables, Carbon Capture + Storage (CCS)

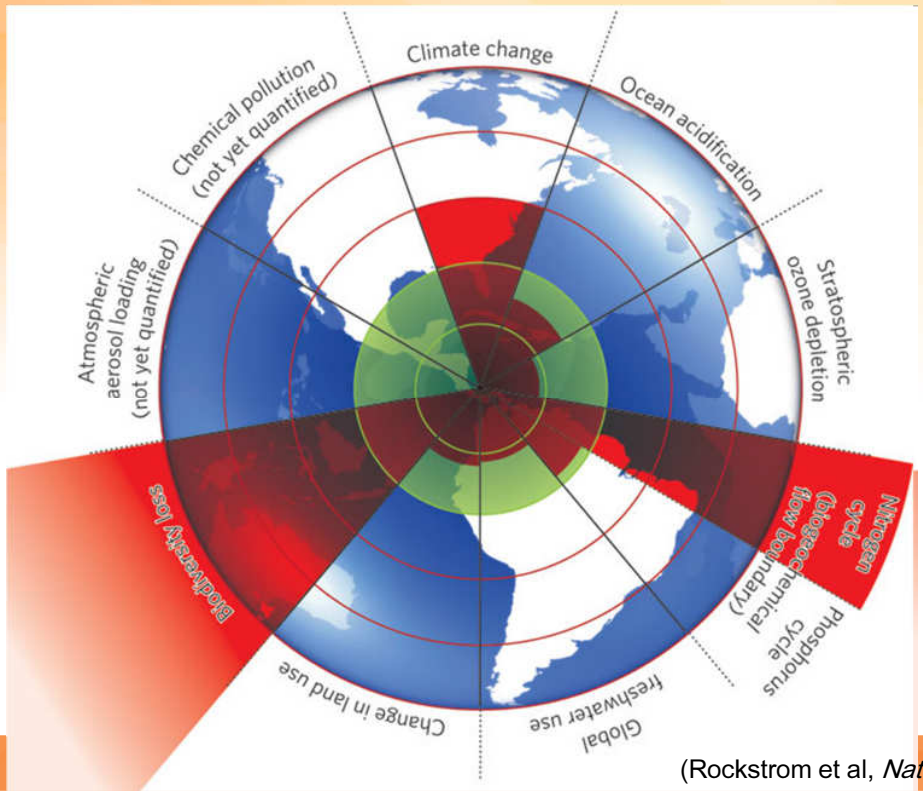
Environmental issues and sustainability

- **Sustainability as "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (www.wikipedia.org).**
- **Key concept and challenge**
  - **tensions, yet potentially also synergies, between its environmental, economic and social dimensions**
  - **Particularly challenging for energy industries which makes vital contribution to societal welfare, is key driver of economic development yet also has major adverse environmental impacts.**



(www.wikipedia.org, 2011)

Possible Global Environmental Boundaries



(Rockstrom et al, *Nature*, 2009)

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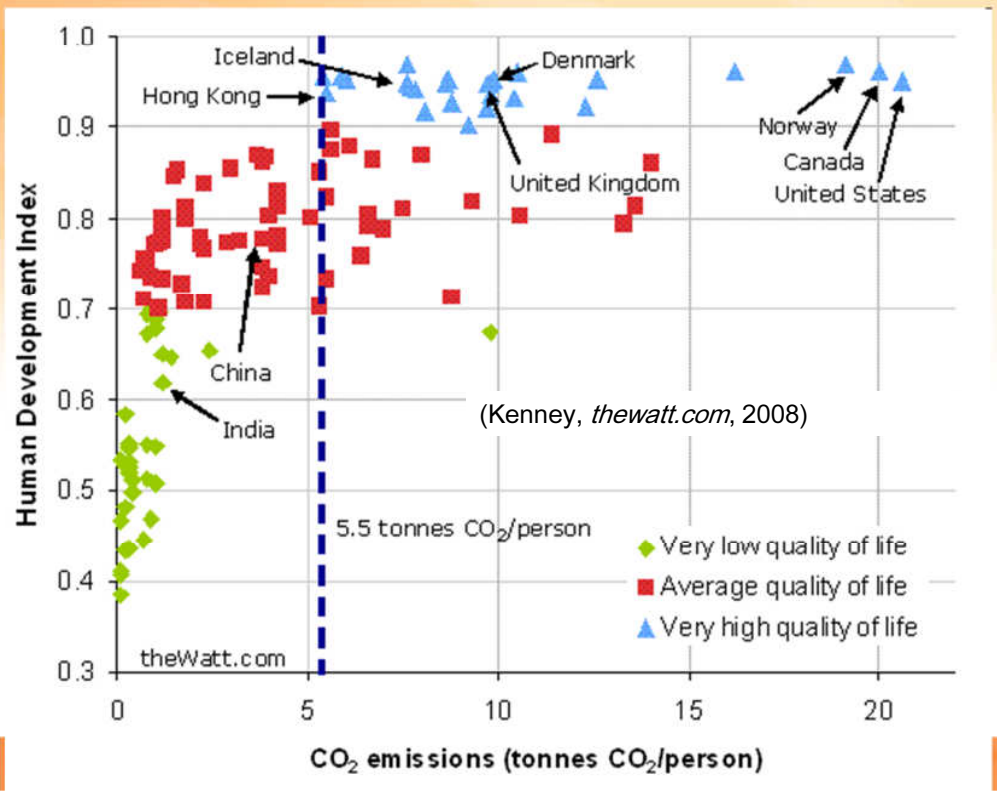
Interactions: GHG and Overall Human Welfare



(Kenney, *thewatt.com*, 2008)

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Climate change context

- Generally worsening scientific prognosis for warming, impacts
- Increasing global emissions
- An evident weakening international response …but
- some growing national efforts

theguardian | TheObserver

Western nations 'used bullying tactics' at climate talks

World Development Movement report accuses developed countries of threatening behaviour at climate change summits

John Vidal
theguardian

Greenhouse gases rise by record amount

Levels of greenhouse gases are higher than the worst case scenario outlined by climate experts just four years ago

Associated Press
guardian.co.uk, Friday 4 November 2011 03.03 GMT

Worst ever carbon emissions leave climate on the brink

Exclusive: Record rise, despite recession, means 2C target almost out of reach

Fiona Harvey, Environment correspondent
guardian.co.uk, Sunday 29 May 2011 22.00 BST

A larger | smaller

theguardian

World headed for irreversible climate change in five years, IEA warns

If fossil fuel infrastructure is not rapidly changed, the world will 'lose for ever' the chance to avoid dangerous climate change

Fiona Harvey, environment correspondent
guardian.co.uk, Wednesday 9 November 2011 10.01 GMT

The shock rise means the goal of preventing a temperature rise of more than 2 degrees

theguardian

UN chief slams rich nations' plans to delay climate change treaty

Achim Steiner says reaching an agreement in 2020 instead of at next month's Durban conference would be 'very high risk'

Fiona Harvey, environment correspondent
guardian.co.uk, Wednesday 23 November 2011 17.48 GMT

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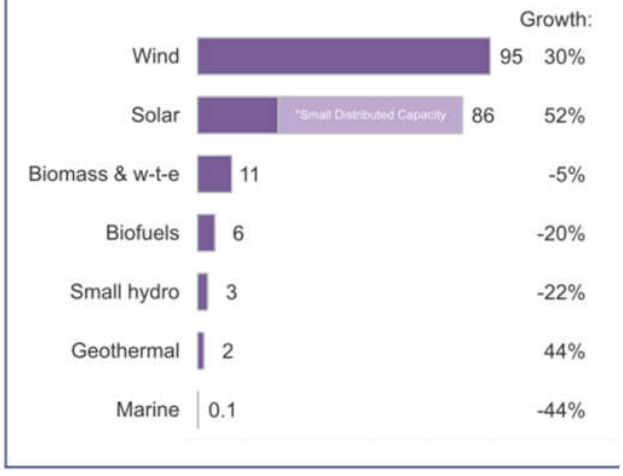
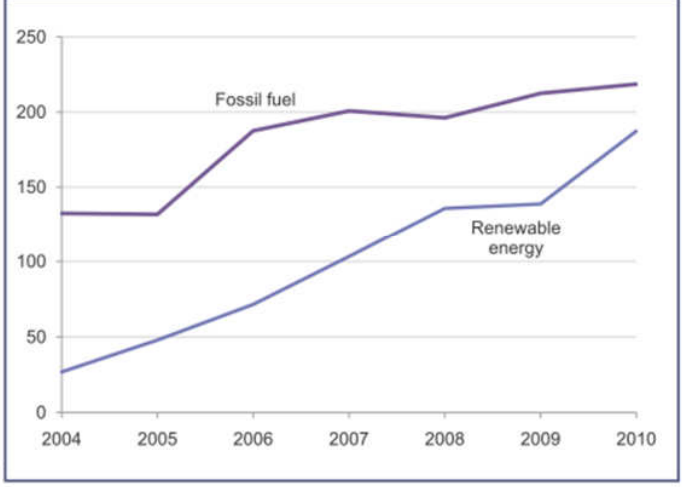
Some good news… renewables

FIGURE 6: FINANCIAL NEW INVESTMENT IN RENEWABLE ENERGY BY TECHNOLOGY, 2010, AND GROWTH ON 2009, $BN



(UNEP/NEF, *Global Trends in Renewable Energy Investment*, 2011)

FIGURE 25: INVESTMENT IN CLEAN ENERGY V CONVENTIONAL CAPACITY, 2004-2010, $BN



Fossil Fuel investment is calculated from EIA & IEA data. Clean energy investment includes asset finance and small scale projects, but excludes large hydro).

Australia's energy + climate context

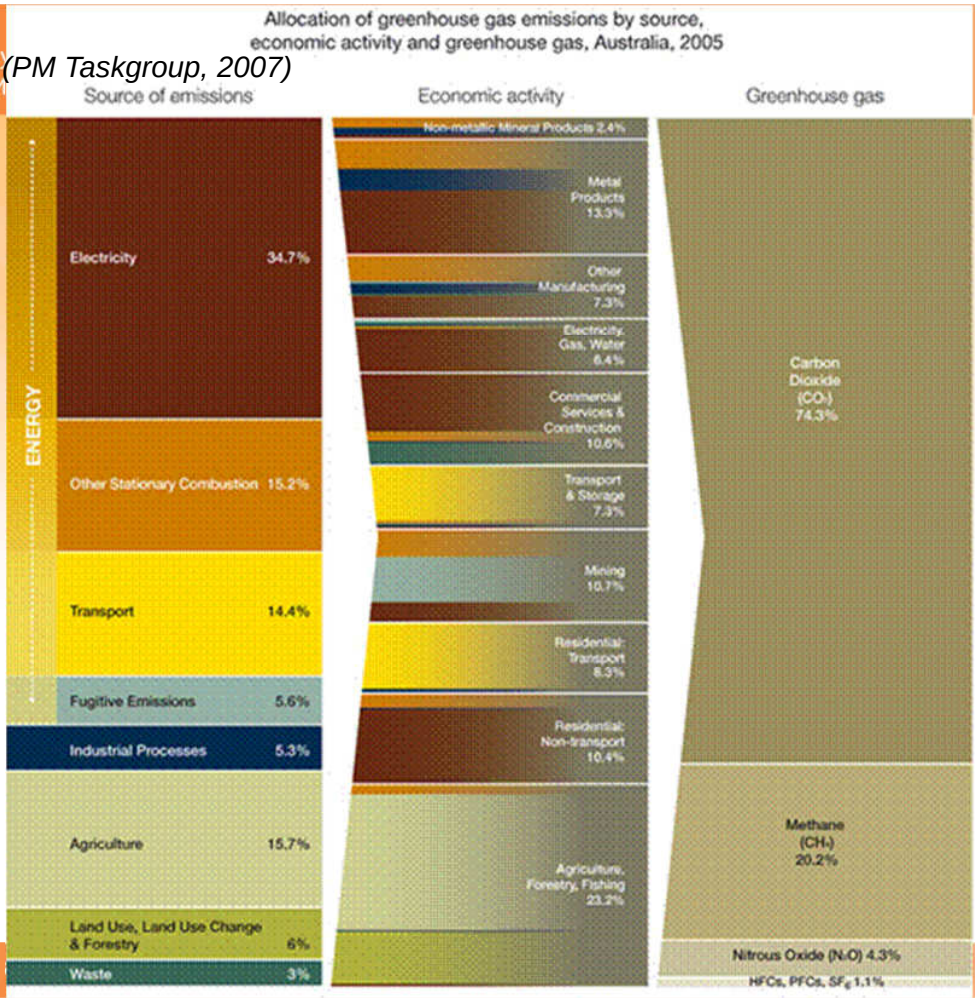
Amongst the world's highest per-capita emissions

An energy + emissions intensive economy

Continuing emissions growth in most sectors including all energy

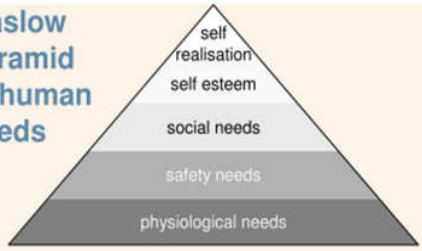
High agricultural and LULUCF emissions for a 'developed' country

(PM Taskgroup, 2007)



A long history of energy policy with some efforts to address some environmental impacts

Maslow pyramid of human needs

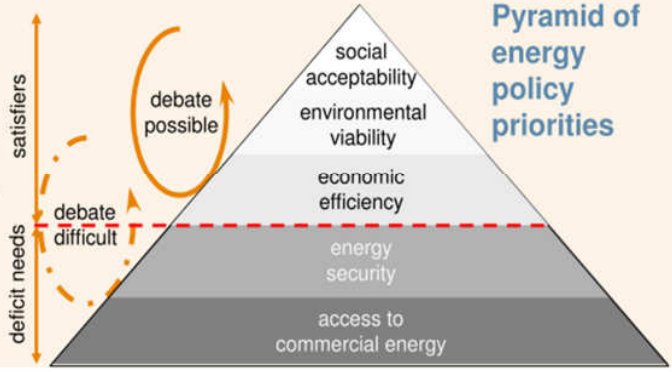


"A person who is lacking food, safety, love and esteem would most probably hunger for food more strongly than for anything else," stated the American psychologist Abraham Maslow in 1943 while formulating a theory to explain the motivational structure of a healthy person.

If Maslow were in Energy Politics…

Abraham Maslow

… he would argue that access to energy, supply security, energy costs, environmental issues and social acceptance are not subject to trade-off, but to a hierarchy: we cannot successfully address higher order issues before proposing and implementing solutions for more direct needs.



Pyramid of energy policy priorities

(World Energy Council, 2010)

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Australian energy policy objectives

(Australian Govt, *Energy White Paper website*, 2011)

ENHANCING AUSTRALIA'S ECONOMIC PROSPERITY

ENERGY WHITE PAPER

Providing secure, affordable and sustainable energy is critical to maintaining Australia's prosperity. For this reason the Government is committed to finalising an Energy White Paper in 2012.

As one of only three net energy exporting OECD countries, Australia is well positioned with many sources of energy to support our domestic requirements and the creation of jobs and income from export opportunities, particularly in the Asia Pacific region. With almost 20 per cent of OECD gas reserves, we must ensure that our energy resources are developed efficiently and sustainably in order to optimise the overall benefit for the Australian community.

The Government recognises that the energy sector is currently facing major challenges. Australia's economy is growing strongly, and demand for Australia's energy – both domestically and for export – is also growing strongly. However, this growth also creates competition for inputs, in particular skilled labour, putting upward pressure on prices. This underscores the importance of replacing ageing energy assets, increasing generation and transmission capacity and thereby ensuring continued reliability of supply.

Possible climate policy implications:

Join the queue.

Continued security of, and access to a competitively priced energy supply for households and industry is a critical priority. Alongside this, Australia needs to continue the transition to a low emissions and environmentally sustainable economy. This will require the development and deployment of new and cleaner low emission technologies supported through actions such as the introduction of a price on carbon.

The Energy White Paper will deliver a clear and robust whole-of-government policy framework to provide certainty for investors as well as reliability and security for the

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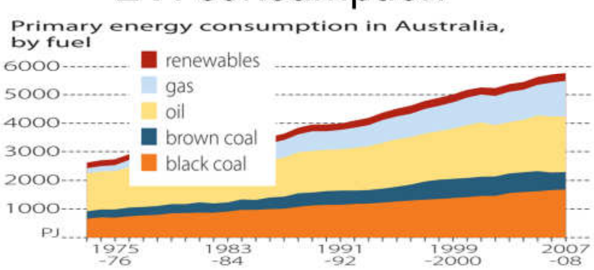
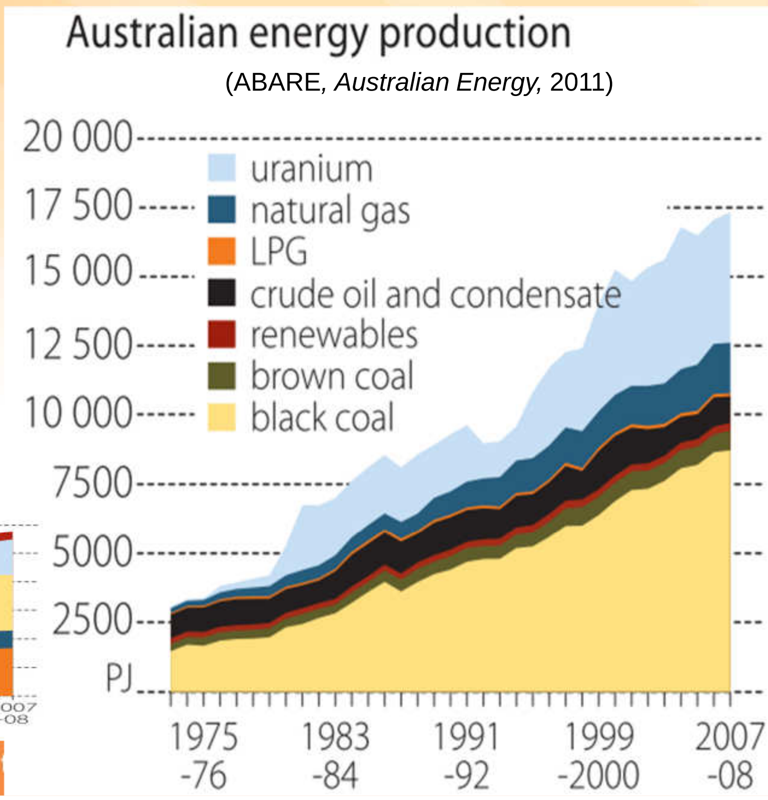
Australia's energy (+climate) policies

- One of the world's major energy exporters
  - #1 Coal
  - #2 Uranium
  - #5 LNG
- Exports approaching 2 X consumption





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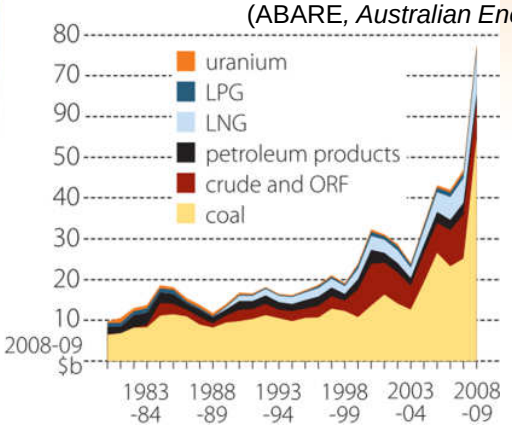
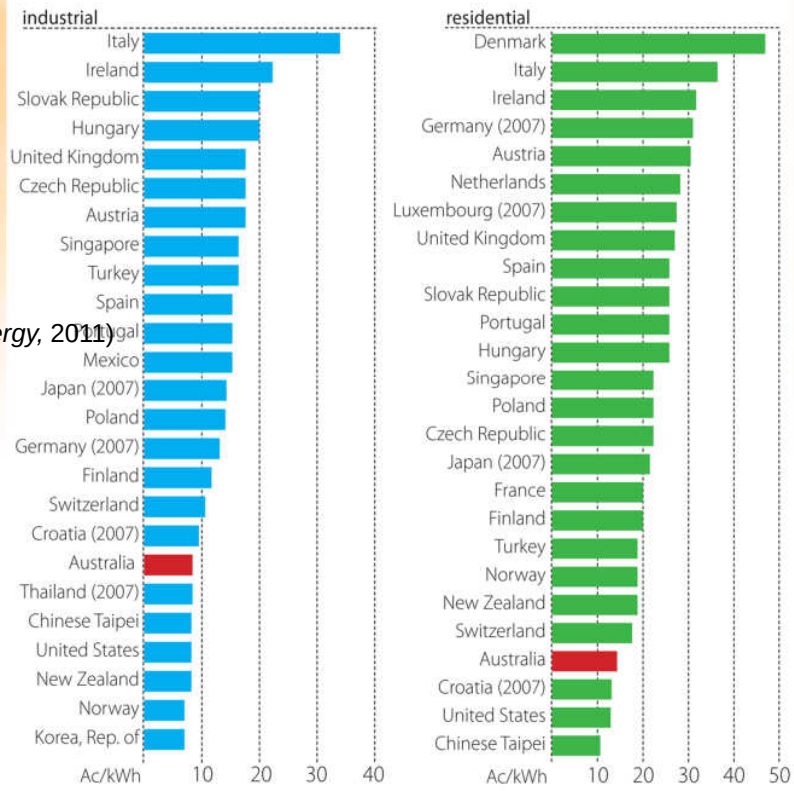
Australian energy exports

(ABARE, *Australian Energy*, 2011)



World electricity prices, selected countries, 2008 a



Significant existing fossil-fuel subsidies in Australia

	2010-11	2011-12	2012-13	2013-14	Total
Concessional FBT treatment of company cars	$1,110	$1,220	$1,290	$1,340	$4,960
Exemption from fuel tax for aircraft	$1,000	$1,050	$1,100	$1,150	$4,300
Concessional tax treatment of oil from north west shelf	$580	$580	$580	$590	$2,330
Accelerated depreciation for planes, oil and gas assets and commercial vehicles	$915	$1,000	$1,030	$1,055	$4,000
Exemption from excise for LPG, LNG and CNG	$550	$320	$350	$370	$1,590
Fuel Tax Credits Scheme for vehicles used in Mining, agriculture and other non-road purposes	$5,162	$5,289	$5,680	$5,799	$21,930
Total	$9,317	$9,459	$10,030	$10,304	$39,110

(The Australian Institute, 2011)

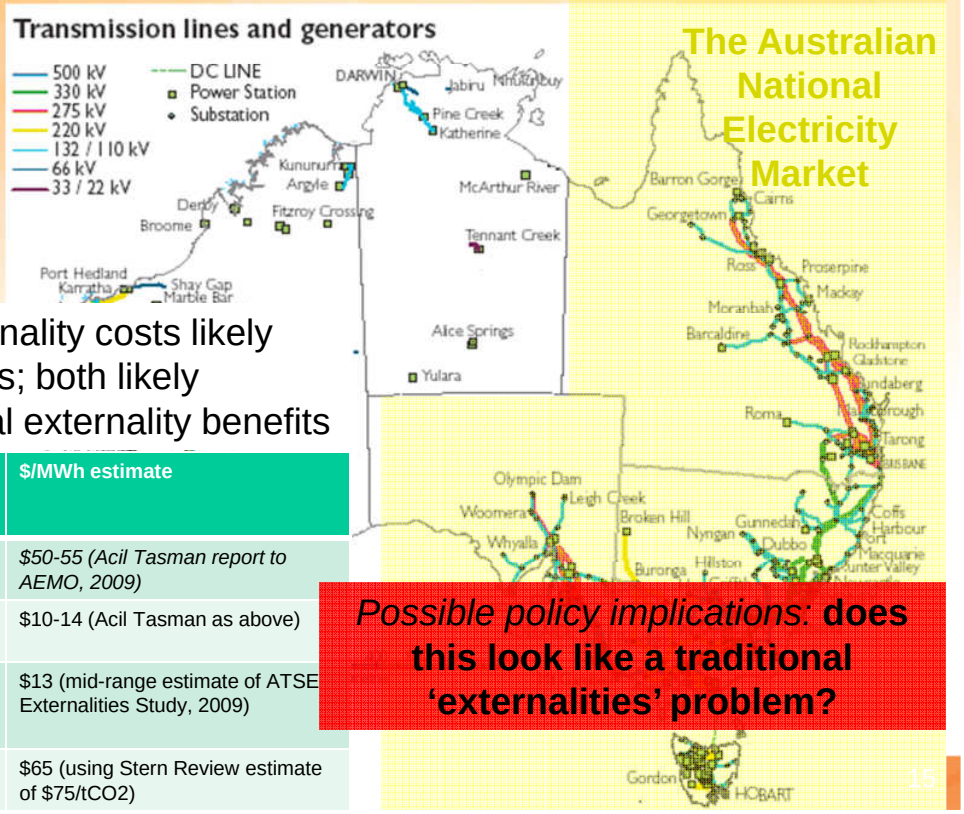
$4 billion in coal subsidies in NSW?

by Solar Choice on November 7, 2011

0 The Auditor-General of NSW released a report today condemning the previous Labour government's implementation of the Solar Bonus Feed-in Tariff Scheme, which became political hotpoint last year when it was found that it would go severely over budget. The irony is that the Auditor-General's report comes on the heels of an article by Climate Spectator that estimates an effective $4 billion subsidy to the Cobbora coal mine to keep the price of coal low enough to facilitate the sale of the state's gen-traders to private firms.

0 Like

NEM: Aust's largest environmental (externalities) market

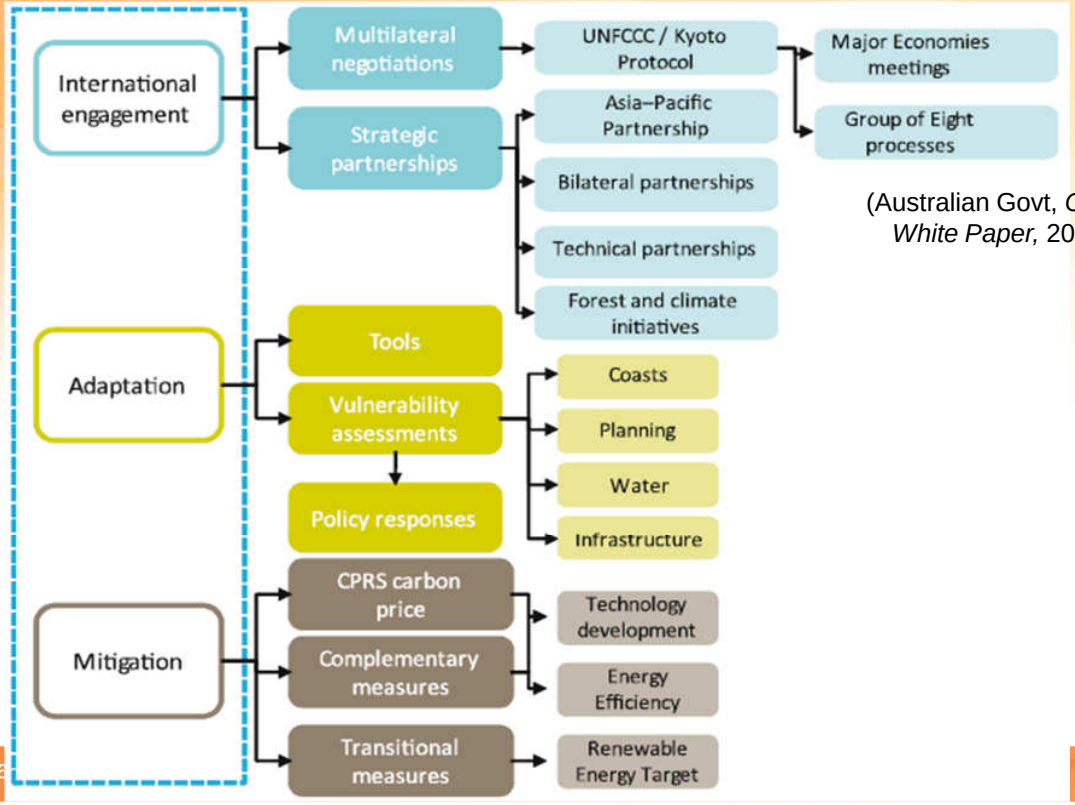


Environmental externality costs likely outweigh direct costs; both likely outweighed by social externality benefits

Coal-fired generation in NSW (2009-10) Note: supplying >90% of state electricity	$/MWh estimate
Direct Long Run Marginal Cost (new SC plant)	*$50-55 (Acil Tasman report to AEMO, 2009)*
Direct Short Run Marginal Cost (fuel, variable O&M)	$10-14 (Acil Tasman as above)
External Health damage costs (PM10, SOx, NOx)	$13 (mid-range estimate of ATSE Externalities Study, 2009)
External Climate Change damage cost	$65 (using Stern Review estimate of $75/tCO2)

Possible policy implications: **does this look like a traditional 'externalities' problem?**

Australian Climate (+ Energy) Framework



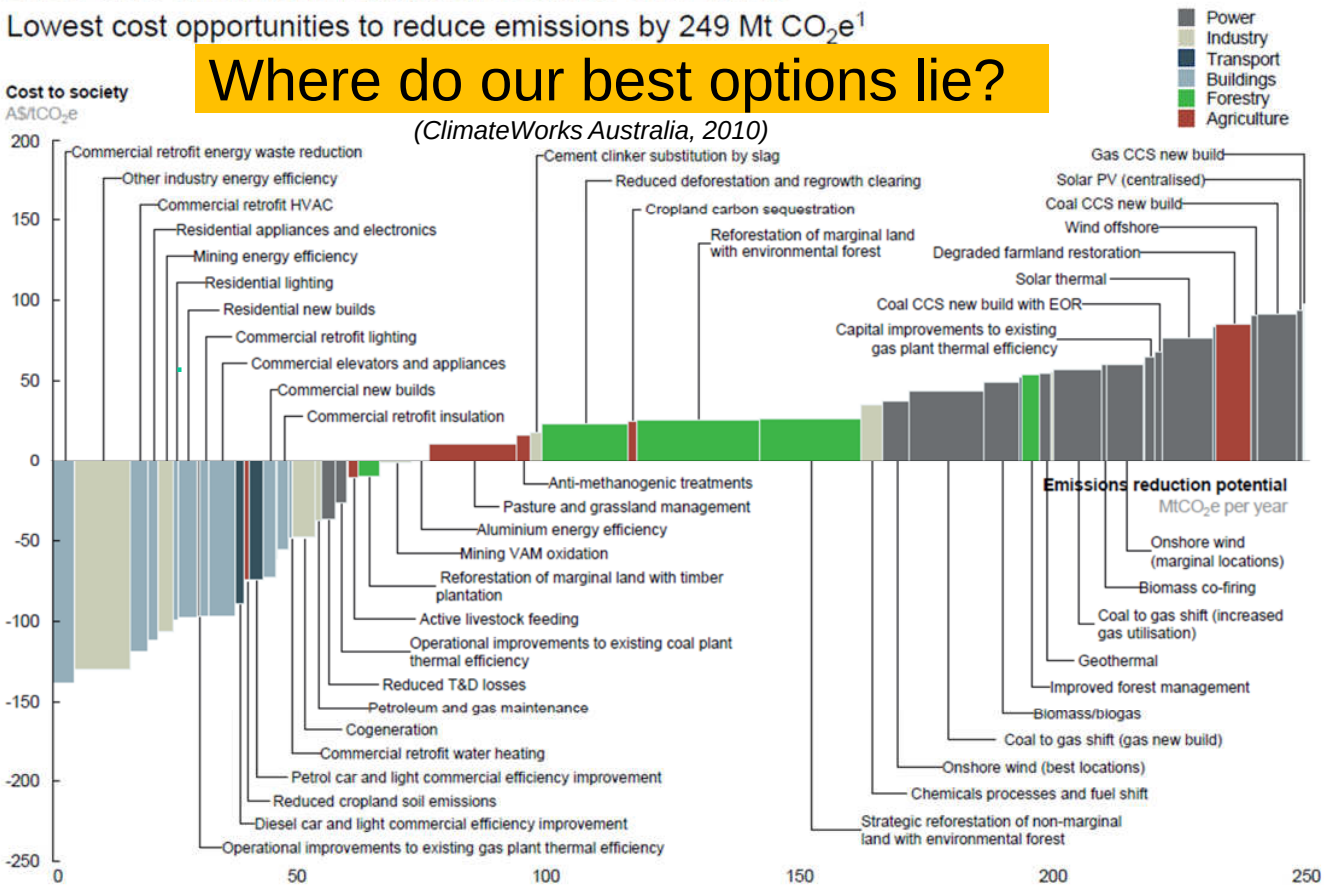
(Australian Govt, *CPRS White Paper,* 2011)

2020 GHG emissions reduction *societal* cost curve

Lowest cost opportunities to reduce emissions by 249 Mt CO_2e[1]

Where do our best options lie?

(ClimateWorks Australia, 2010)



1 Includes only opportunities required to reach emission reduction target of 249 Mtpa (25% reduction on 2000 emissions); excludes opportunities involving a significant lifestyle element or consumption deferral, changes in business activity mix, and opportunities with a high degree of speculation or technological uncertainty

SOURCE: ClimateWorks team analysis (refer to bibliography)

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Achievements to date: EE policy the 'Quiet' Achiever

Estimated emissions reductions over Kyoto significantly greater than renewable energy or direct abatement policies implemented to date

Name (Australian Govt, 2010)	Kyoto period average (Mt CO_2-e)
Clean Energy Initiative: CCS Flagship	Not estimated
Energy Efficiency in Government Operations	<0.1
Energy Efficient Homes Package: HIP	1.3
Greenhouse Challenge	<0.1
Greenhouse Gas Abatement Program (GGAP)	0.8
Industry Greenhouse Program	0.2
National Strategy on Energy Efficiency	14.0
Equipment Energy Efficiency (E3) Program	*6.3*
Energy efficiency requirements: Building codes	*4.2*
Mandatory disclosure requirements: Buildings	*<0.1*
Framework Cool Efficiency Program	*0.1*
Phase-out of incandescent lighting	*1.0*
Phase-out of inefficient water heaters	*0.1*
Energy Efficiency Opportunities Program	*2.4*

Key EE policies to date have been regulatory

… (continued)

(Australian Govt, 2010)

NSW Greenhouse Gas Abatement Scheme	0.7	
Greenhouse Gas Abatement Scheme		*0.7*
NSW Energy Savings Scheme		*0.1*
Queensland Gas Scheme	2.2	
Renewable Energy Target[3]	8.8	
Large-scale Renewable Energy Target (LRET)		*8.5*
Small-scale Renewable Energy Scheme (SRES)		*0.2*
Renewable Remote Power Generation Program (RRPGP) and Renewable Energy Commercialisation Program (RECP)	0.1	
Solar Cities	<0.1	
Victorian Energy Efficiency Target and Energy Saver Incentive Scheme	0.2	
Total	**29**	

What can governments do regarding **C**?

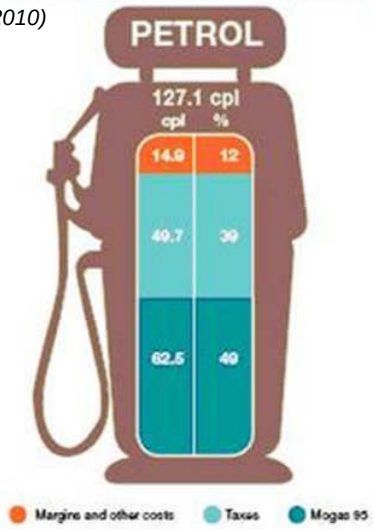
- ***Issue*** *is not whether to price carbon (will cost $ to reduce emissions, $ to 'adapt' if we don't)*
  instead*, who will pay how much to whom + when*
- Options: Tax, Spend and Regulate
  - millennia of experience in this
- … or, over last 2 decades, growing interest in creating 'designer' markets to achieve environmental objectives
  - Renewable Energy Targets, **Emissions Trading**
- Some insights
  - To spend is to tax - *Milton Friedman*
  - Taxation impacts: revenue, redistribution, repricing + representation
  - Regulation has a proven track record in environmental challenges … has only recently fallen out of favour

Already many **C** based energy prices

- Energy highly valuable – vital roles, non-substitutable
  - Not just a question of direct costs of extraction + conversion
- Potentially major differences b/n cost and value
- Many of these costs + values are externalities unless addressed by govts
- Key externalities until now include social welfare, resources management, energy security, pollutants
- *… now climate change and an environmental price on carbon in Aust.*

Chart 23 Components of Australian retail RULP prices in the five largest cities: 2008–09

(ACCC, 2010)



Source: ACCC calculations based on Platts, CBA and Informed Sources data.

Carbon pricing – from theory to practice

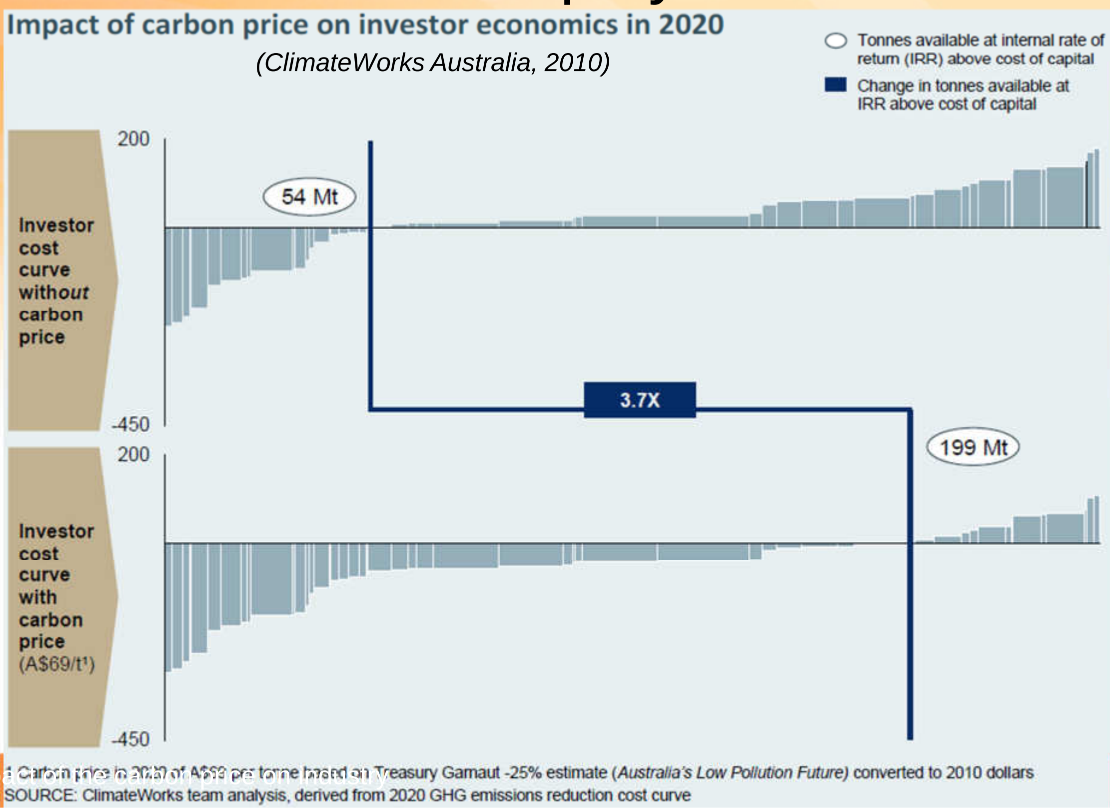
(adapted from Clive Spash, *Brave New World of Carbon Trading*, www.clivespash.org)

- Underlying economic theory on pollution control
  - An aberration on otherwise perfectly functioning markets
  - Known or knowable pollution control costs and benefits
  - Optimal pollution control equates marginal costs of control & benefits
  - Taxes set the price, emissions trading sets the quantity
- … may not adequately address challenges of practical implementation?
  - Oversimplification – range of climate change drivers beyond **C**
  - Existing market failures + other distortions – eg. fossil fuel subsidies
  - Markets, power and vested interests
  - ***What about equity considerations?***

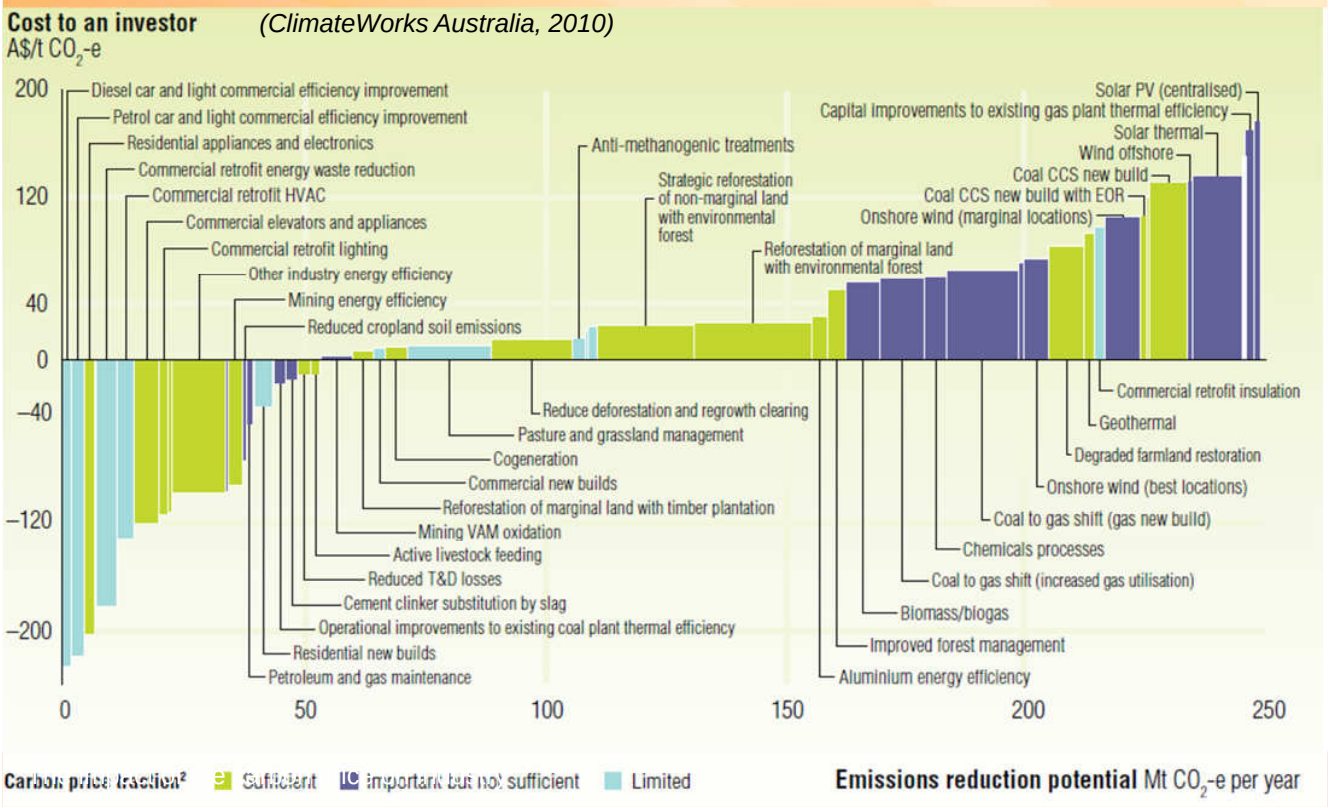
C pricing around the world to date

- Developed countries *(DCCEE, 2011)*
  - ETS already operating in 27 EU + 4 other countries, New Zealand, 10 US states. Trials in South Korea + Japan.
  - Carbon taxation in UK, Denmark, Finland, Norway, Sweden, Netherlands + Canada
- Developing countries
  - India: coal tax to fund research and development on renewable energy technologies
  - China: value-based tax on coal, oil and gas extraction in largest gas-producing province, plans to extend to all other western provinces
- *Almost all countries*
  - *A range of 'implicit' **C** prices and subsidies*

A price on carbon can play a valuable role...



… but has limitations



(ClimateWorks Australia, 2010)

CARBON PRICING MECHANISM

Carbon price: a two-stage approach:	**1. Fixed price period**—The carbon pricing mechanism will commence on 1 July 2012, with a price that will be fixed for the first three years. The price will start at $23 per tonne and will rise at 2.5 per cent each year in real terms. **2. Emissions trading scheme**—On 1 July 2015, the carbon price will transition to a fully flexible price under an emissions trading scheme, with the price determined by the market.
Coverage	Broad coverage from commencement, encompassing the stationary energy sector, transport (as described below), industrial processes, non-legacy waste, and fugitive emissions. Only landfill facilities with direct emissions of 25,000 tonnes CO2-e a year or more will be liable under the carbon price. A carbon price will not apply to household transport fuels, light vehicle business transport and off-road fuel use by the agriculture, forestry and fishing industries. An effective carbon price will be applied to domestic aviation, domestic shipping, rail transport, and non-transport use of fuels. Users of these fuels can opt-in to the mechanism under the Opt-in Scheme.
International linking	International linking to credible international carbon markets and emissions trading schemes from the commencement of the flexible price period. At least half of a liable party's compliance obligation must be met through the use of domestic permits or credits.
Price ceiling and floor	Price ceiling and floor will apply for the first three years of the flexible carbon price period. The price ceiling will be set at $20 above the expected international price and will rise by 5 per cent in real terms each year. The price floor will be $15, rising by 4 per cent each year in real terms.

Industry assistance	The $9.2 billion **Jobs and Competitiveness Program** will provide significant support for jobs and protects the competitiveness of these emissions-intensive trade-exposed industries. The Program also ensures that industry, local communities and workers have a smooth transition to a clean energy future and that these industries have a strong incentive to reduce their carbon pollution.
Energy Security	An **Energy Security Fund** will be established to ensure there is a smooth transition which preserves energy security. The Energy Security Fund comprises two elements: 1. An allocation of free carbon units and cash payments to strongly affected coal-fired electricity generators. These allocations will be conditional on electricity generators strongly affected by a carbon price publishing **Clean Energy Investment Plans**, which show how they will reduce their pollution, and by meeting power system reliability standards. 2. The Government will seek to negotiate the closure of around 2,000 megawatts (MW) of highly polluting generation capacity by 2020. Closing down some of our highest polluting coal-fired generation capacity makes room for investment in lower pollution plants—and kick starts the transformation of our energy industry in a managed way.
Household Assistance	Assistance for Australian households, through tax cuts and increased payments, to help them with increased living costs as a result of the introduction of a carbon price.

RELATED CLEAN ENERGY FUTURE PROGRAMS

Assisting manufacturing and energy efficiency	A range of new and existing measures to encourage energy efficiency are targeted at households, businesses, communities, Government, buildings and transport. The Government is delivering the $1.2 billion **Clean Technology Program**, over and above the Jobs and Competitiveness Program, to help directly improve energy efficiency and reduce carbon pollution in manufacturing industries and support research and development in low pollution technologies. The $300 million **Steel Transformation Plan** will support and assist the industry transition to a clean energy future, and recognises the pressures currently facing this industry. The $1.3 billion **Coal Sector Jobs Package** will provide transitional assistance to help the coal industry to implement carbon abatement technologies for the mines that produce the most carbon pollution. The amount of carbon pollution produced by coal mines varies greatly, so the fairest way to deliver assistance is to target assistance at those mines that are most impacted by the introduction of the carbon price.
Renewable energy	Over $13 billion will be invested in clean energy projects, including through the Clean Energy Finance Corporation. In combination with the carbon price and Renewable Energy Target, this investment will drive the biggest expansion in the clean energy sector in Australia's history. **Clean Energy Finance Corporation**—will invest in the commercialisation and deployment of renewable and clean energy projects. **Australian Renewable Energy Agency**—will improve the competitiveness of renewable energy and related technologies through supporting renewable energy technology innovation.
Land use	Incentives for the farming, forestry and land sectors to reduce carbon pollution and increase the amount of carbon stored on the land. Includes a range of measures such as funding for biodiverse carbon stores and policies to help farmers and land managers make the most of carbon farming opportunities. These measures will complement the **Carbon Farming Initiative**.

Possible industry responses

- General positioning
  - Virtually all Australian industry stakeholders favour carbon price… debate instead revolves around what price, when and on who?
  - Direct action alternatives increasingly derided
- Some key Industry options
  - Seek to stay outside pricing regime
    - Best carbon price is one you don't pay but others do, subsidies possible *however possible risks of other policies, sovereign risks*
  - Compensation
    - Best carbon price is one that others pay for you, windfall profits also possible …. *however can this be maintained?*
  - Compliance
    - Carbon just another cost of doing business, focus on core competencies … *however underlying principle of emissions trading is that price increases until sufficient action occurs*

Potential impacts of a **C** price on electricity prices

- Many price drivers
- Many uncertainties wrt **C** pricing
- Renewable support as an implicit **C** price
- Future price estimates have been rising over last few years…
- *Your final bill still depends on you*

(AGL, *Working Paper #17, 2010*)

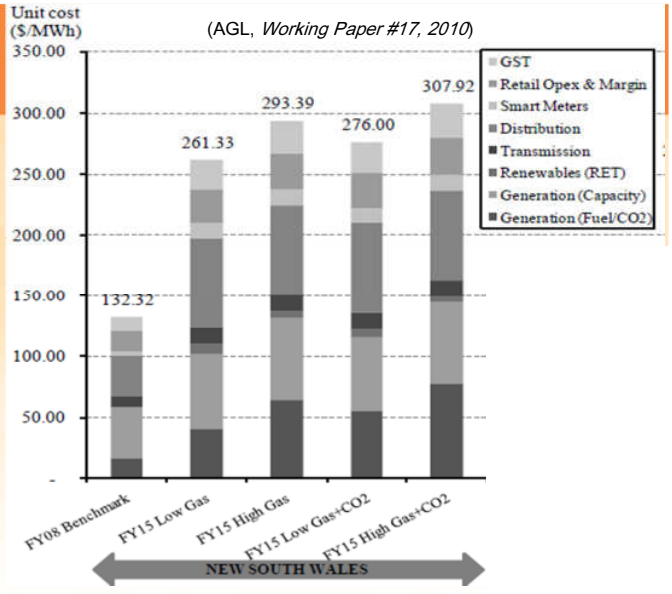
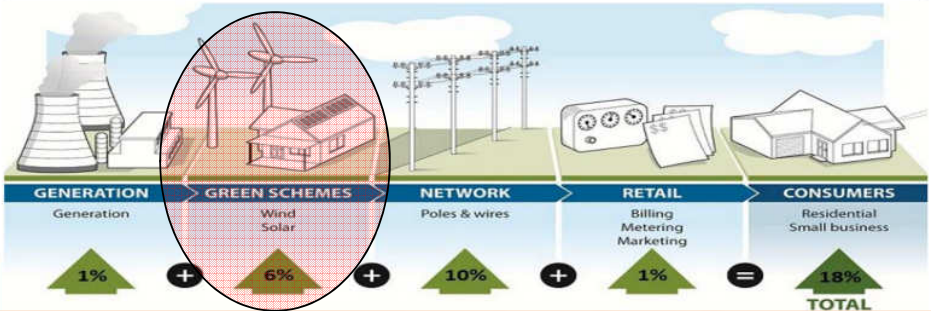
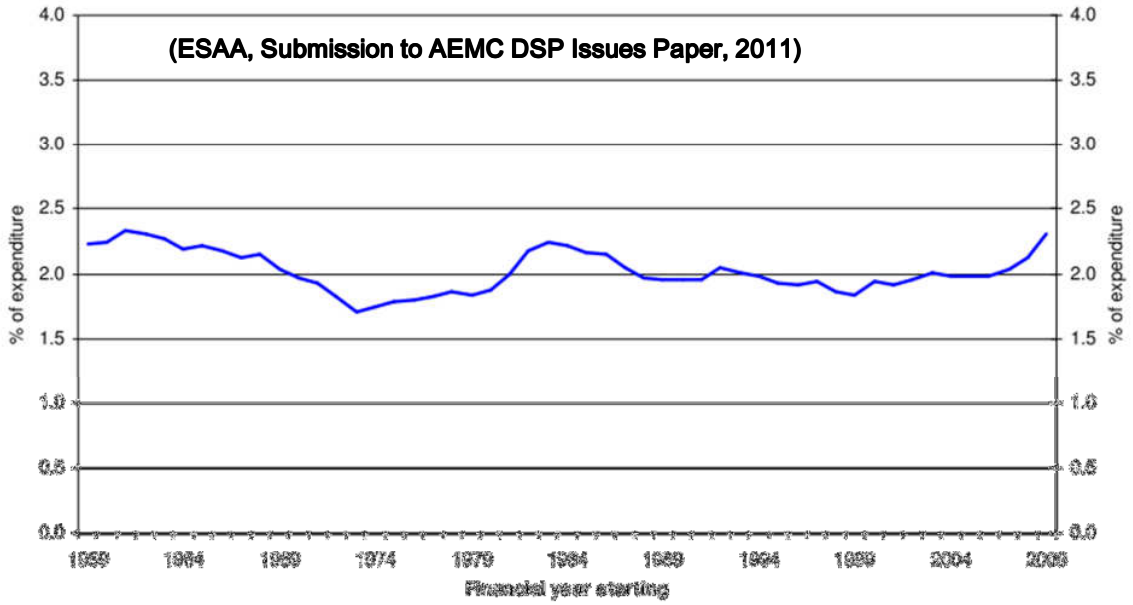


Figure 1.1 Contributions from the supply chain to overall price increases on 1 July 2011 (IPART, *Draft Determination on Regulated Electricity Prices, 2011*)



Domestic energy prices now climbing….

Chart 3: Share of Household Final Consumption Expenditure on Electricity, Gas and Other Fuels, 1959-2009 (per cent)



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In conclusion

- The recently legislated Clean Energy Plan is a decade too late, clearly inadequate to the scale of the challenge and highly compromised…
- … and yet still a world leading opportunity for Australia to finally take serious action and seek international leadership in a global low carbon future
- The question is now
  - *Will the key Australian stakeholderseffectively engage and innovatively respond to this challenge, and opportunity?*
    - *or continue to demand subsidies, compensation, a 'low' C price*
  - *Will the political process continue to support them in doing so through ongoing coherent and comprehensive policy development and implementation?*

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Thank you… and *questions*

Many of our publications are available at:
www.ceem.unsw.edu.au