Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



Some recent Australian Climate and Energy Policy Developments

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Energy and **C**limate challenges

Most E = C, most E policies = C policies, most C policies = E policies

Synergies welcome but perceived conflicts often drive decision making

Possible Conflicts

Coal vs. Gas?

Equitable supply

Energy Security

- Oil, gas & coal prices increasing & more volatile, emerging reliability stresses on electricity sector
- Australia: 'energy rich' but growing dmnd, exports

Climate Change

- Growing global emissions and climate change concerns yet little evidence of an effective international or national policy response to date
- Australia: amongst the highest per capita electricity industry emissions around the world

Societal welfare

- Unsustainable energy use & emissions in industrialised world, unsustainable lack of energy services in developing countries
- Australia requires transition from 'cheap' energy

Possible Synergies

Renewable Energy

Cost-effective EE

Some current CEEM research efforts

- Facilitating intermittent renewable energy integration in the NEM
  - forecasting and control of wind + solar energy, market design to facilitate high penetrations
- Emissions Trading Schemes
- Renewable energy policy support options in restructured industries
  - Expanded eRET, feed-in tariff options, wider policy support
- Interactions between electricity markets and climate policies
  - Emissions trading, carbon taxes, renewable energy support
- Technology assessment for sustainable energy options
  - Energy efficiency, gas and cogeneration, renewables, CCS, nuclear
- Opportunities, challenges and options with Distributed Resources
  - Distributed generation, energy storage, flexible demand
- 'Robust' climate policy mixes
- Energy efficiency policy – including non-market oriented options
- Integration of electric vehicles into the electricity industry
- Sustainable energy options for developing countries

Australian energy policy objectives

ENHANCING AUSTRALIA'S ECONOMIC PROSPERITY

ENERGYWHITEPAPER

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 [illegible] underscores the importance of replacing ageing energy [illegible] generation and transmission capacity and thereby ensuring continued reliability of supply.

Possible climate policy implications:

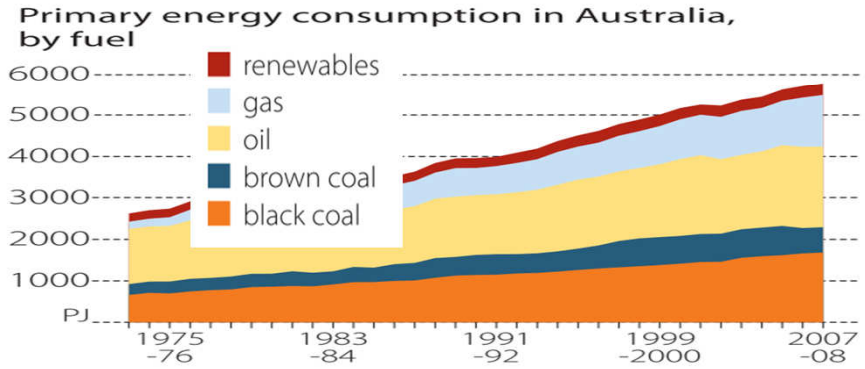
Join the queue.

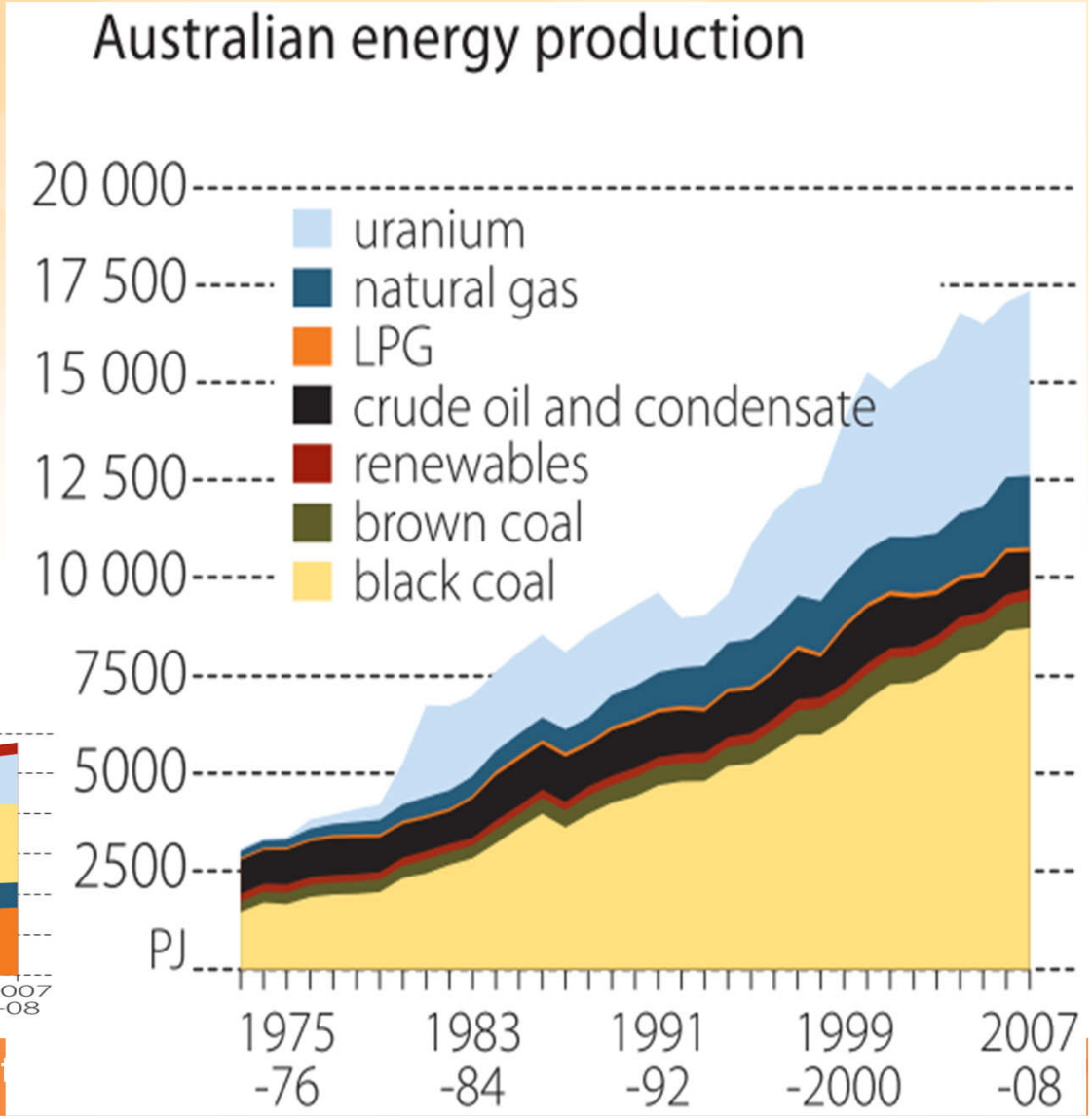
Continued security of, and access to a competitively priced energy supply for households and industry is a critical priority. Alongside this, Australia needs to continue the transition to a low emissions and environmentally sustainable economy. This will require the development and deployment of new 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

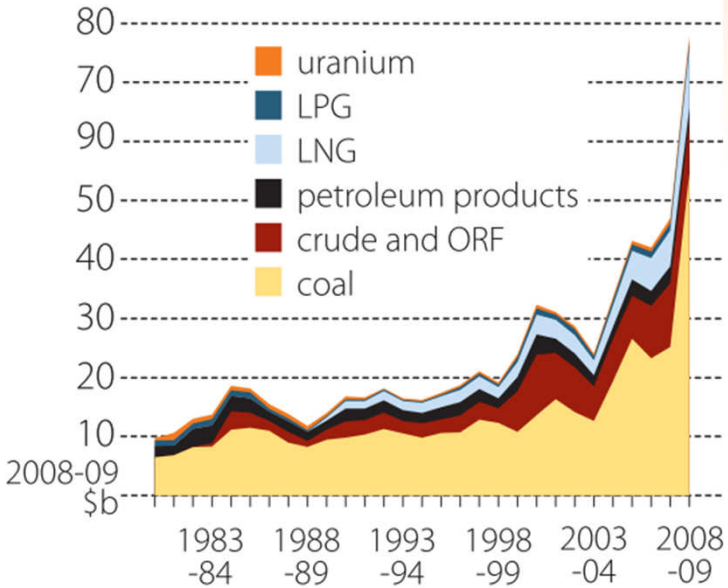
Australia's energy (+climate) policies

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

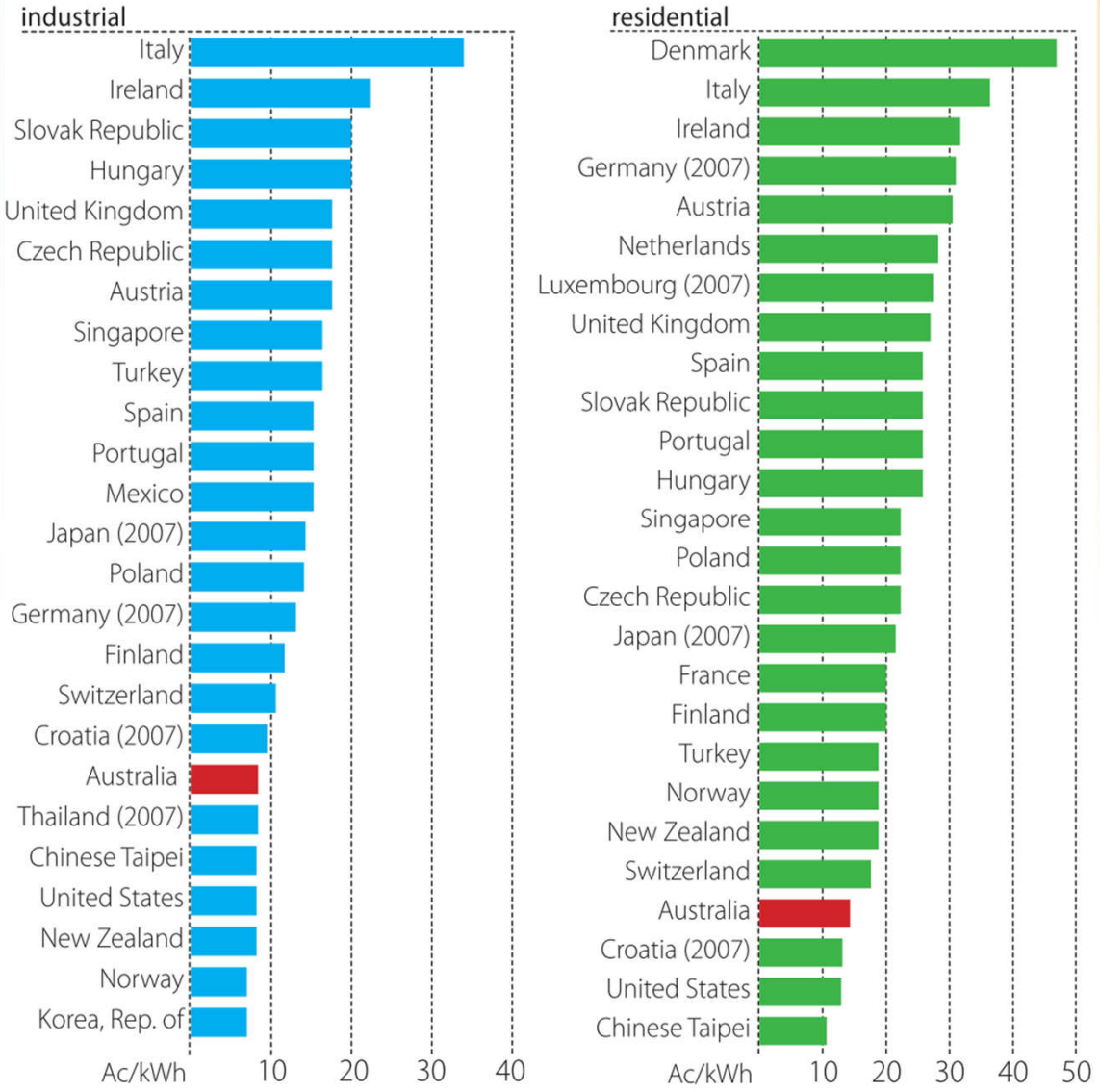




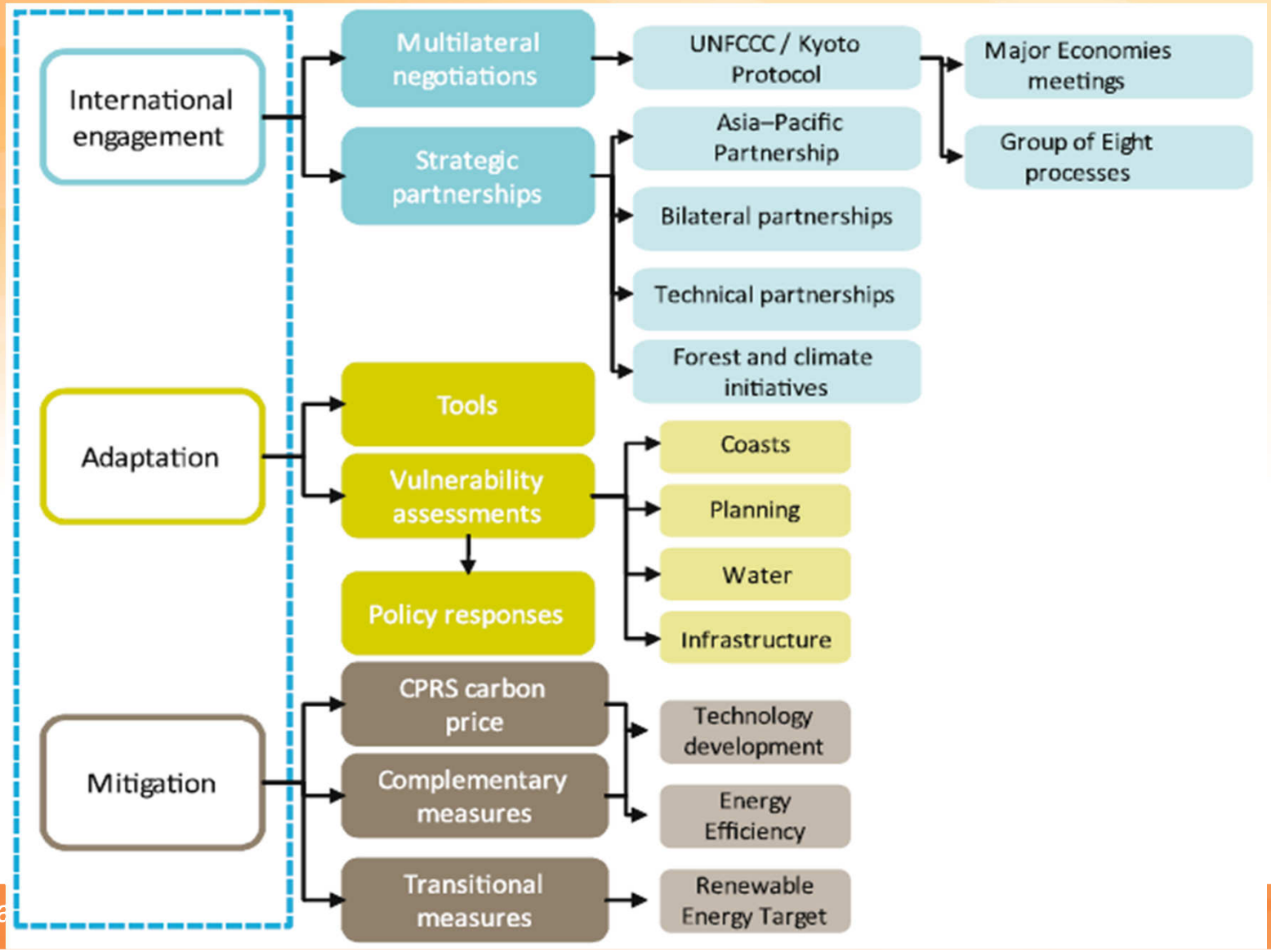
Australian energy exports



World electricity prices, selected countries, 2008 a

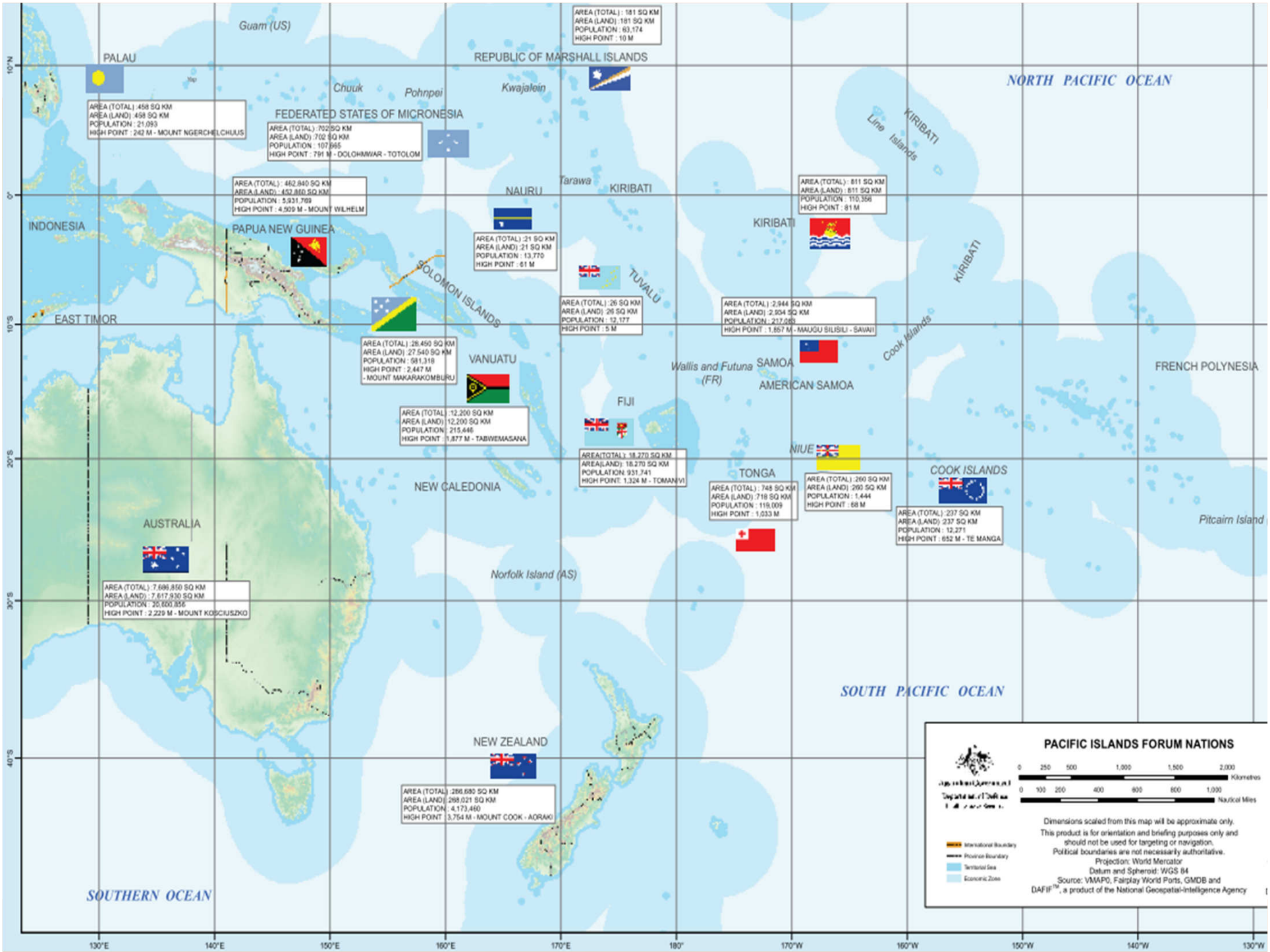


Australian Climate (+ Energy) Framework

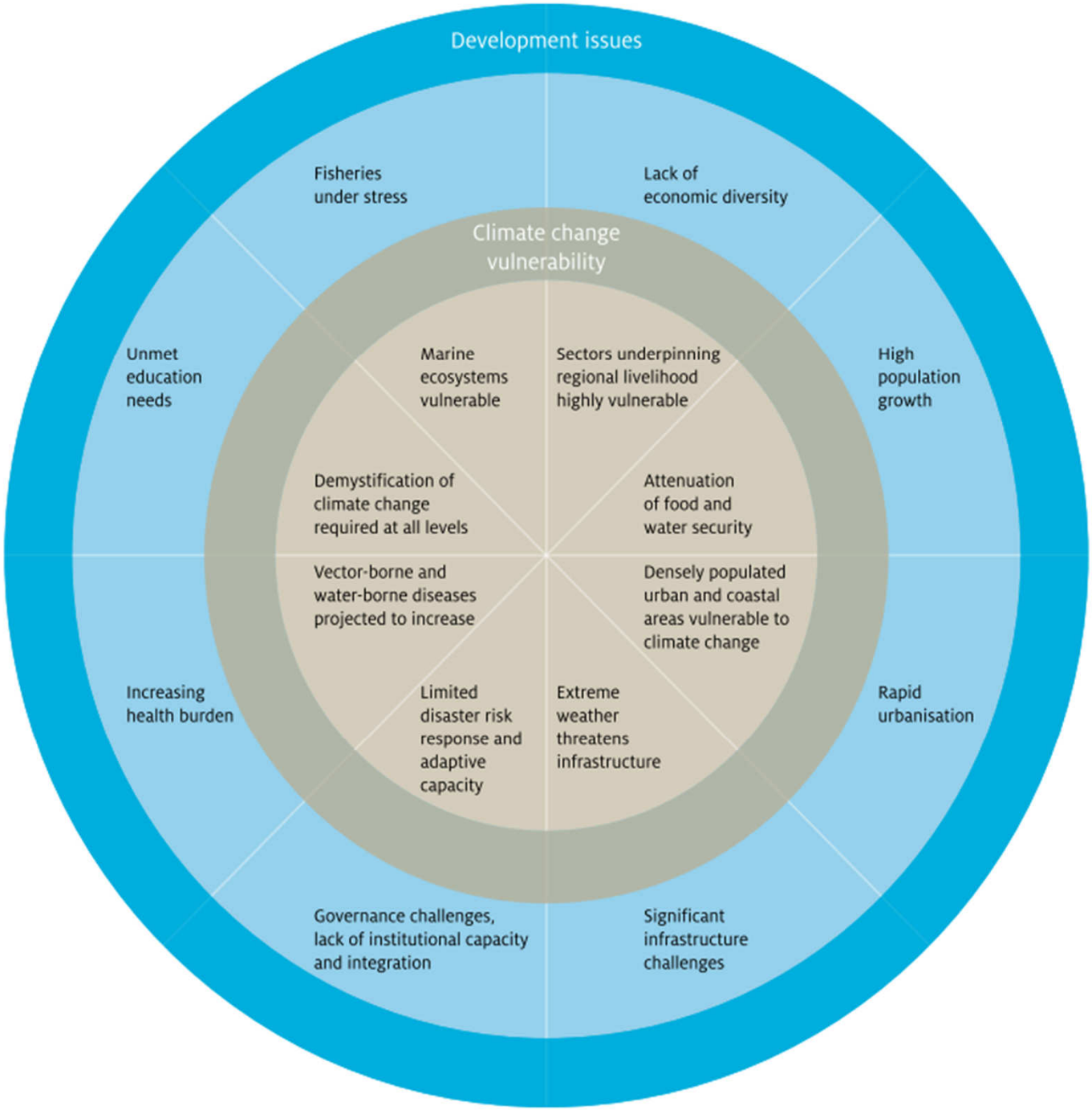


International multilateral, bilateral + regional activities

- High level meetings on climate change that complement and help progress the UNFCCC agenda, including the Group of Twenty and the Major Economies Forum on Energy and Climate (MEF).
- Bilateral Climate Change Partnership Program.
- Australia working with our Pacific island neighbours to ensure that climate change does not undermine sustainable development gains.
- Australia is taking action through the International Forest Carbon Initiative to help reduce emissions from deforestation and forest degradation in developing countries (REDD)… working closely with Indonesia and PNG to build capacity to reduce emissions from forests.
- Australia assisting vulnerable countries in region adapt to impacts of climate change through International Climate Change Adaptation Initiative.
- Australia is actively involved in a range of initiatives on technology and policy to mitigate greenhouse gas emissions.

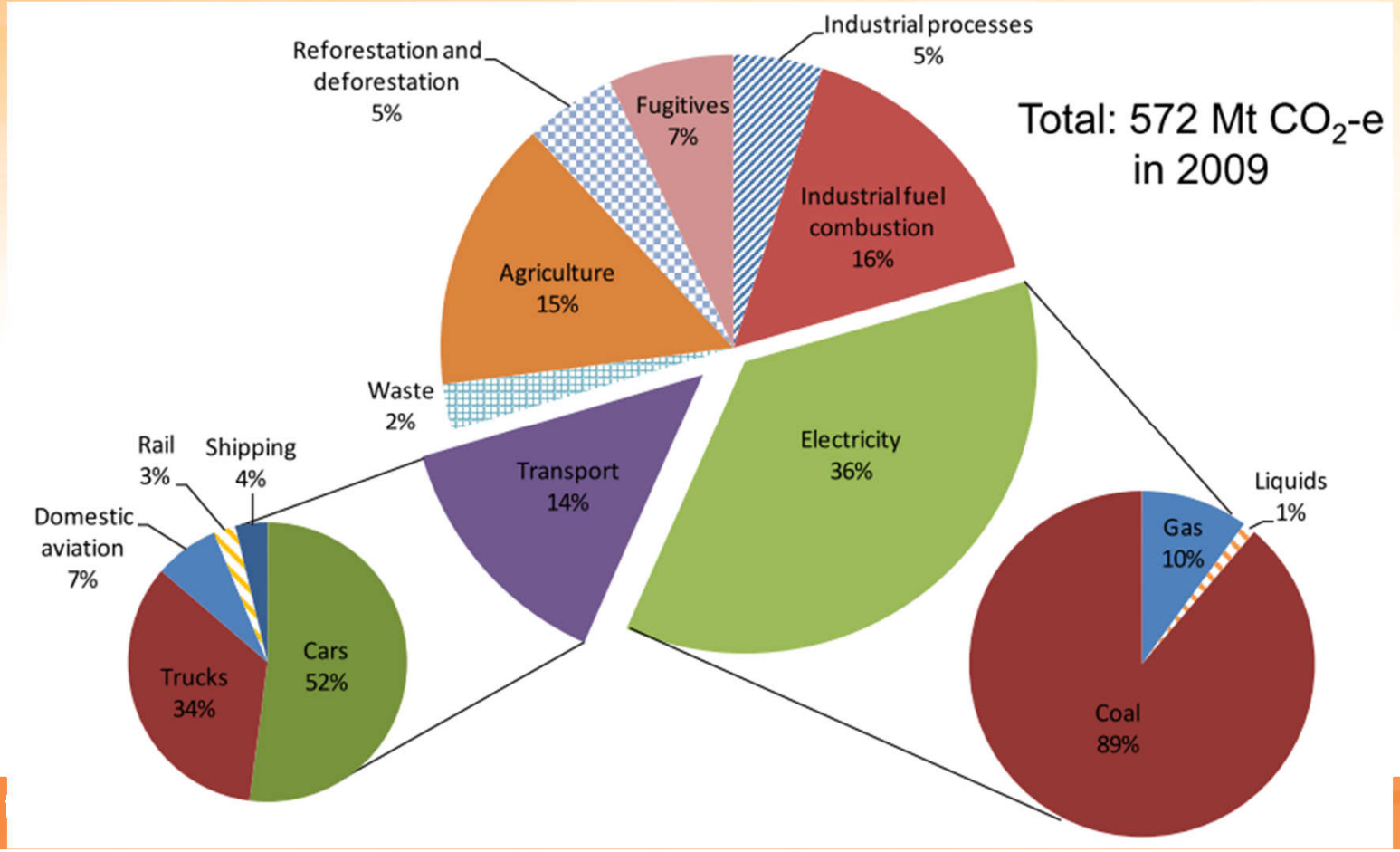

Guam (US)
PALAU
AREA (TOTAL) :458 SQ KM
AREA (LAND) :458 SQ KM
POPULATION : 21,093
HIGH POINT : 242 M - MOUNT NGERCHELCHUUS
AREA (TOTAL) : 181 SQ KM
AREA (LAND) : 181 SQ KM
POPULATION : 63,174
HIGH POINT : 10 M
REPUBLIC OF MARSHALL ISLANDS
Chuuk
Pohnpei
Kwajalein
FEDERATED STATES OF MICRONESIA
AREA (TOTAL) :702 SQ KM
AREA (LAND) :702 SQ KM
POPULATION : 107,665
HIGH POINT : 791 M - DOLOHMWAR - TOTOLOM
NORTH PACIFIC OCEAN
KIRIBATI
Line Islands
AREA (TOTAL) : 462,840 SQ KM
AREA (LAND) : 452,860 SQ KM
POPULATION : 5,931,769
HIGH POINT : 4,509 M - MOUNT WILHELM
NAURU
Tarawa
KIRIBATI
AREA (TOTAL) :21 SQ KM
AREA (LAND) :21 SQ KM
POPULATION : 13,770
HIGH POINT : 61 M
AREA (TOTAL) : 811 SQ KM
AREA (LAND) : 811 SQ KM
POPULATION : 110,356
HIGH POINT : 81 M
KIRIBATI
INDONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
TUVALU
AREA (TOTAL) : 26 SQ KM
AREA (LAND) :26 SQ KM
POPULATION : 12,177
HIGH POINT : 5 M
KIRIBATI
EAST TIMOR
AREA (TOTAL) : 2,944 SQ KM
AREA (LAND) : 2,934 SQ KM
POPULATION : 217,083
HIGH POINT : 1,857 M - MAUGU SILISILI - SAWAI
Cook Islands
AREA (TOTAL) :28,450 SQ KM
AREA (LAND) :27,540 SQ KM
POPULATION : 581,318
HIGH POINT : 2,447 M
- MOUNT MAKARAKOMBURU
VANUATU
Wallis and Futuna (FR)
SAMOA
AMERICAN SAMOA
FRENCH POLYNESIA
AREA (TOTAL) :12,200 SQ KM
AREA (LAND) 12,200 SQ KM
POPULATION : 215,446
HIGH POINT : 1,877 M - TABWEMASANA
FIJI
AREA(TOTAL) : 18,270 SQ KM
AREA(LAND): 18,270 SQ KM
POPULATION: 931,741
HIGH POINT: 1,324 M - TOMANIVI
NIUE
TONGA
COOK ISLANDS
NEW CALEDONIA
AREA (TOTAL) : 748 SQ KM
AREA (LAND) :718 SQ KM
POPULATION : 119,009
HIGH POINT : 1,033 M
AREA (TOTAL) :260 SQ KM
AREA (LAND) :260 SQ KM
POPULATION : 1,444
HIGH POINT : 68 M
AREA (TOTAL) :237 SQ KM
AREA (LAND) :237 SQ KM
POPULATION : 12,271
HIGH POINT : 652 M - TE MANGA
Pitcairn Island
AUSTRALIA
Norfolk Island (AS)
AREA (TOTAL) : 7,686,850 SQ KM
AREA (LAND) : 7,617,930 SQ KM
POPULATION : 20,600,856
HIGH POINT : 2,229 M - MOUNT KOSCIUSZKO
SOUTH PACIFIC OCEAN
NEW ZEALAND
AREA (TOTAL) :286,680 SQ KM
AREA (LAND) :268,021 SQ KM
POPULATION : 4,173,460
HIGH POINT : 3,754 M - MOUNT COOK - AORAKI
SOUTHERN OCEAN
10°N
0°
10°S
20°S
30°S
40°S
130°E
140°E
150°E
160°E
170°E
180°
170°W
160°W
150°W
140°W
130°W
PACIFIC ISLANDS FORUM NATIONS
0 250 500 1,000 1,500 2,000 Kilometres
0 100 200 400 600 800 1,000 Nautical Miles
International Boundary
Province Boundary
Territorial Sea
Economic Zone
Dimensions scaled from this map will be approximate only.
This product is for orientation and briefing purposes only and should not be used for targeting or navigation.
Political boundaries are not necessarily authoritative.
Projection: World Mercator
Datum and Spheroid: WGS 84
Source: VMAP0, Fairplay World Ports, GMDB and DAFIF™, a product of the National Geospatial-Intelligence Agency

Pacific Forum nations facing extraordinary challenges



Complexity + scale of required Australian **C** action

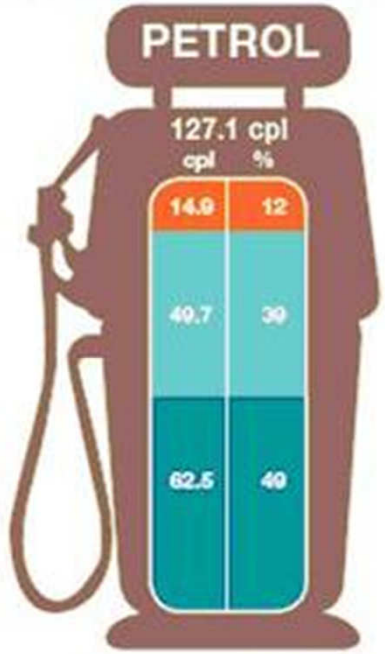
- Australian emissions amongst highest per-capita in the world
- National emissions continue to grow (except for land-use)
- Avoiding dangerous warming might require reductions of 90% by 2050



… 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 governments
- Key externalities until now include social welfare, resources management, energy security, conventional pollutants
- *… now climate change*

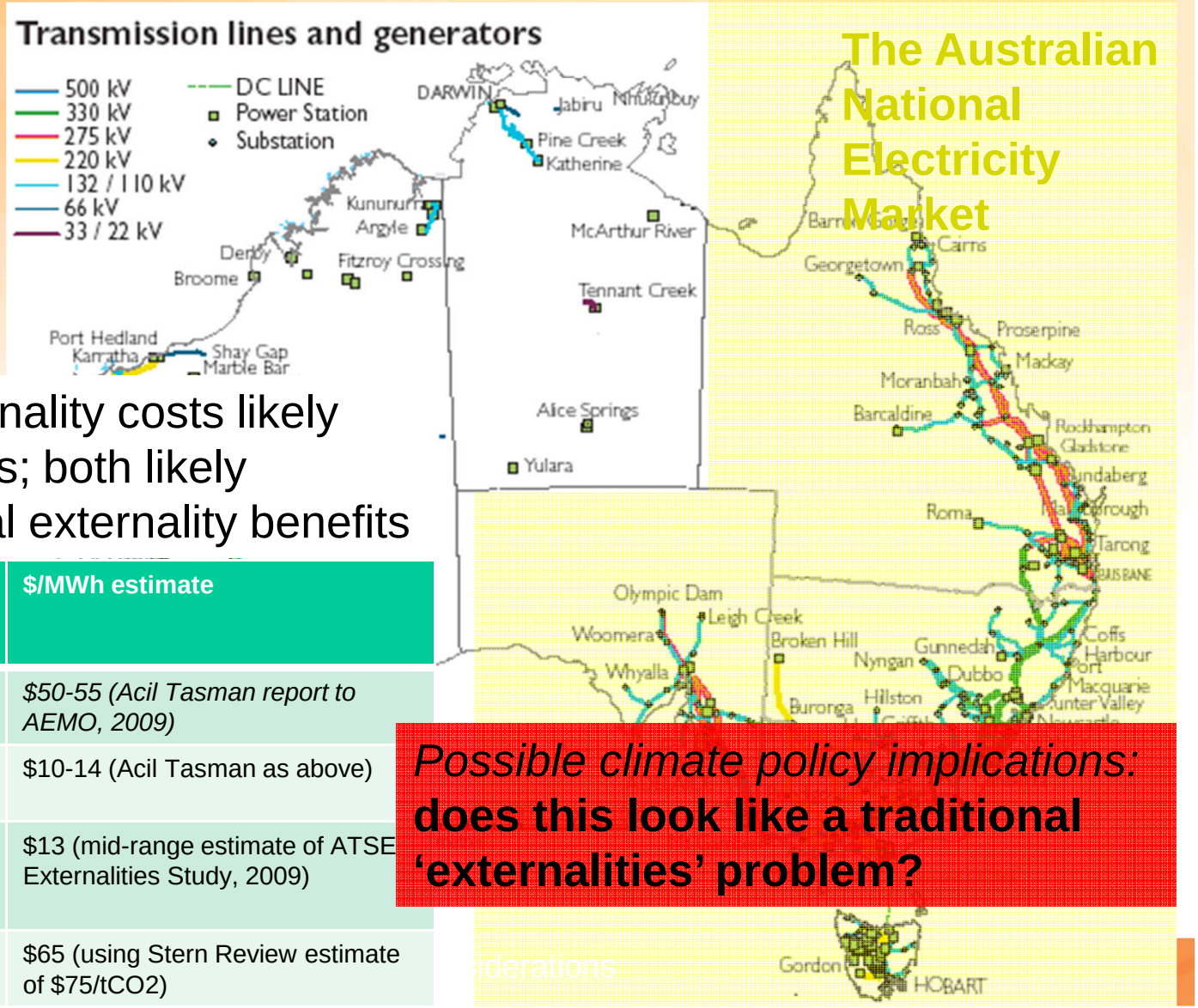
Chart 23 Components of Australian retail RULP prices in the five largest cities: 2008–09



Margins and other costs Taxes Mogas 95

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

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

Overall objective for the NEM (NEL Sec. 7)

*The national electricity market objective is to promote efficient investment in, and efficient use of, electricity **services** for the long term interests of **consumers** of electricity with respect to **price, quality, reliability and security of supply** of electricity and the reliability, safety and security of the national electricity system*

- Are all objectives reflected in market design?
  - One reason there is effective competition in the Victorian Retail Market is "Because the provision of energy is viewed as a homogenous, low engagement service " AEMC, Effectiveness of Competition in Victoria, 2008

Possible climate policy implications: **distributed options and energy efficiency adversely impacted by disfunctional retail markets**

- Lack of env. and wider sustainability objectives a **design choice**
  - *As government desires that NEM contributes to achieving such objectives must implement 'external' policies to drive changes*

Possible climate policy implications: **not an imposition on participants but an obligation – role of NEM then to faciliate necessary changes**

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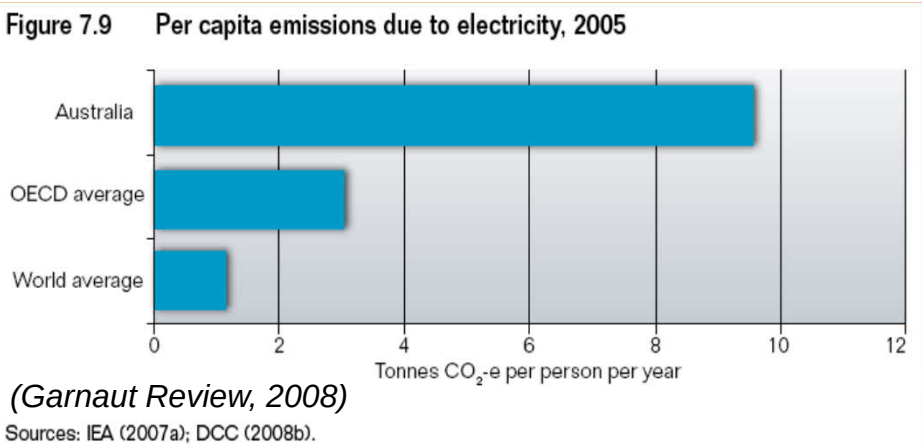
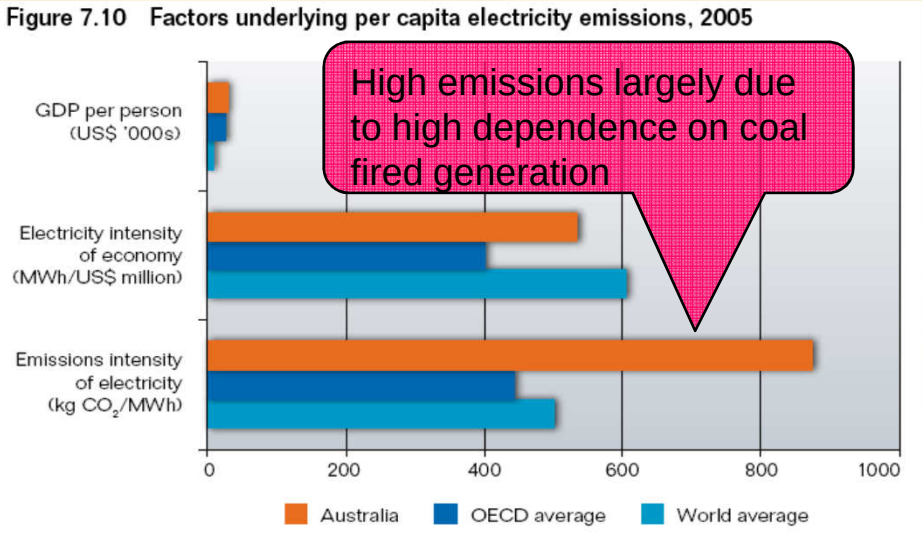
C pricing & electricity

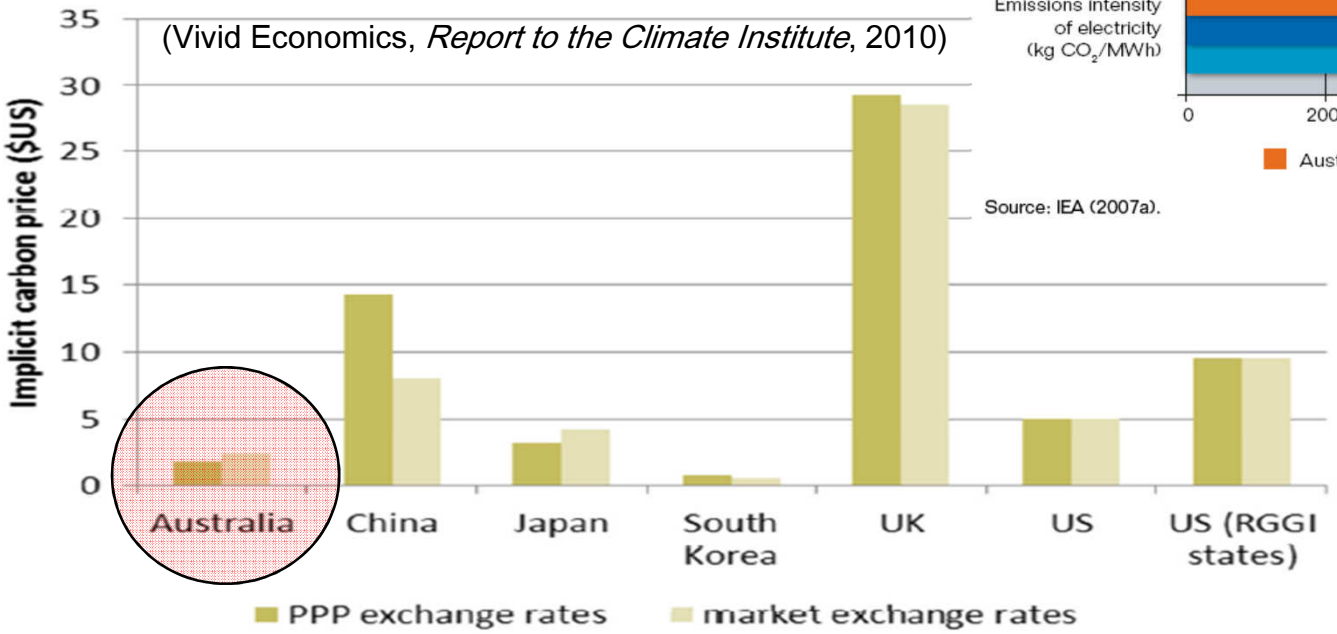
- One of the world's most emissions intensive electricity industries
- Current policies including eRET represent modest 'implicit' **C** price
- Explicit (eg. EU ETS) and implicit **C** prices of many other countries exceed current Australian efforts



(Garnaut Review, 2008)



(Vivid Economics, *Report to the Climate Institute*, 2010)



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?***

(former) Carbon Pollution Reduction Scheme

Australian ETS discussions since 1998, bipartisan consensus for ETS in 2007, collapse of consensus in 2010

- Coverage
  - 6 Kyoto gases, approx. 75% national emissions
  - Around 1000 firms with mandatory obligations, otherwise upstream liability on oil and gas, 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
- Unlimited use of some kyoto units including CDM
- Price caps (but not floors)
- Permit allocation
  - Free allocation to EITE, other strategic (politically powerful) sectors
  - Otherwise auctioning
- Revenue from auctioning
  - 'protect' vulnerable consumers
  - support some sectors to reduce emissions

Current Australian **C** Pricing Framework

Multi-Party Climate Change Committee

- Could commence with fixed price (within ETS framework) as early as mid 2012
- Convert to ETS within 3-5 years subject to Australian and international factors
  - Including International **C** markets, progress on negotiations
- Likely ETS design (starting point the former CPRS)
  - Broad coverage (but not land-use?)
  - International linkages (potentially limited)
  - Assistance to households and businesses still to be determined
- Complementary policies still required (but limited scope?)

Key renewable drivers: MRET/eRET 'designer' mkt

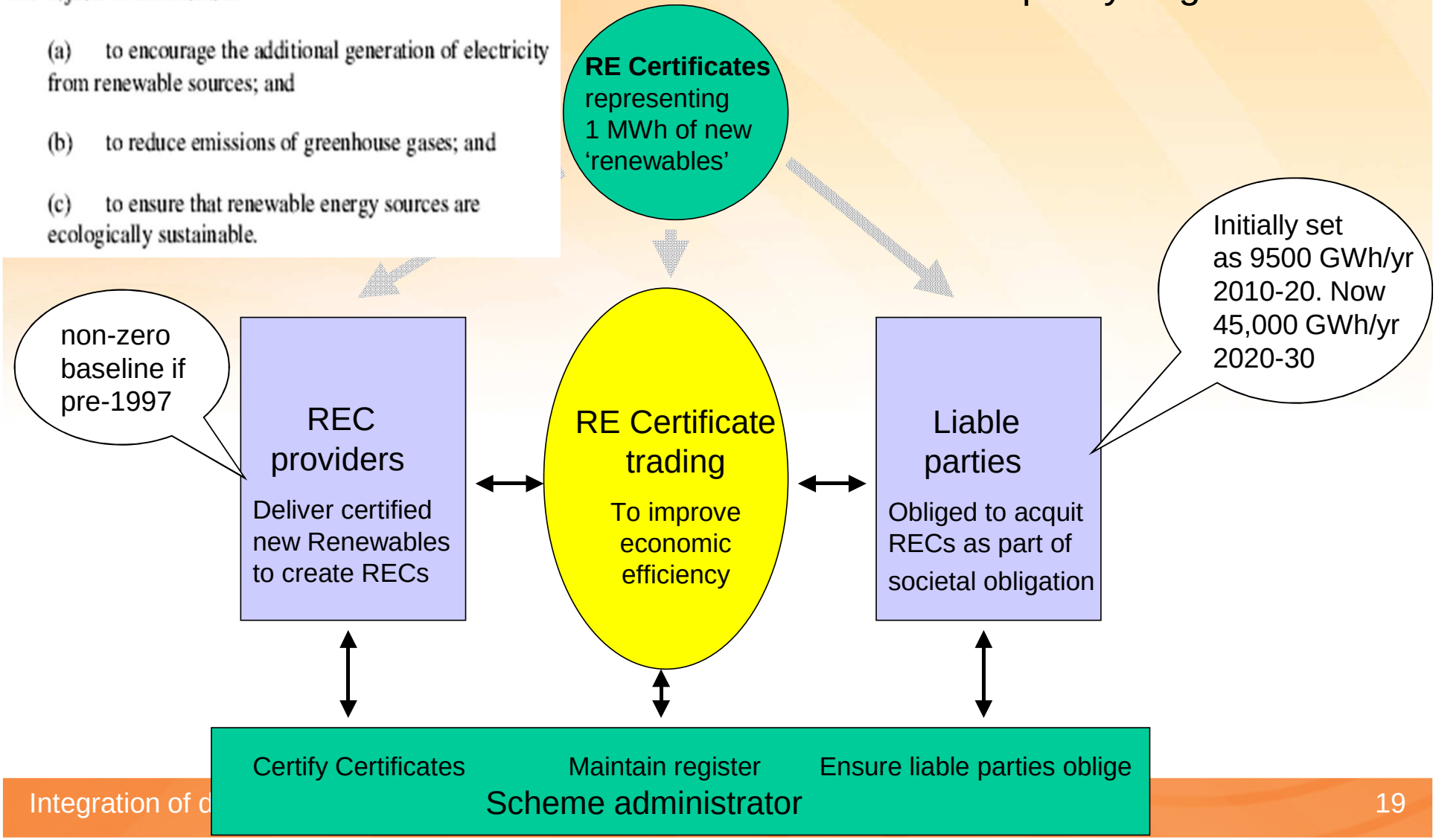
… will succeed or fail on quality of governance

The objects of this Act are:

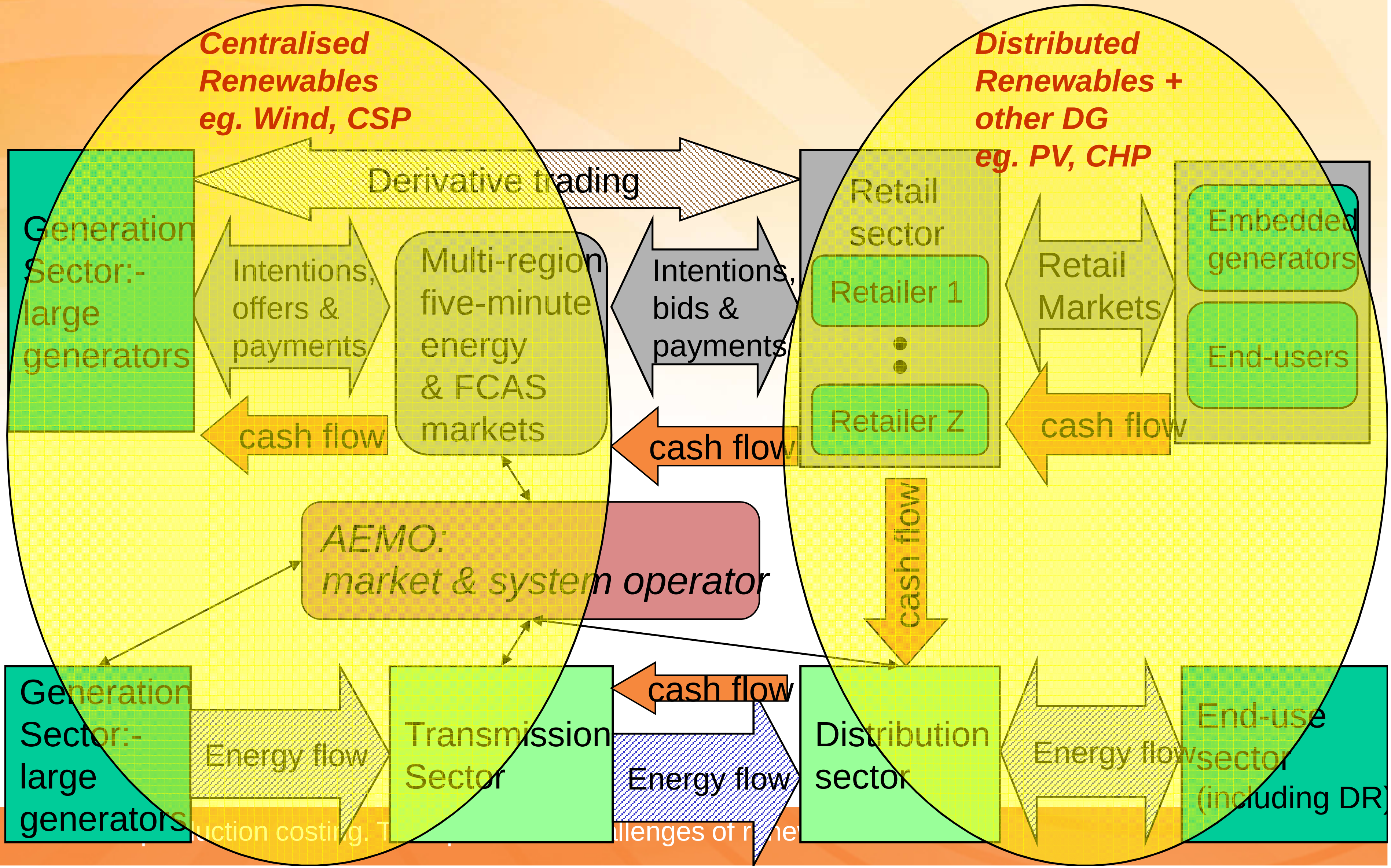
(a) to encourage the additional generation of electricity from renewable sources; and

(b) to reduce emissions of greenhouse gases; and

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



Two ‘worlds’ for renewables and DE integration



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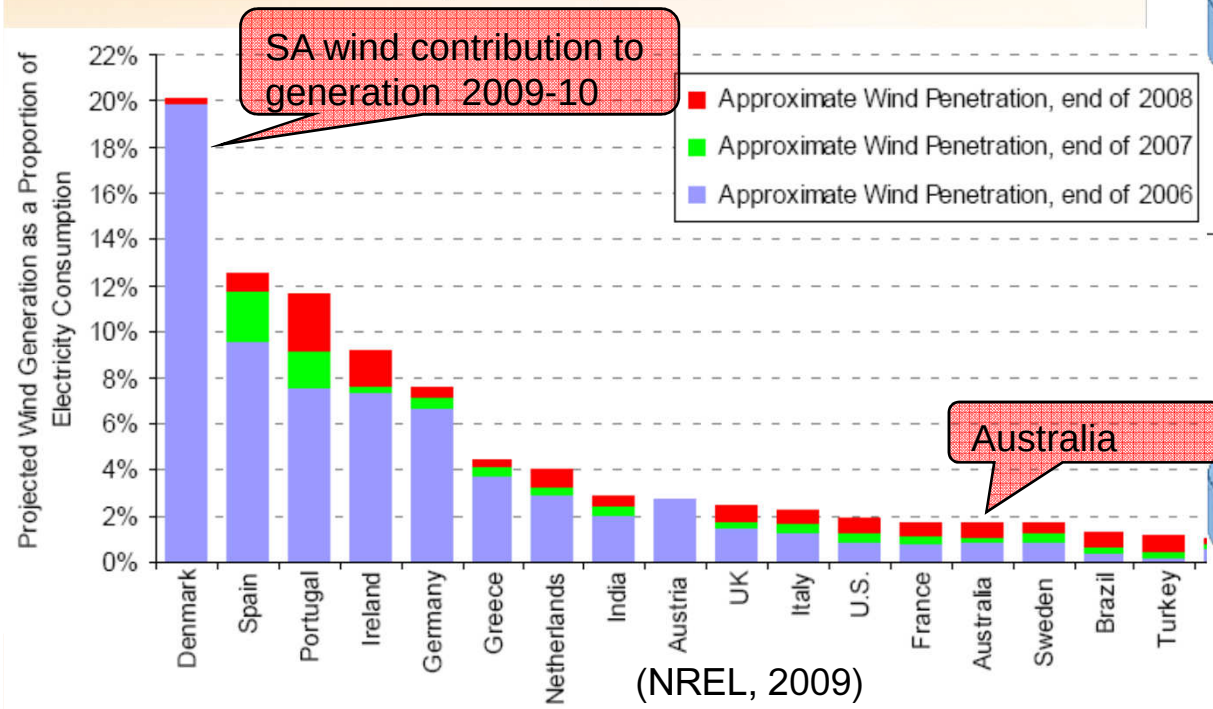
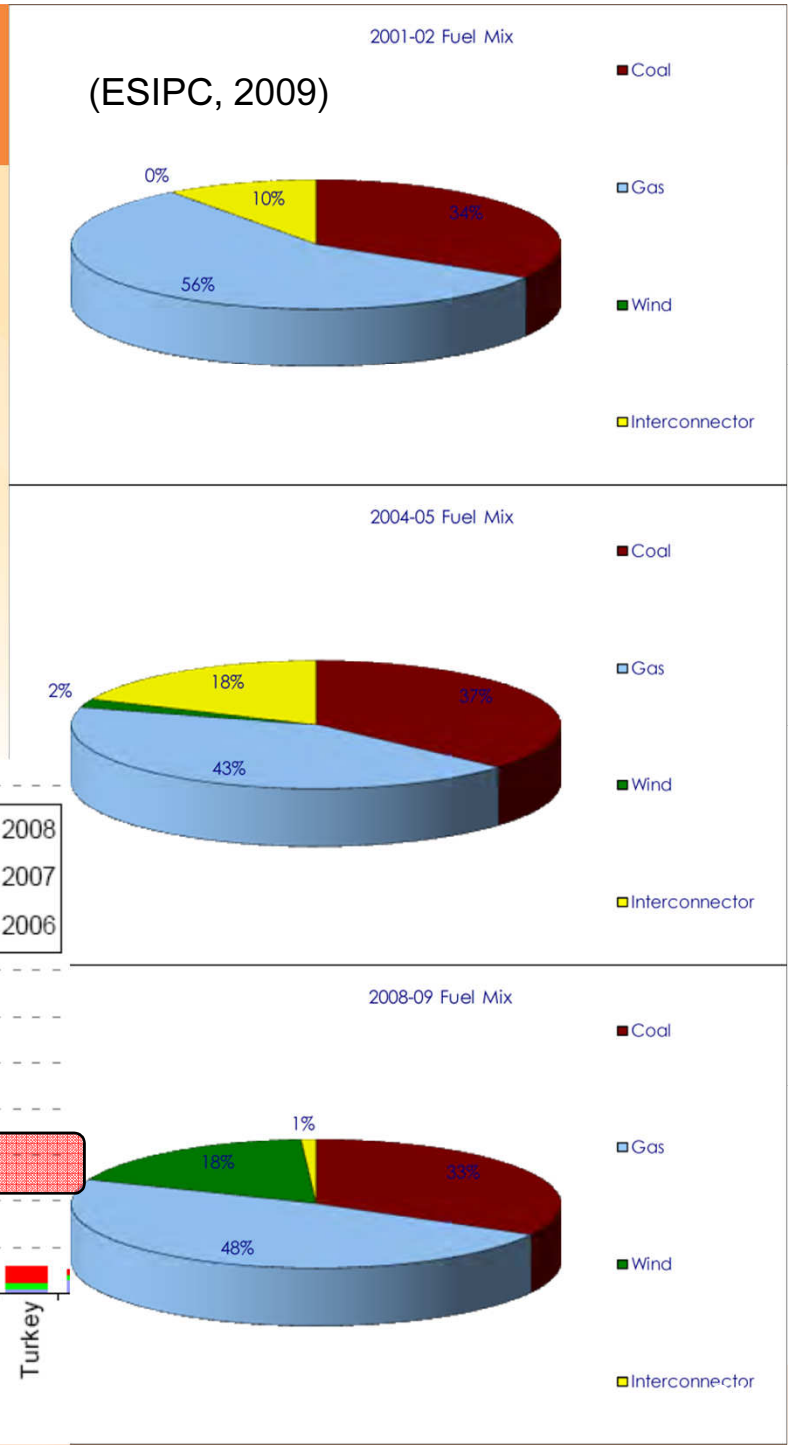
Wind in South Australia

- A world leading jurisdiction for assessing the potential value of complementary resources wrt intermittent renewables
  - A large and rapid deployment of wind with a world leading penetration
  - Excellent solar resource
  - High wholesale spot/ancillary service market transparency



(NREL, 2009)



(ESIPC, 2009)

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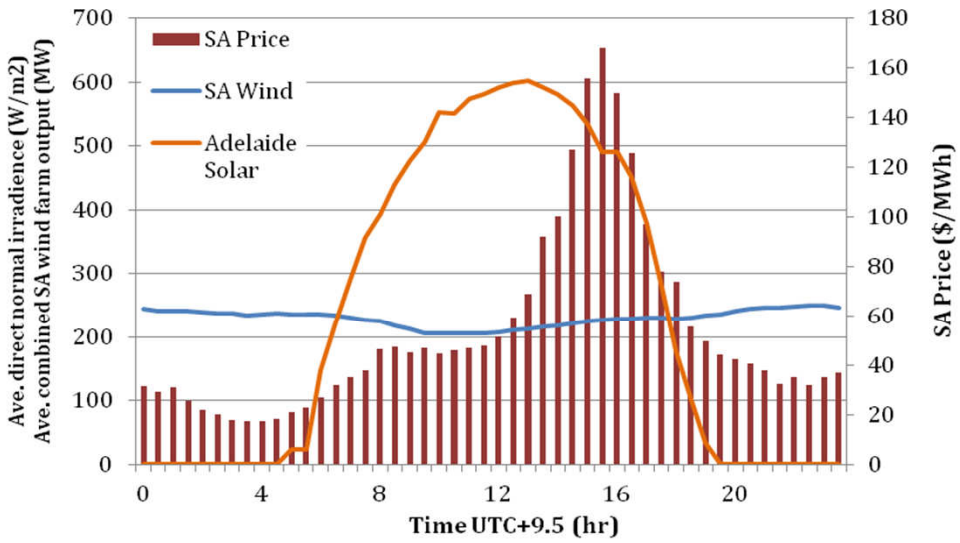
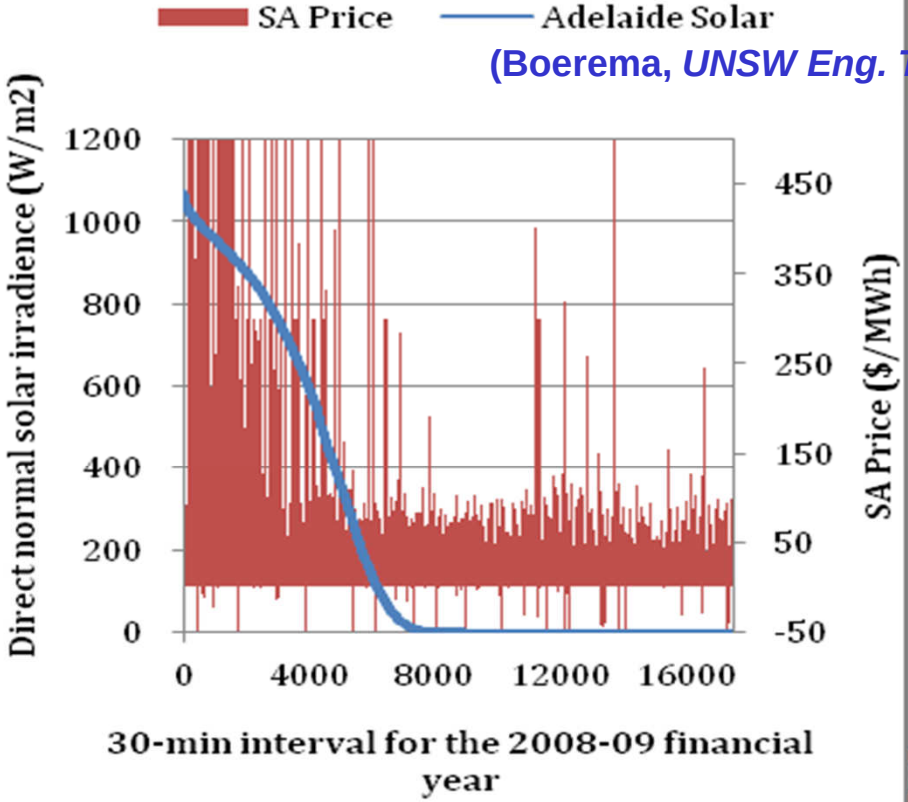
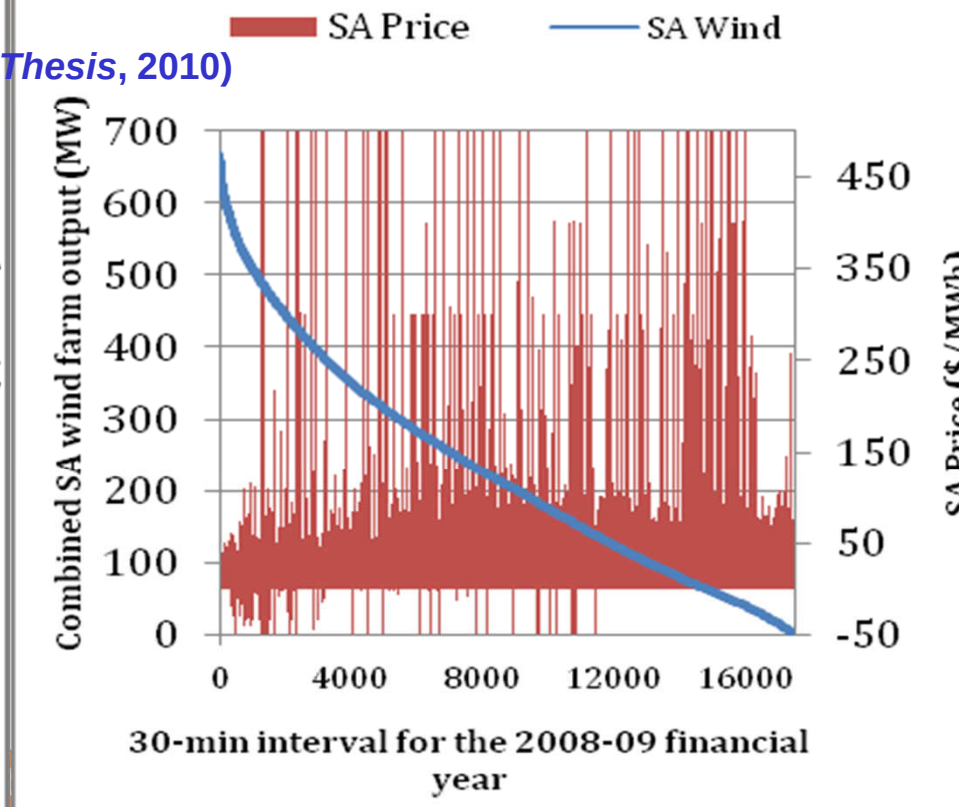
Renew gen. and price

- In 2008-9, large tracking PV plant may have earned spot revenue >$100/MWh or 2X Wind $/MWh
- Key driver is correlation with demand (key price determinant)



(Boerema, *UNSW Eng. Thesis*, 2010)





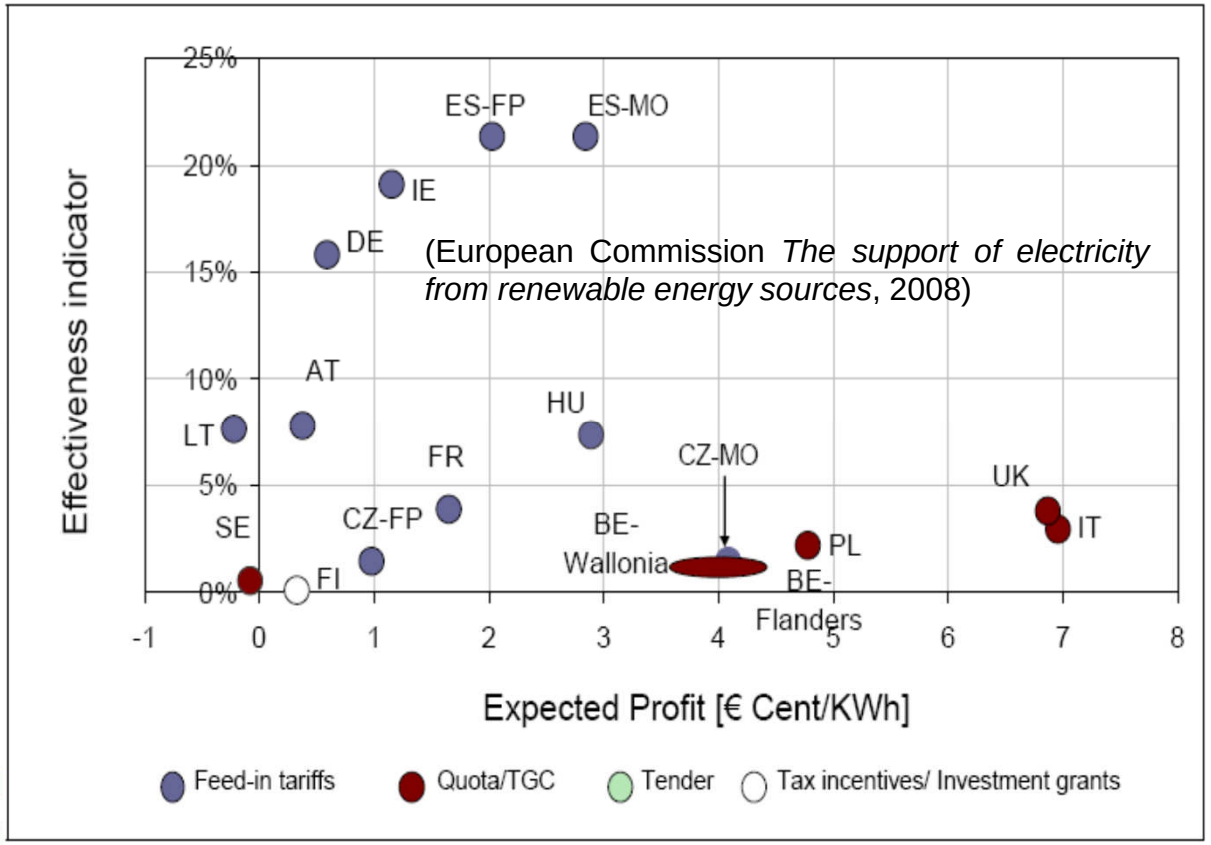
Wind's energy value

- Energy value of wind declines as penetrations increase
  - An 'efficient' market signal – generation without inherent energy storage has lower value than conventional generation with storable primary energy sources (coal, gas, hydro, diesel)
- Wind in SA currently being managed by conventional generation in SA (and NEM more widely)
  - Significant 'storage' competition in the wholesale space

Period (Cutler, et al, 2011)	All wind farms ($/MWh)	All other generators ($/MWh)
Financial year 2008-9	46.6	73.5
Financial year 2009-10	47.4	90.1

MRET performance to date… and for 2020?

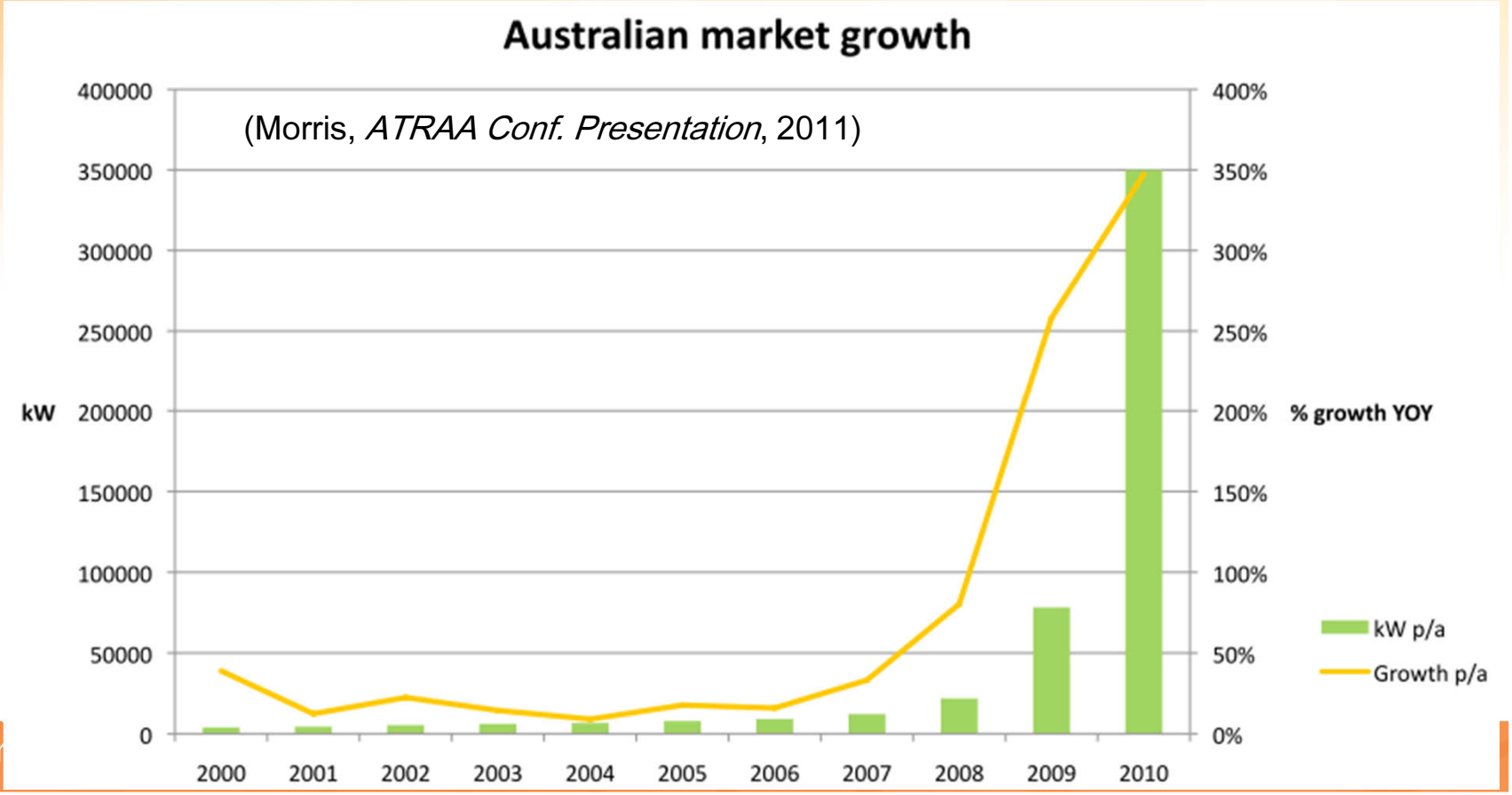
- **To date:** modest ramping target easily met + considerable new investment with apparent efficiency – low subsidy $/MWh by international standards
- **Yet:** international experience generally poor with certificate schemes for reasons that seem to include governance capture by incumbents, risks for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



(European Commission *The support of electricity from renewable energy sources*, 2008)

PV deployment has recently accelerated

- High recent growth in PV deployment – almost all residential systems
- Penetration levels in some regions of the Dx network becoming significant – solar cities, demographics, developer strategies



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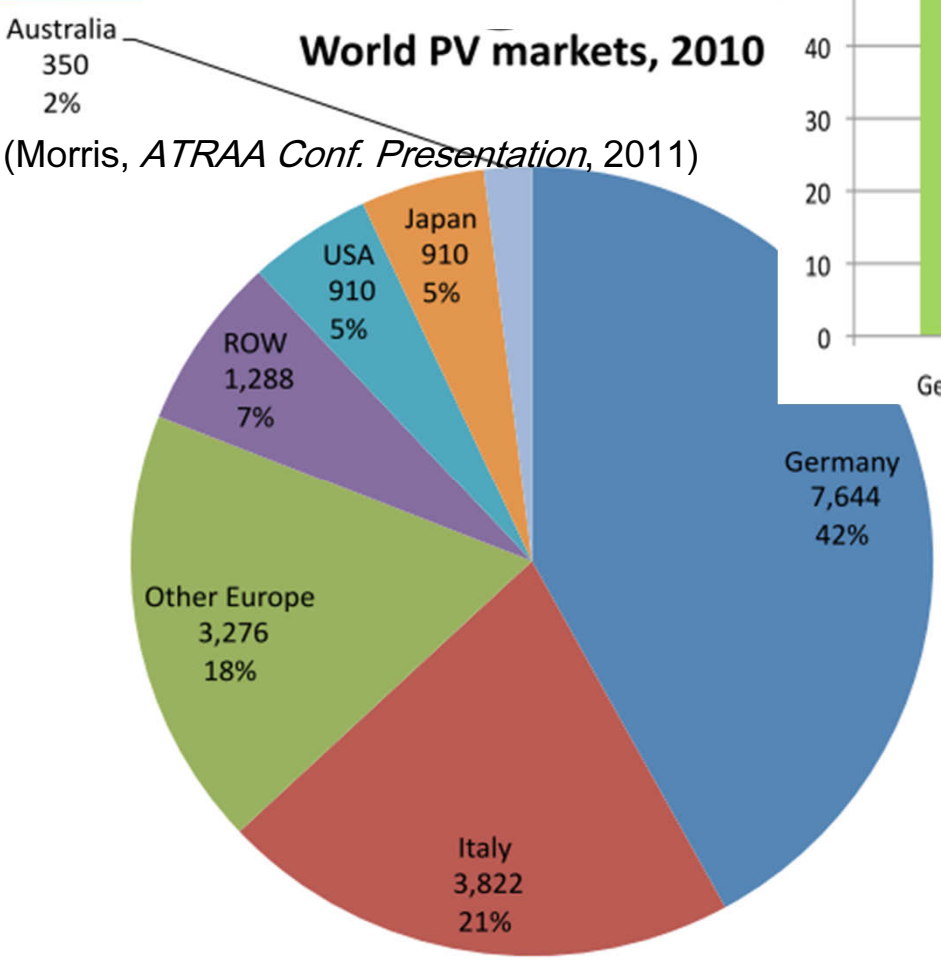
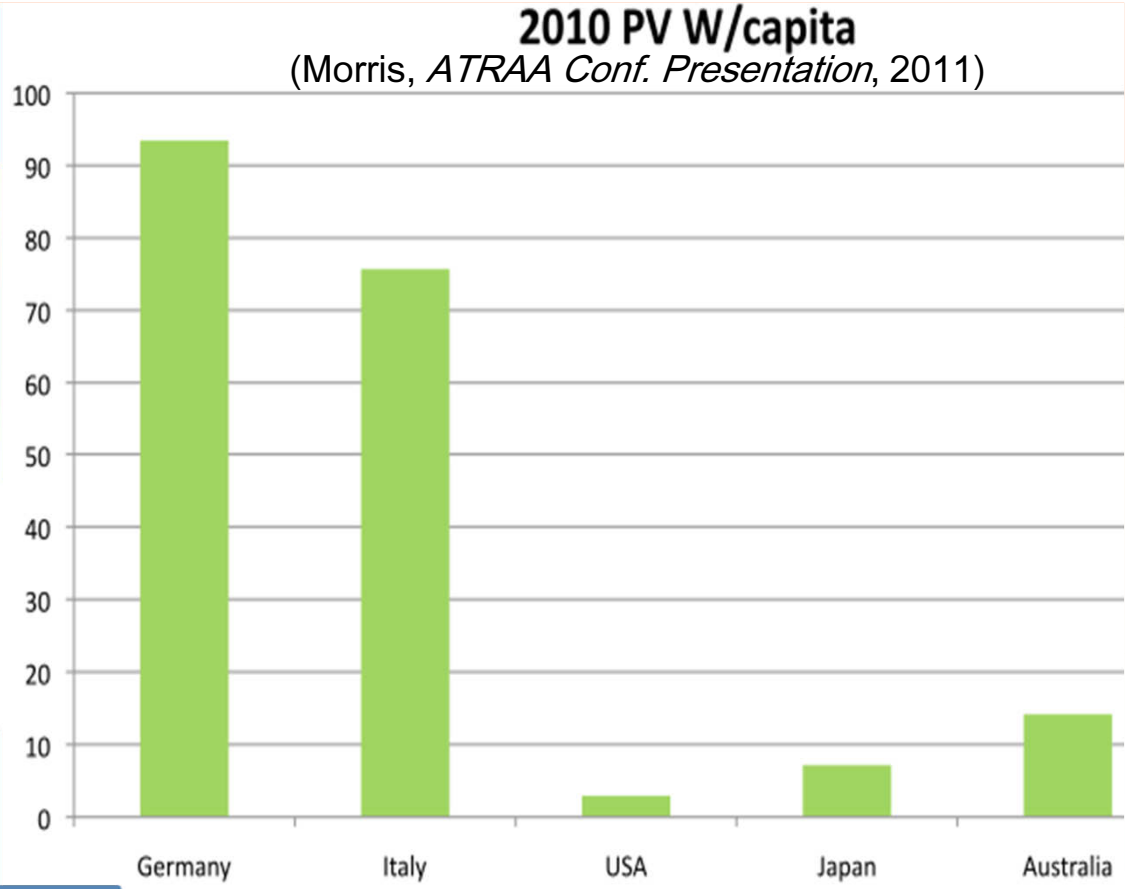
A significant recent player with growing penetrations



(Morris, *ATRAA Conf. Presentation*, 2011)



(Morris, *ATRAA Conf. Presentation*, 2011)

Facilitating new technologies? **Software+Orgware**

- Renewables pose significant challenges for existing industry capabilities, institutional frameworks

The Art of Knowing and Doing

The study of **technology** concerns *what* things are made and *how* things are made. Technology, from the Greek *science of* (practical) *arts,* has both a *material* and an *immaterial* aspect.

Technology = Hardware + Software + "Orgware"

(IIASA, *What is technology?,* 2006)




Hardware

Software

Orgware

Hardware: Manufactured objects (artifacts)

Software: Knowledge required to design, manufacture, and use technology hardware

"Orgware": Institutional settings and rules for the generation of technological knowledge and for the use of technologies

Distributed renewables particularly challenging…

- Hardware often arrives before software and orgware
- New technologies being deployed by new players with limited ‘software’ understanding and inadequate institutional frameworks

Garrett under fire over dodgy solar installations

By Samantha Hawley for AM

(www.abc.net.au, 2010)

Updated Thu Feb 18, 2010 9:38am AEDT

As Environment Minister Peter Garrett grapples to control his home insulation program, there are now concerns about the potential for house fires because of badly-installed solar panels.

ABC's Lateline program has revealed that up to 2,000 homes could be at risk of electrical fires from poorly installed roof-top solar panels, and Mr Garrett's department is now considering an audit into the scheme.

Ted Spooner, from Standards Australia's committee on renewable energy, has told Lateline that there is no restriction to stop panels which do not meet the Australian standards being imported into Australia.

Mr Spooner says there needs to be more inspectors and an audit of the scheme.

"There is very, very limited inspection of houses to make sure they actually meet those requirements," he said.

"If you have poor quality modules, you can have fractures in electrical joints, and that can lead to arcs and then fires, and these burn at quite high temperatures."

Up to 2,000 homes could be at risk of electrical fires from poorly installed roof-top solar panels (ABC News, file photo)

VIDEO: Dodgy solar panels spark fire concerns (Lateline)

AUDIO: More Garrett woes with questions over solar panel installation (AM)

RELATED STORY: Industry rejects substandard insulation claims

RELATED STORY: Garrett phones mum after son's insulation death

Peter Marshall from the United Firefighters Union of Australia says there are concerns faulty panels could cause high voltage fires.

"The problem is, there's been a rush towards installing this type of equipment," he said.

There have not been any solar panel fires in Australia yet, but it is understood that the Department of Environment is looking into whether an audit is needed.

Energy efficiency policy the 'Quiet' Achiever

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

Name	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*

… (continued)

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**	

Possible lessons for C + E policy governance

- NEM provides an example of 'serious' governance
  - Robustness designed in – security regime that overrides market
  - Very high transparency in market operation
  - Formal separation of powers and interfaces between policy making, rule making, operation and enforcement
  - Rules for changing the rules; any party can propose a rule change at any time, highly transparent process with 'stakeholder' management

Possible climate policy implications: Serious governance the key to successful market-based policy approaches;

- Policy failure should not be an option – security regime required
- High transparency with significant disclosure obligations
- Robust against the rent-seekers (often incumbents)
- Fixable: "market and investor' certainty should never over-ride necessary repairs and improvements

NEM governance appears far more robust than that for some other key environmental markets to date including MRET/eRET, NSW GGAS, proposed CPRS design

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Thank you… and *questions*

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