

**Australian Business Economists
Forecasting Conference**

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Economics of Climate Change

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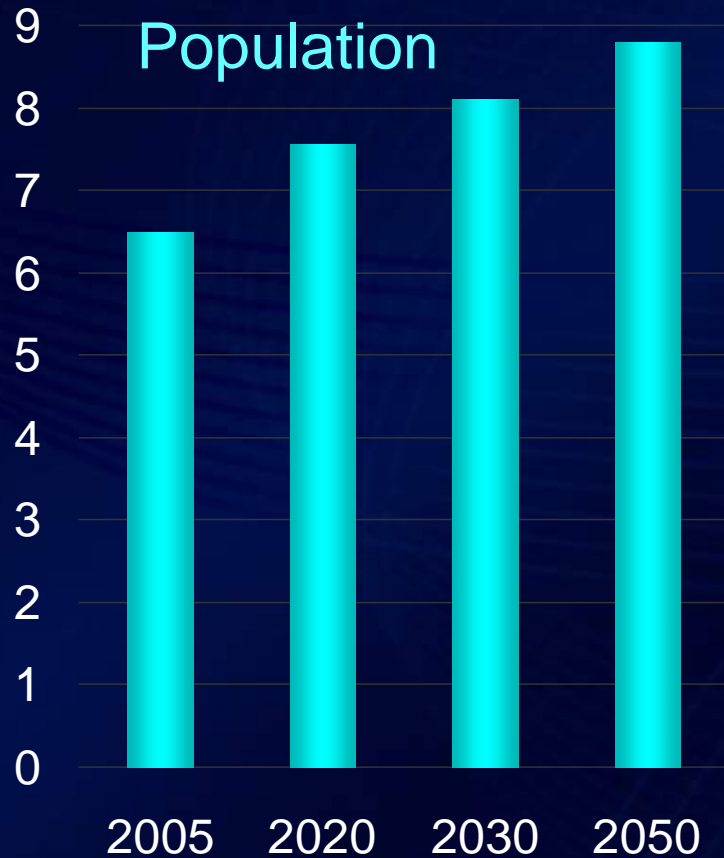
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Overview of presentation

- Emission and climate projections
- Climate change impacts
- Mitigation
- Adaptation
- Way forward

Global energy consumption and emissions drivers

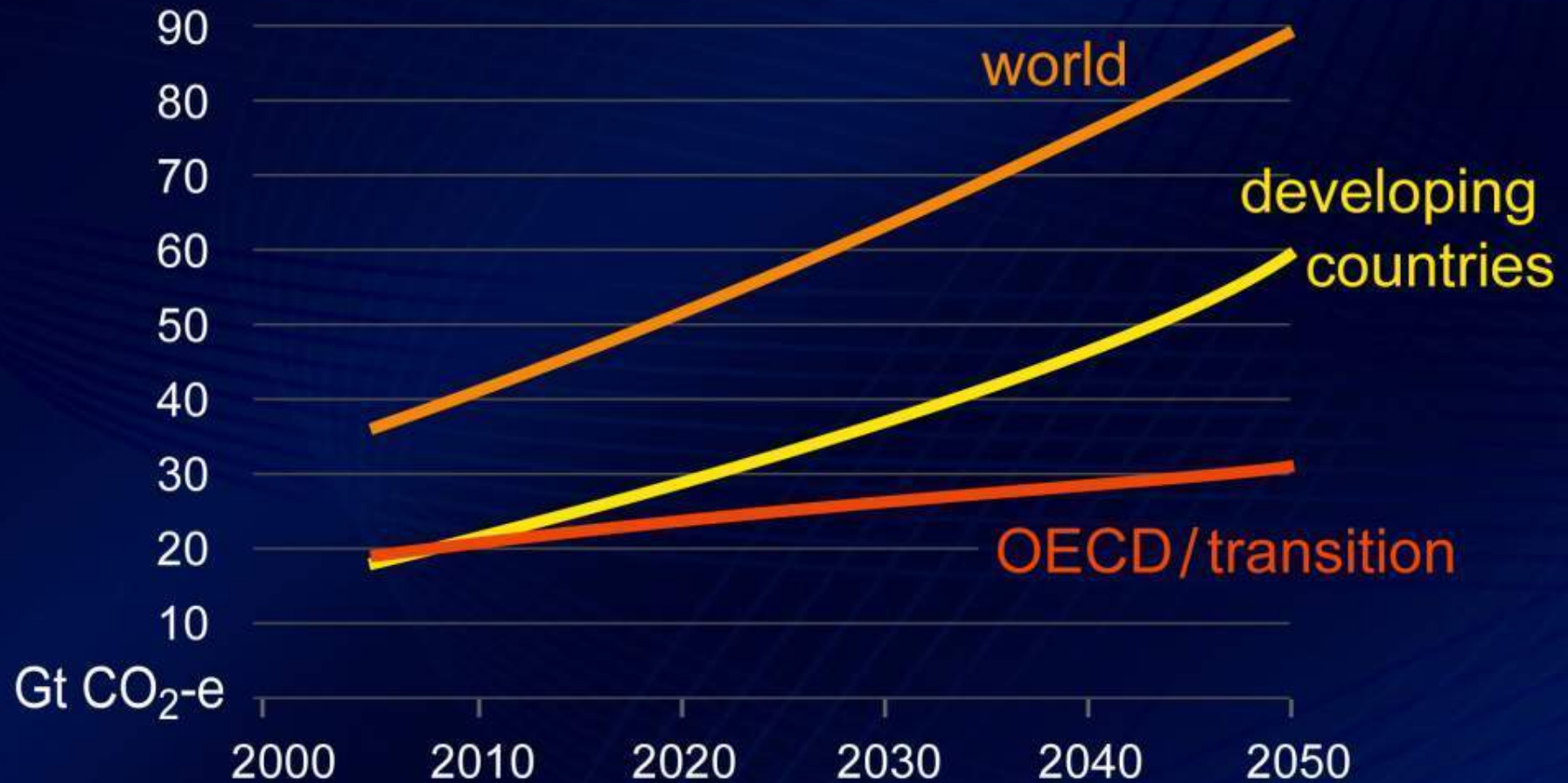
billion



2005 US\$trillion



Global emissions, reference case



Climate projections in Australia

Change in key variables, relative to 1990			
	Temperature increase (°C)	Change in rainfall (%)	Sea level rise (cm)
2030	0.7 – 1.2	-10 – +5	6.4 – 21.5
2070	1 – 5	-30 – +20	12.8 – 42.9

Based on CSIRO (2007)

Key risk areas: Australia

Water resources	decreased flows reduced water quality
Agriculture and forests	changes in productivity increased incidence of pest & diseases
Health	increased risk of disease and heat stress
Industry/settlement	threats to infrastructure change in migratory patterns
Ecosystems	decreased biodiversity threat to the Great Barrier Reef

Categories of economic impacts

- Market sector impacts:
 - ▶▶ Factor supply and productivity
 - ▶▶ Income and consumption patterns

- Non-market (or non-priced) impacts
 - ▶▶ Environment
 - ▶▶ Eco-systems
 - ▶▶ Human health

- Catastrophic impacts

Estimated impact of climate change on world agricultural productivity at 2080

percent change from reference case

	without carbon fertilisation	with carbon fertilisation
World	-16	-3
Developed countries	-6	8
Developing countries	-21	-9
Africa	-28	-17
Asia	-19	-7
Middle East – North Africa	-21	-9
Latin America	-24	-13

Source: Cline (2007)

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*Estimated impact of climate change on
Australian agricultural productivity at 2080
percent change from reference case*

	without carbon fertilisation	with carbon fertilisation
Australia	-27	- 16
South east	- 12	1
South west	- 14	- 1
Central east	- 23	- 12
Central west	- 35	- 25
North	- 41	- 33

Source: Cline (2007)

Droughts

- Impact of current droughts exacerbated by higher temperatures from global warming
- Expected increase in occurrence:
 - ▶▶ up to 20% more drought months over most of Australia by 2030
 - ▶▶ up to 40% more droughts in eastern Australia by 2070
 - ▶▶ up to 80% more in south western Australia by 2070

Source: CSIRO (2007)

Economic impact of drought in Australia

- Drought is estimated to have reduced the rate of economic growth by:
 - ▶▶ 1 percentage point in 2002-03
 - ▶▶ 0.75 percentage points in 2006-07from what would otherwise have been achieved

Full range of measures needed

- ▶▶ carbon pricing
- ▶▶ RD&D funding
- ▶▶ regulatory arrangements
- ▶▶ technology partnerships
- ▶▶ international collaboration
- ▶▶ adaptation strategies

Current Australian mitigation policies

Name	Policy	Cost of abatement (per tonne)	Policy cost
MRET	Mandatory targets for uptake of renewables	high	\$208 million a year in subsidies from 2010
Photovoltaic rebate programme	Cash rebates	high	\$202 million
Queensland 13% gas scheme	Electricity retailers	high	\$61 – \$106 million a year in subsidies by 2010
VRET	Renewable electricity – 10% by 2016	high	
GGAP	Grants to cost effective abatement opportunities	low	

Renewable energy

- Clean Energy Target
 - ▶▶ to commence in 2010
 - ▶▶ additional 30,000 GWh (from 16,000 GWh baseline) by 2020
 - ▶▶ equivalent to about 15 per cent of Australia's electricity generation at 2020

- MRET
 - ▶▶ additional 9,500GWh renewable energy by 2010
 - ▶▶ 2 per cent of additional electricity to be from renewables

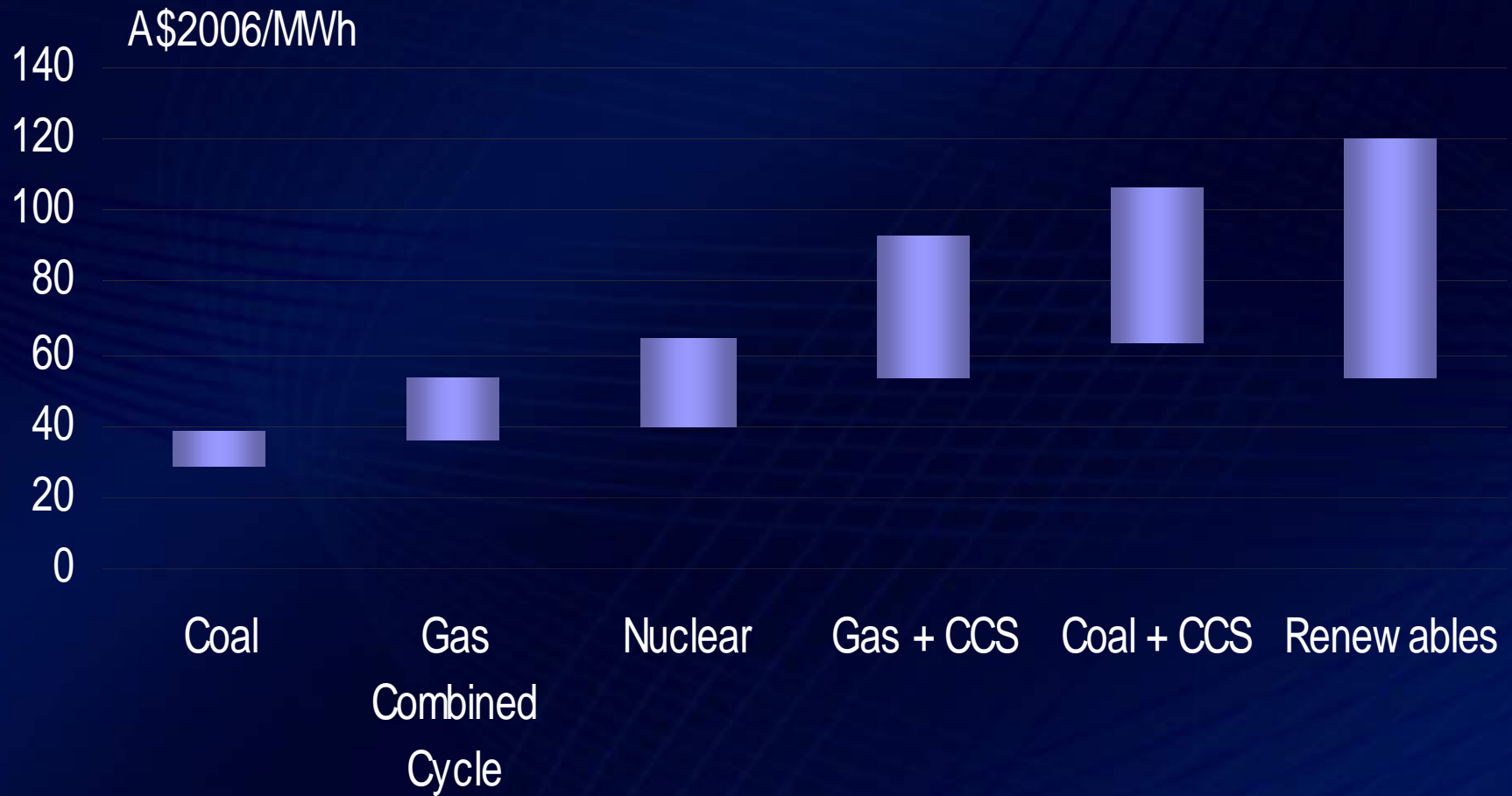
Technology

- Low emissions and energy efficient technologies will play the key role in:
 - ▶▶ reducing energy consumption
 - ▶▶ decarbonising energy supply
 - ▶▶ reducing GHG emissions
 - ▶▶ addressing energy security
 - ▶▶ allowing simultaneous achievement of other economic and social development goals

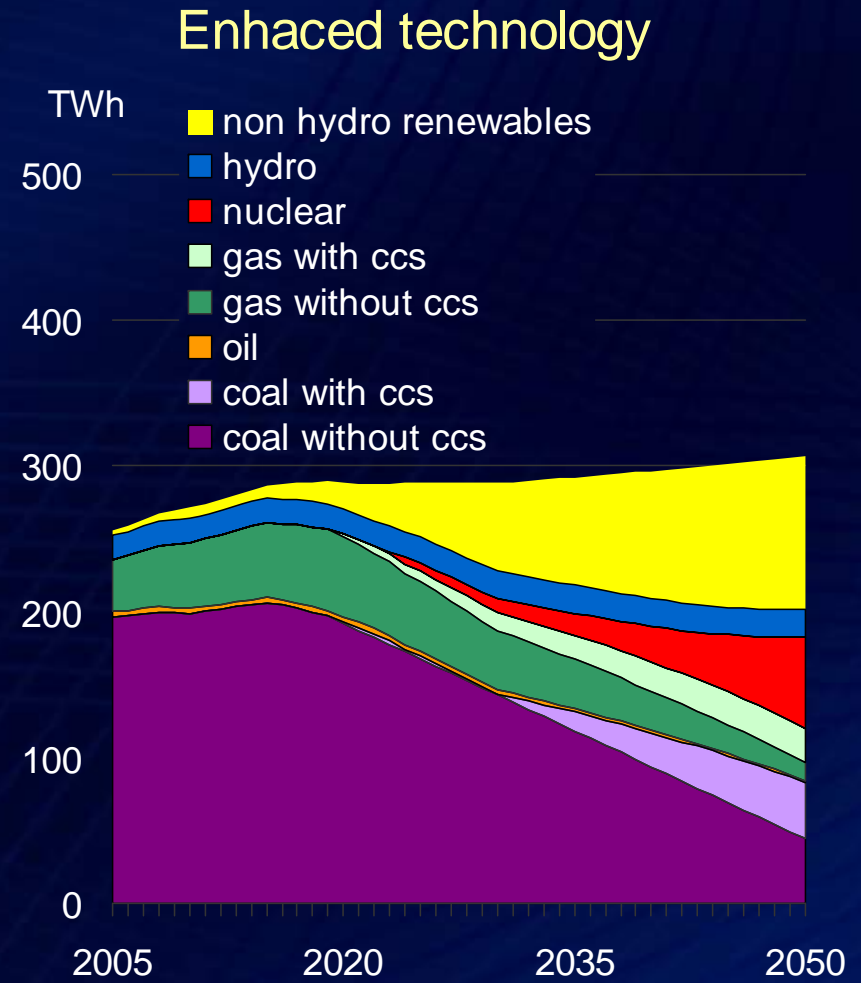
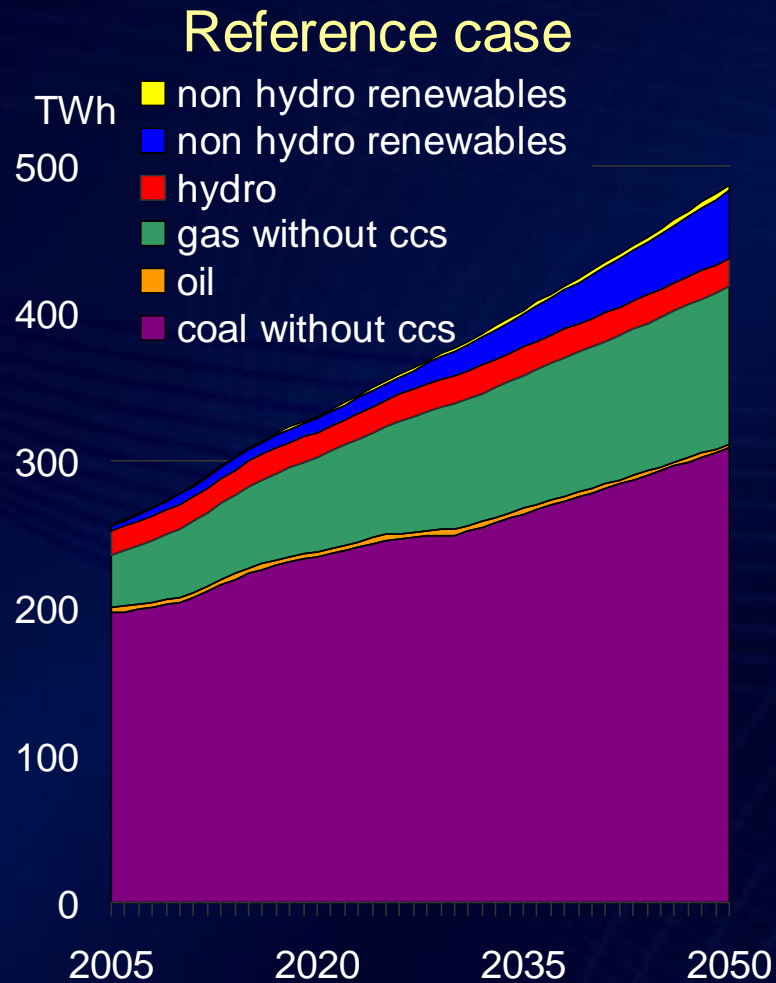
Key technologies

electricity	<ul style="list-style-type: none">▪ advanced coal and gas▪ advanced & lower cost renewables and nuclear▪ CCS from ~2020
transport	<ul style="list-style-type: none">▪ more efficient ICE's▪ hybrids▪ biofuels
households and buildings	<ul style="list-style-type: none">▪ more efficient end-use energy consumption▪ CFLs▪ LEDs▪ heating and hot water▪ better building design

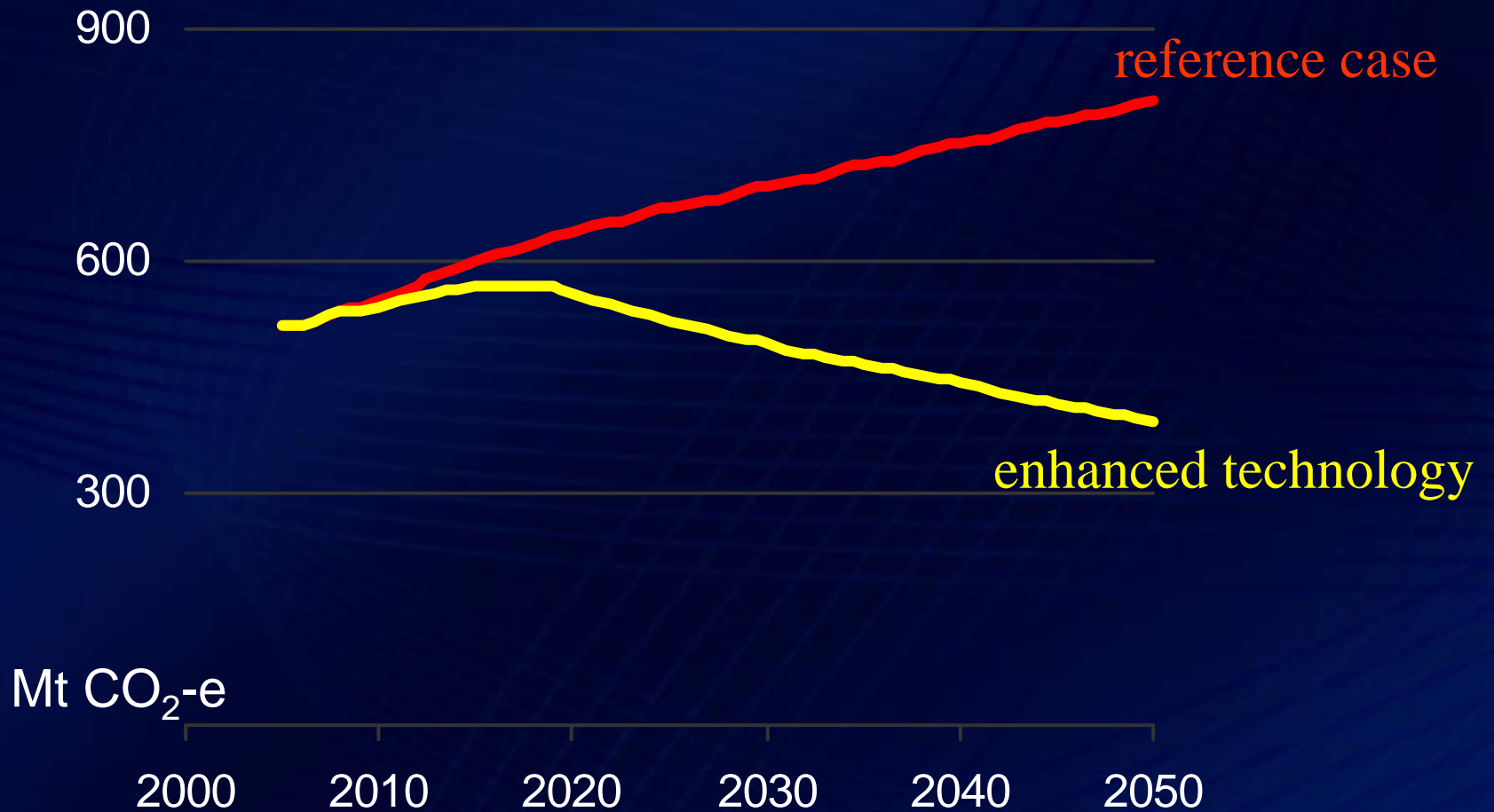
Relative costs of technologies, electricity generation



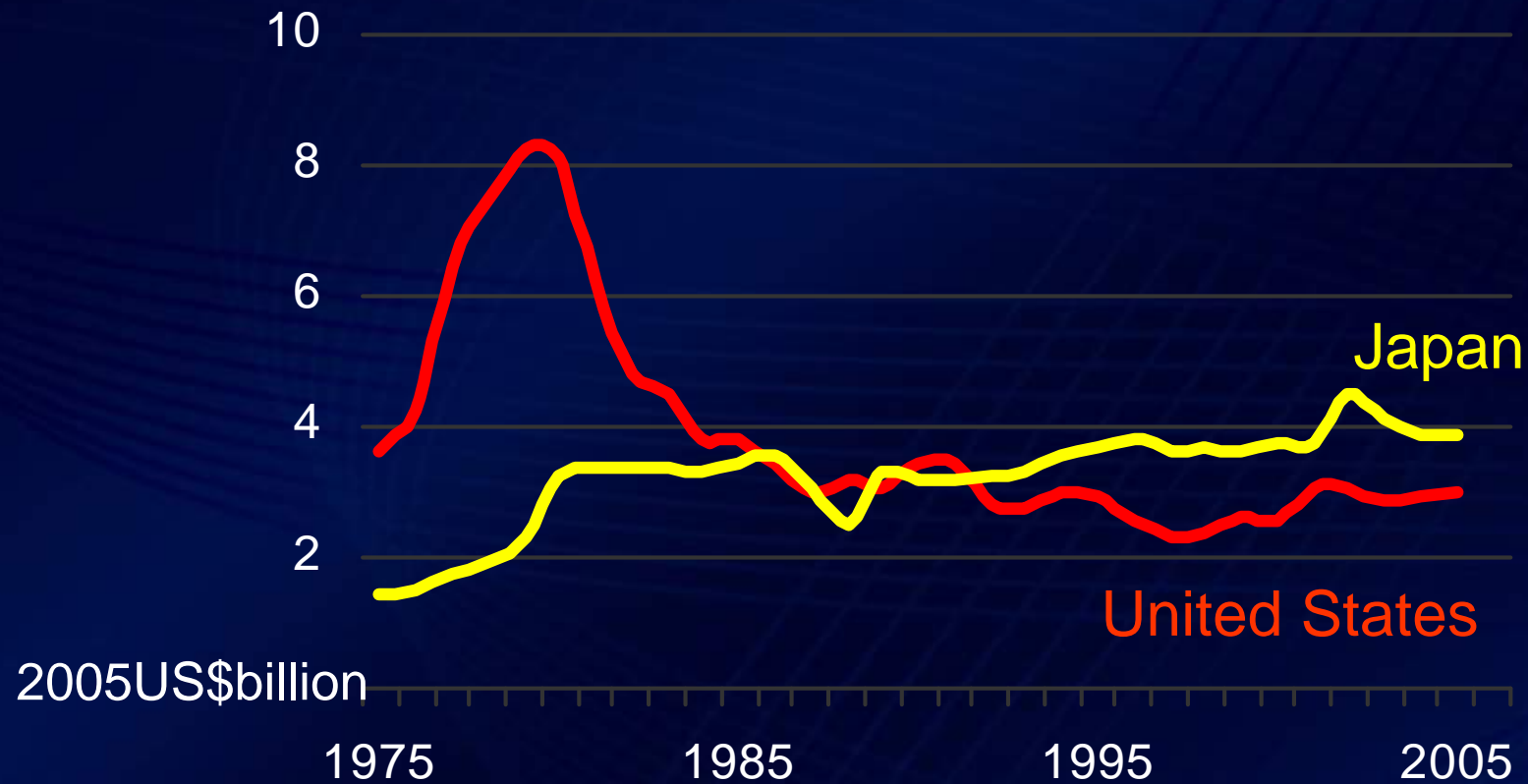
Australian electricity fuel mix



Australian emissions



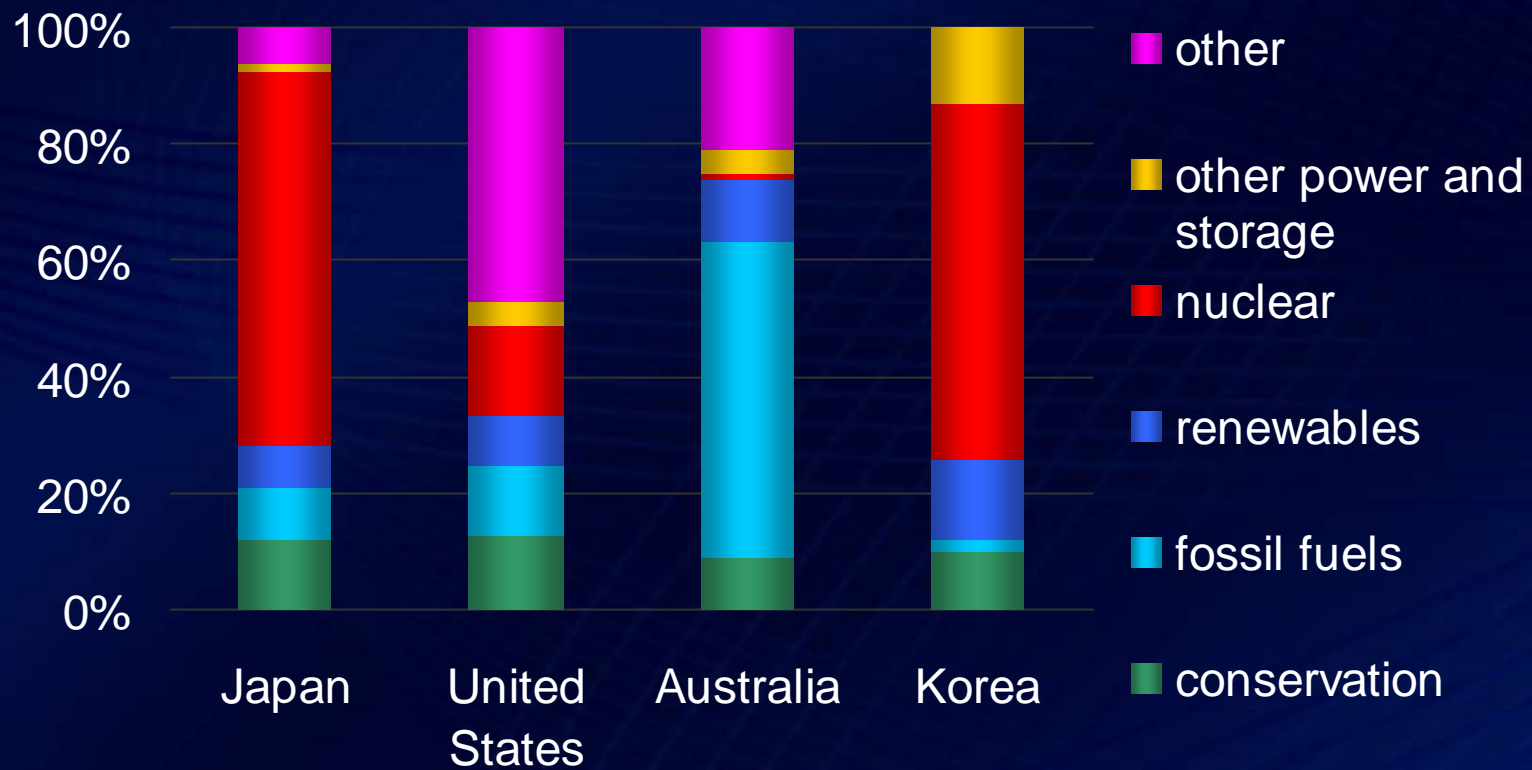
Government spending on energy R&D



Government spending on energy R&D



Composition of energy R&D



Unilateral Australian abatement 2030

	all sectors	TEEI's (including agriculture) shielded
Change in Australian emissions <i>relative to reference case</i>	- 12%	- 12%
Carbon price <i>2006 A\$/t CO₂-e</i>	\$15	\$31
Change in Australian GDP <i>relative to reference case</i>	- 0.7%	- 1.1%
Carbon leakage per unit of Australian abatement	12.8%	3.6%

Incorporating agriculture into an emissions trading scheme - challenges

- Measurement and monitoring
 - ▶▶ Uncertainties and high transaction costs
- Allocation of permits
 - ▶▶ Free allocation vs auctioning
- Trade exposed emission intensive industry
 - ▶▶ Negative trade implications may warrant special consideration

Incorporating agriculture into an emissions trading scheme - challenges

- Downstream allocation of reporting obligations
 - ▶▶ Lower transaction costs, increased coverage, reduced abatement incentives

- Offsets
 - ▶▶ Forestry offsets on agricultural land
 - ▶▶ Additionality and permanency requirements

Potential for agricultural land to switch to forestry in Australia

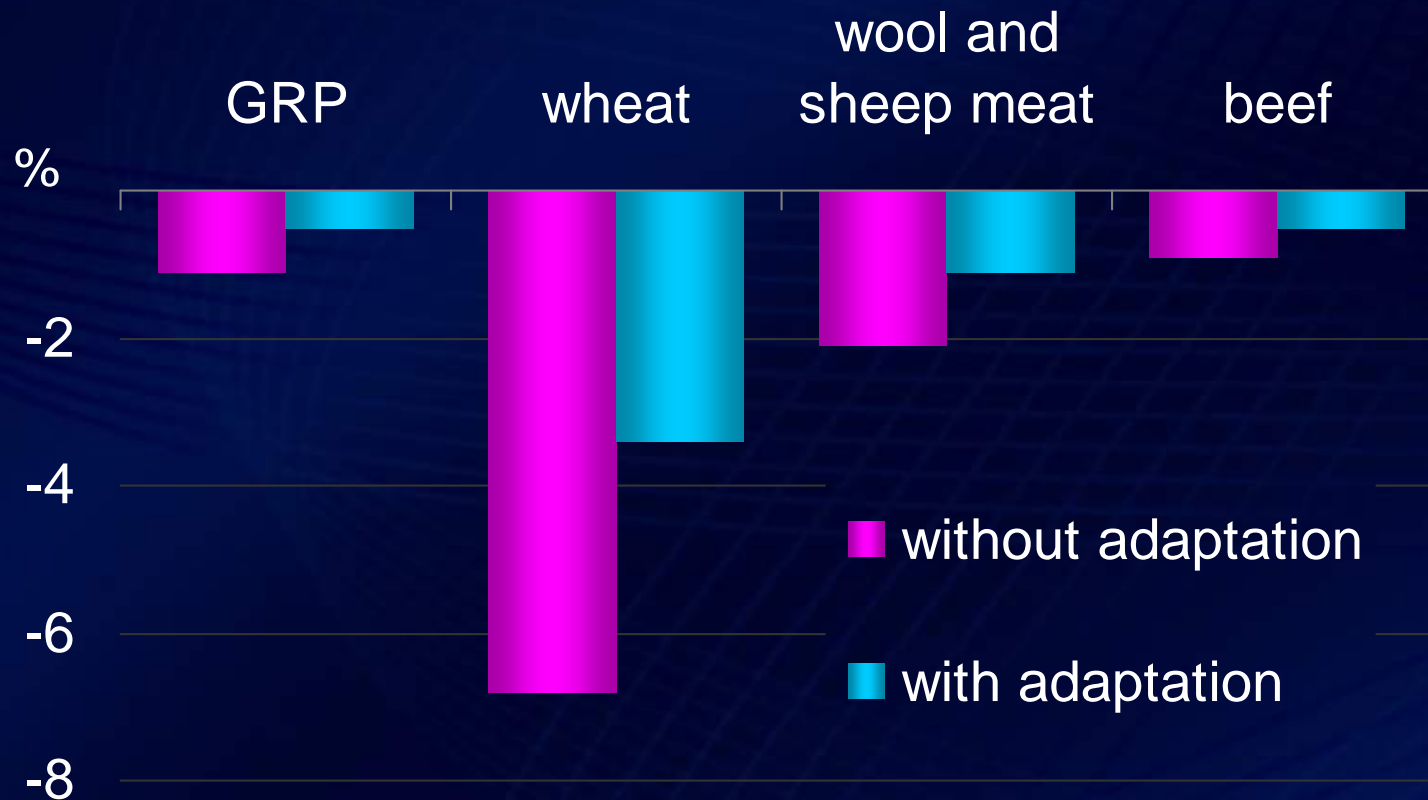
Carbon price	\$20/t CO ₂ -eq	\$30/t CO ₂ -eq	\$40/t CO ₂ -eq
Log Price	m ha	m ha	m ha
\$60/m ³	6	19	40
\$50/m ³	3	10	25

Assuming 50 per cent of log volume is sequestered indefinitely

Climate change, regional economic impacts and adaptation at 2030

NSW case study

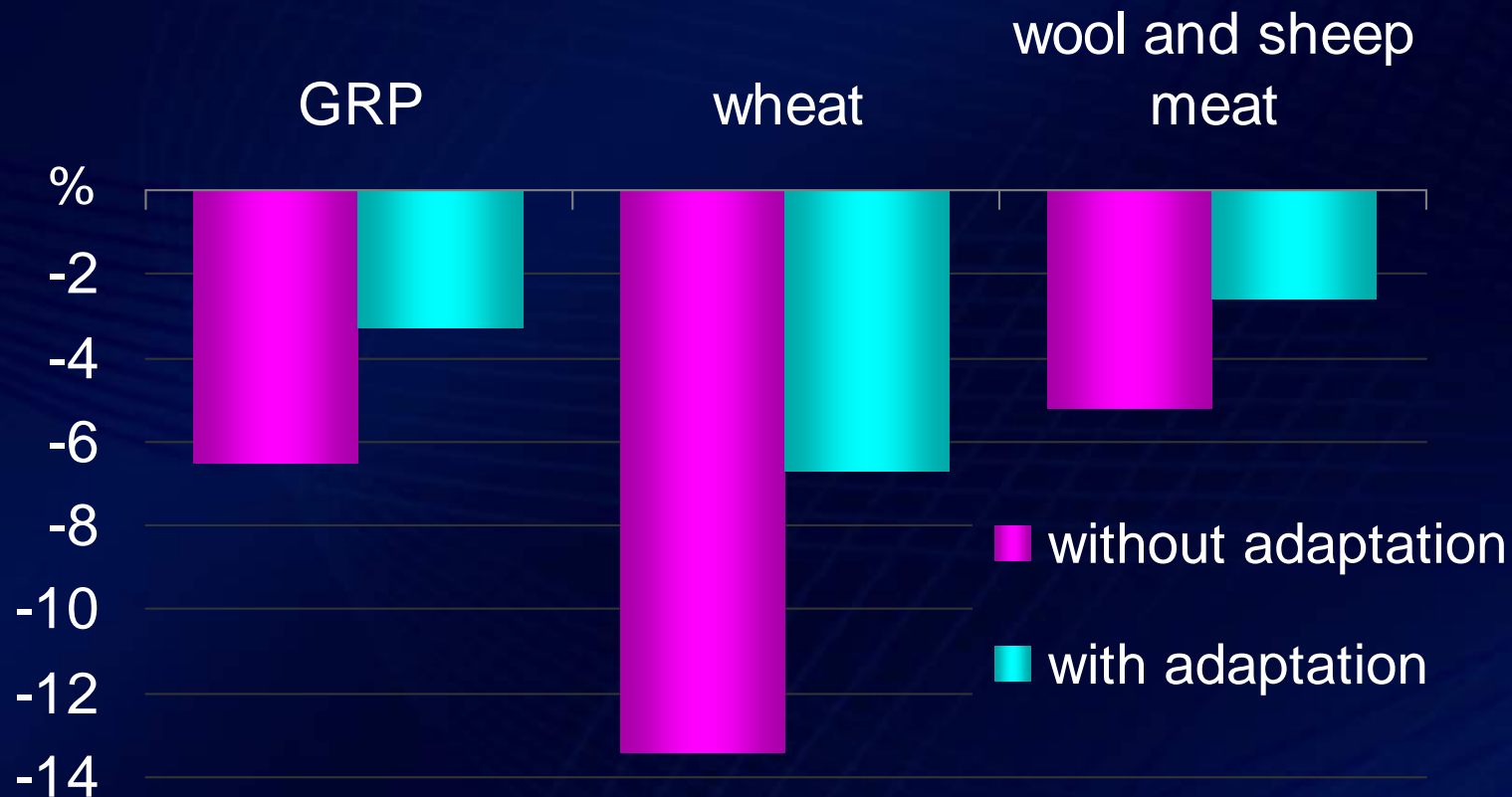
% change relative to reference case



Climate change, regional economic impacts and adaptation at 2030

Western Aust. case study

% change relative to reference case



GM technology and climate change

- Increased resistance to pests and disease
- Increased resistance to salinity, heat and frosts
- Enhanced drought tolerance
- Lower use of herbicide and pesticide sprays can reduce fossil fuel use
- Use of conservation tillage on herbicide tolerant plants

Source: ISAAA (2006); Lee (2007) Spangenberg (2007)

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