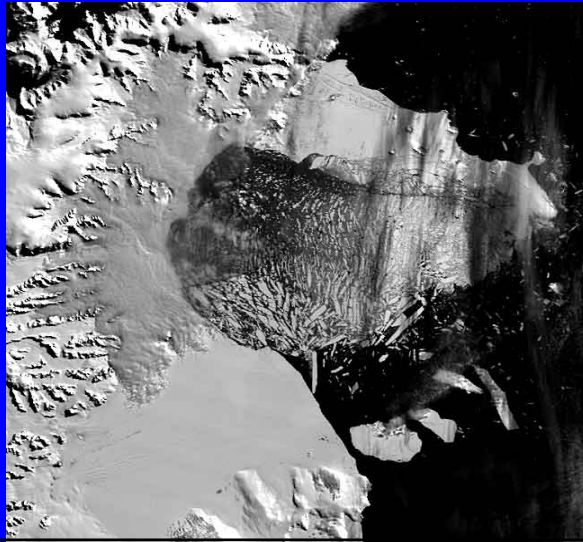


A Sustainable Energy Future for Australia

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Collapse of Larsen B ice shelf, Antarctica

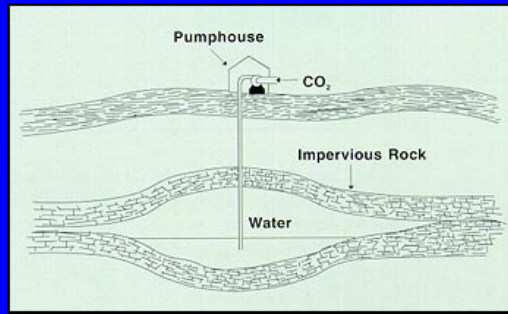


Australian Government finally Acknowledges
that there is a Problem



Federal Government's Main 'Solution': Coal Power with Capture & Storage of CO₂

- ☀ May not be commercially available for 20 years or more
- ☀ Risks of escape of buried gas
- ☀ Will cost more than wind power and bioenergy from crop residues



- Necessary and cheaper at NW Shelf gas fields

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'Clean Coal': Capture & Sequestration of CO₂

Still has:

- Air and water pollution
- Risks to coal miners
- Land degradation

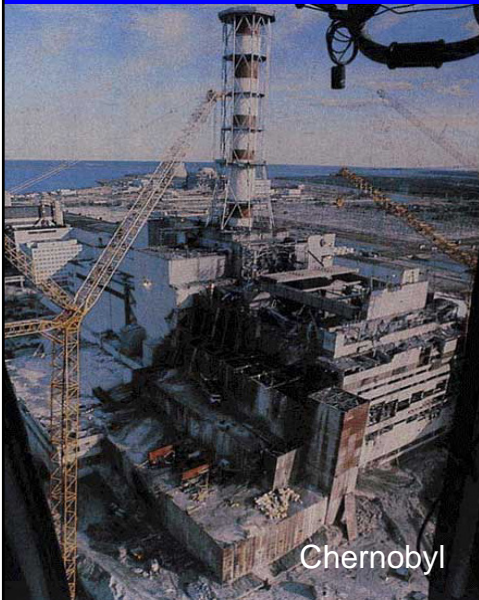


Debate Over Coal and CO₂

The Economist, 6-12 July 2002



Federal Govt's Back-up 'Solution': Nuclear Power



- ☀ Proliferation of nuclear weapons
- ☀ Superb terrorist target
- ☀ Rare but devastating accidents
- ☀ Managing high-level wastes
- ☀ Emits increasing amounts of CO₂ as uranium ore grade decreases
- ☀ More expensive than wind power
- ☀ Too slow to build

Energy Inputs & CO₂ Emissions

Van Leeuwen & Smith (2005) www.stormsmith.nl

High-grade U ore

Contains 0.1% or more of yellowcake

- ☀ Energy inputs generated in several yrs of operation (lifetime about 40 years)
- ☀ CO₂ emissions much less than gas-fired station's
- ☀ Reserves: several decades at current level of U use

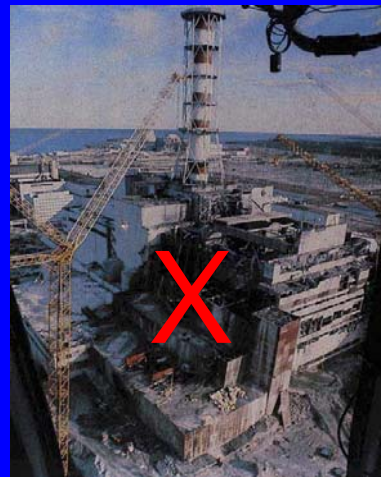
Low-grade U ore

Contains 0.01% or less of yellowcake

- ☀ Substantial energy inputs, mainly from mining & milling
- ☀ CO₂ emissions similar to gas-fired power station's
- ☀ Vast reserves of low- & very low-grade ore – impossible to use

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It's not a choice between coal and nuclear!



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Brief Q & A on Australian Government's 'Solutions'

Next: Energy/Greenhouse Scenarios

9

The Genuine Solution

Sustainable Energy Future for Australia
based energy efficiency, renewable energy &
natural gas (the cleanest fossil fuel) during the
transition

10



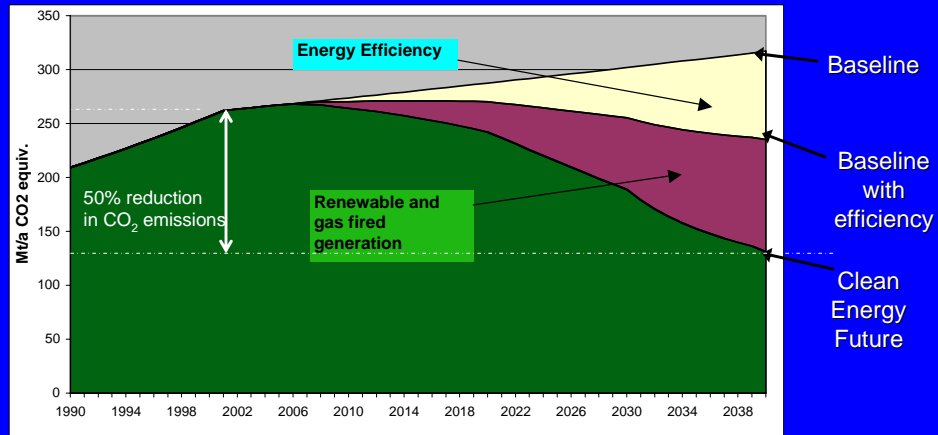
A Clean Energy Future for Australia (2004)

http://wwf.org.au/publications/clean_energy_future_report.pdf

Stationary energy	Electricity (grid-connected & remote); residential heat; industrial heat and engines
Long-term target	Reduction to 50% of 2001 CO ₂ emissions by 2040
Technologies	Small changes to existing technologies
Economic growth	Continuing

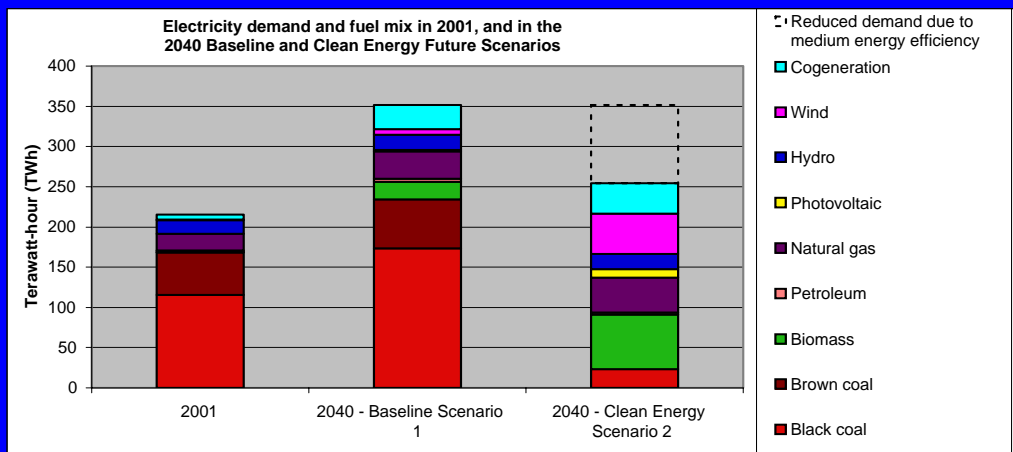
i.e. Big reduction without major technical breakthroughs!

CEF: Emissions from Electricity, Australia, 1990–2040



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CEF: Fuel Mix for Electricity in 2001, 2040 Baseline, & 2040 Scenario 2



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CEF: Electricity Generation: 2040 Cleaner Electricity Mix

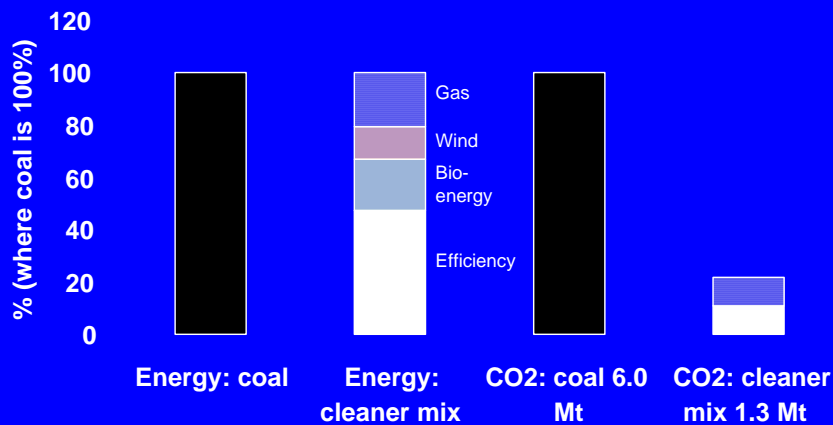
Efficient energy use to reduce demand. Then:

Natural gas:		30%
Bioenergy from crop residues & oil mallee:		28%
Wind power:		20%
Coal: (85% now)		9%
Hydro: (8% now)		7%
Solar electricity:		5%

Achieves 78% reduction in CO₂ emissions from electricity

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Replacing a 1000 MW Coal Power Station in NSW : Annual Energy & CO₂ Emissions



Cleaner mix achieves 79% reduction in CO₂ emissions compared with coal-fired power station.

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Direct Local Jobs per Unit of Electricity Generated

Source of electricity	Relative number of jobs in Australia
Coal electricity + coal mining	1
Wind power with 50% Australian content	2-3
Bio-electricity with 50% Australian content	Approx. 3.5 (mostly rural)

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Allen Consulting's Macroeconomic Model for Australian Business Roundtable on Climate Change

Conservative assumptions:

- ☀ 'Early action' 2013; 'late action' 2022
- ☀ No unilateral action by Australia
- ☀ Efficient energy use underestimated, as in almost all 'top-down' models

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Allen Consulting: Results

Scenario	Rate of GDP growth (%)	Projected GDP in 2050 (\$ x 10 ¹²)	Emissions reduction 2000–50 (%)
Base	2.2	2.12	60
'Early action'	2.1	2.00	60
'Delayed action'	1.9	1.84	60

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Stern Review

- ☀ Cost of business-as-usual will be huge: 5–20% of annual global GDP by 2050
- ☀ Costs equivalent to a world war or a major economic depression
- ☀ Costs of greenhouse response will be small: about 1% of annual global GDP by 2050

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Brief Q & A on Energy/Greenhouse Scenarios

Next: Sustainable Energy Technologies

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Energy Efficiency: Residential

- ☀ Solar efficient design in new buildings & retrofits
- ☀ Insulation of buildings
- ☀ Efficient lighting
- ☀ Efficient heating & cooling
- ☀ Efficient shower heads & taps



Christie Walk, Adelaide City

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Energy Supply

In CEF study, biomass supplies 28% electricity in 2040

- Fuels include wheat stubble, sugar cane residues & plantation forest residues.
- Residues & organic wastes cheapest & fastest, but resource limited.
- Price depends on distance that fuel is transported
- Generates baseload power



Burning sawmill & sugar cane residues at Rocky Point, Qld

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Energy Supply

In CEF study, wind generates 20% of electricity in 2040

- 20% of electricity achieved in Denmark, 25% by 2010
- Changes to transmission network are needed
- Large-scale dispersed wind + gas turbines can substitute for coal in grid = baseload



Albany wind farm, W.A.

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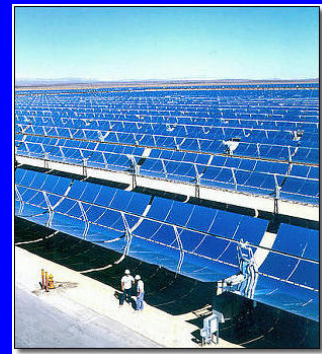
Large-Scale, Dispersed Wind is *not* 'Intermittent'

- ☀ Single wind turbines are intermittent (they switch on and off frequently in low winds)
- ☀ Multiple wind farms, located in different separated locations, are not intermittent. In general, their total output varies slowly.
- ☀ At windy sites, about 2700 MW of wind power can substitute for the electricity generation of a 1000 MW coal power station, which can be retired.
- ☀ The wind farms can be made as reliable as coal, by adding a little peakload plant, such as gas turbines.
- ☀ Since the peakload plant has low capital cost and is operated infrequently, it provides reliability insurance with a low premium.

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Additional Baseload Under Development

- Solar thermal electricity with thermal storage in water, rock bed or thermo-chemical system
- Hot dry rock geothermal power
- Will be ready before, and economically competitive with, before 'Generation 4' nuclear power stations



Gas as a Transitional Fuel

- ☀️ Combined cycle power stations: 30% of electricity in CEF in 2040
- ☀️ Cogeneration of electricity and heat, especially in industrial & commercial sectors
- ☀️ Back-up for solar hot water, solar space heating & solar thermal electricity
- ☀️ Back-up for wind power with peak-load gas turbines

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Brief Q & A on Sustainable Energy Technologies

Next: What we can do

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What we can do

- ☀ Individual / family actions?
- ☀ Social movement?
- ☀ We need both!

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Key Govt Policies Needed

- ☀ Ratify Kyoto Protocol & support stronger targets – **Federal**
- ☀ Mandatory Renewable Energy Target: increase target & extend time period – **Federal and/or States**
- ☀ Introduce general carbon pricing, either by carbon tax or emission permits with cap & trade – **Federal or States**
- ☀ R & D funding for bioenergy, solar electricity – **Federal**
- ☀ Fund urban public transport and intercity rail equally with roads - **Federal and States**
- ☀ Remove subsidies to production & use of fossil fuels – **mainly Federal**

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Additional Key State Govt Policies Needed

- ☀ Ban all new conventional coal-fired power stations
- ☀ Extend BASIX to existing residential & commercial buildings
- ☀ Foster solar for hot water, solar electricity & solar clothes drying
- ☀ Planning: ensure locations of major travel destinations are supplied by public transport, preferably rail
- ☀ Improve urban public transport, especially heavy & light rail, and integrate with urban planning
- ☀ Stop building major roads; limit parking places in urban centres & subcentres



Policy Areas for Local Govt

- ☀ Development planning: ensure locations of travel destinations are supplied by public transport, preferably rail
- ☀ Foster solar for hot water, electricity & clothes drying
- ☀ Join Cities for Climate Protection, and move rapidly from process to reduction of CO₂ emissions
- ☀ Cut emissions from local govt assets & operations, especially buildings, appliances, equipment & vehicles
- ☀ Expand local community education: workshops, libraries, information sheets, web pages
- ☀ Build bike & pedestrian paths
- ☀ Protect solar access



Brief Q & A on Policies and Strategies

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Conclusion

- ☀ Human-induced climate change appears to be accelerating
- ☀ 'Clean' coal may not be ready for 20 years or more
- ☀ Nuclear power is not a solution
- ☀ Efficient energy use, some types of renewable energy and gas (as a transitional fuel) are ready now
- ☀ Federal Government is delaying strong action (especially carbon pricing) until its preferred technologies are ready
- ☀ Individual action is necessary, but not sufficient.
- ☀ We need a social movement to generate the political will in governments and Oppositions (Federal & State).

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Further Reading

Report:

Saddler, Diesendorf & Denniss (2004) *A Clean Energy Future for Australia*

Book:

Diesendorf (2007, in press) *Greenhouse Solutions with Sustainable Energy*