A Sustainable Energy Future for Australia

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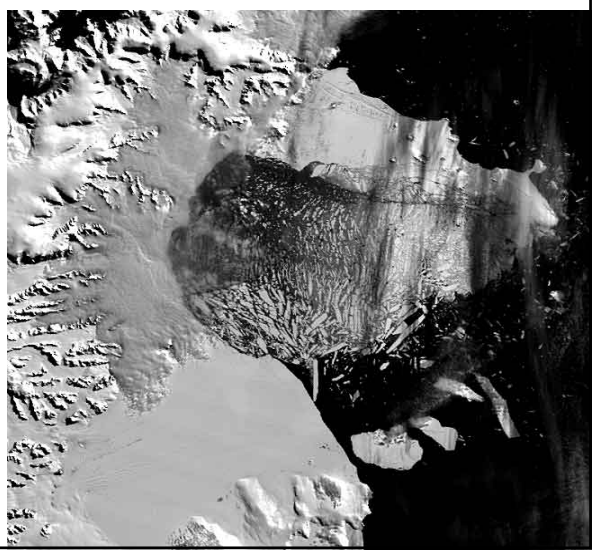
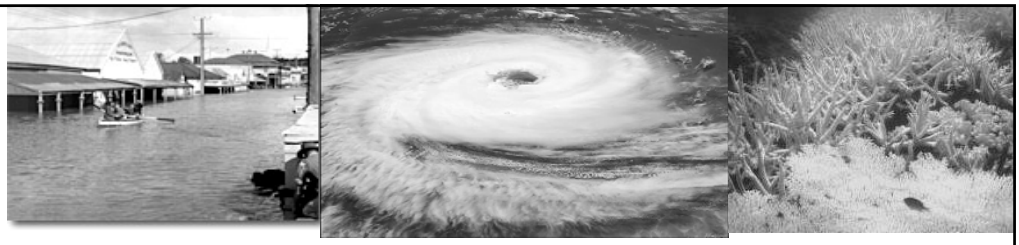


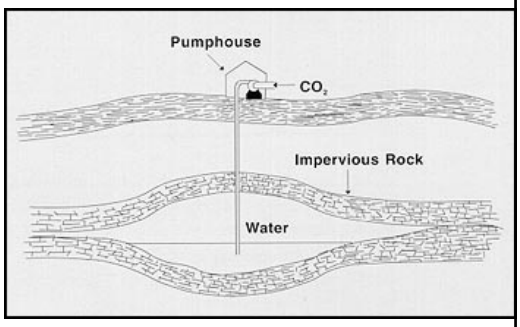
Collapse of Larsen B ice shelf, Antarctica



Australian Government finally Acknowledges that there is a Problem

Federal Government's Main 'Solution': Coal Power with Capture & Storage of CO_2

- 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 CO_2

Still has:

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

Debate Over Coal and CO_2

The Economist, 6-12 July 2002

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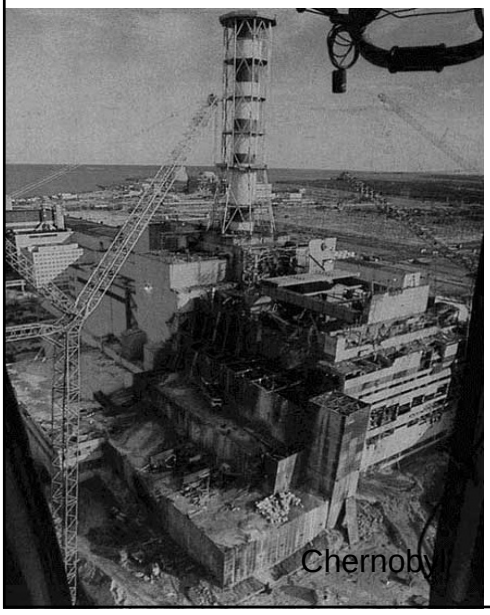
Federal Govt's Back-up 'Solution': Nuclear Power



Chernobyl

- Proliferation of nuclear weapons
- Superb terrorist target
- Rare but devastating accidents
- Managing high-level wastes
- Emits increasing amounts of CO_2 as uranium ore grade decreases
- More expensive than wind power
- Too slow to build

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Energy Inputs & CO_2 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)
- CO_2 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
- CO_2 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

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The Genuine Solution

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

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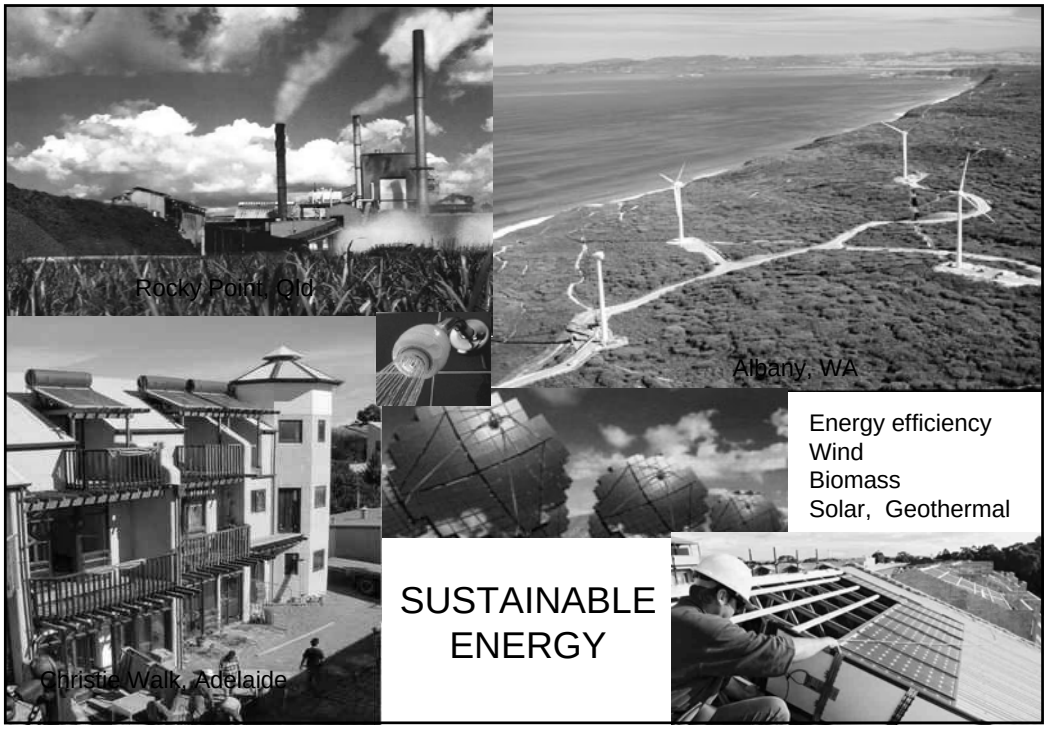

A Clean Energy Future for Australia (2004)

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!

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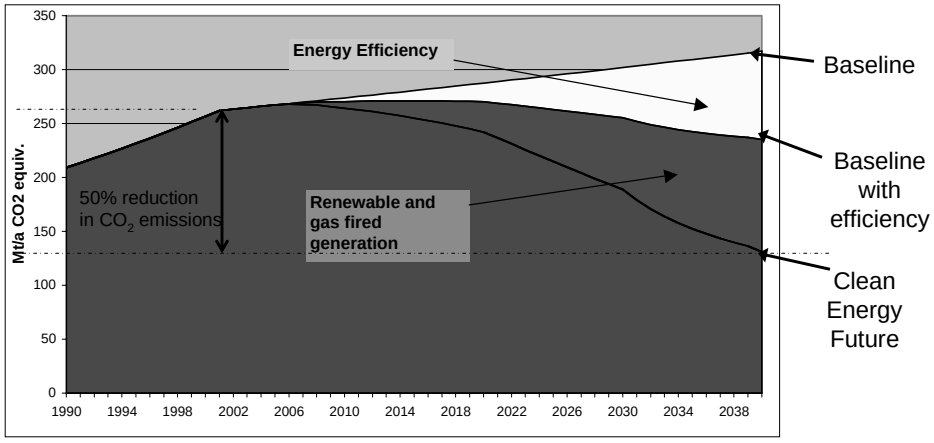
CEF: Emissions from Electricity, Australia, 1990–2040



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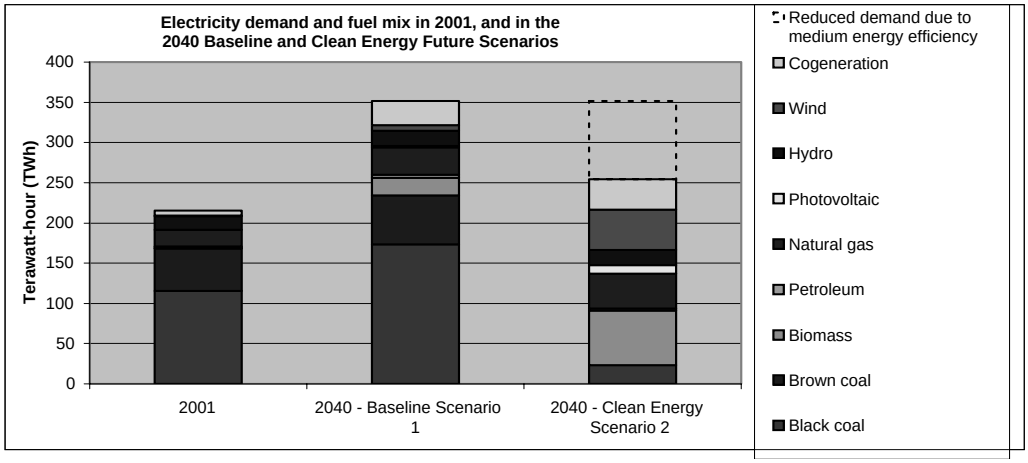
CEF: Fuel Mix for Electricity in 2001, 2040 Baseline, & 2040 Scenario 2



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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 CO_2 emissions from electricity

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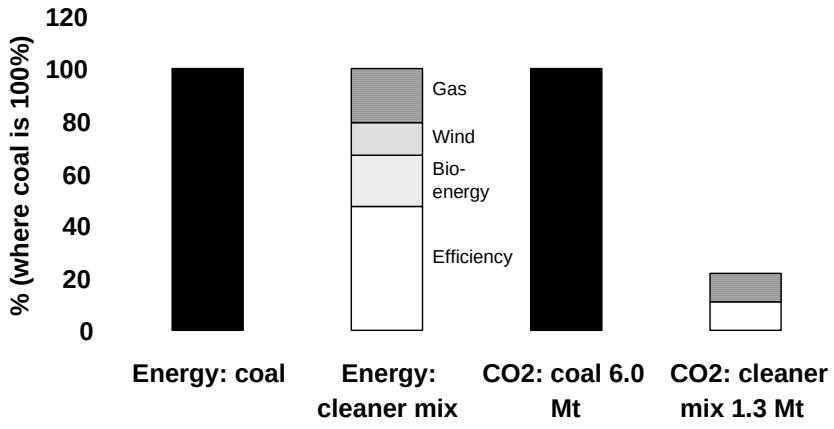
Replacing a 1000 MW Coal Power Station in NSW :
Annual Energy & CO_2 Emissions



Cleaner mix achieves 79% reduction in CO_2 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 in operated infrequently, it provides reliability insurance with a low premium.

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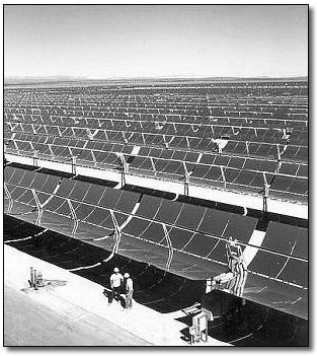
Additional Baseload Under Development

- 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 CO_2 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*

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