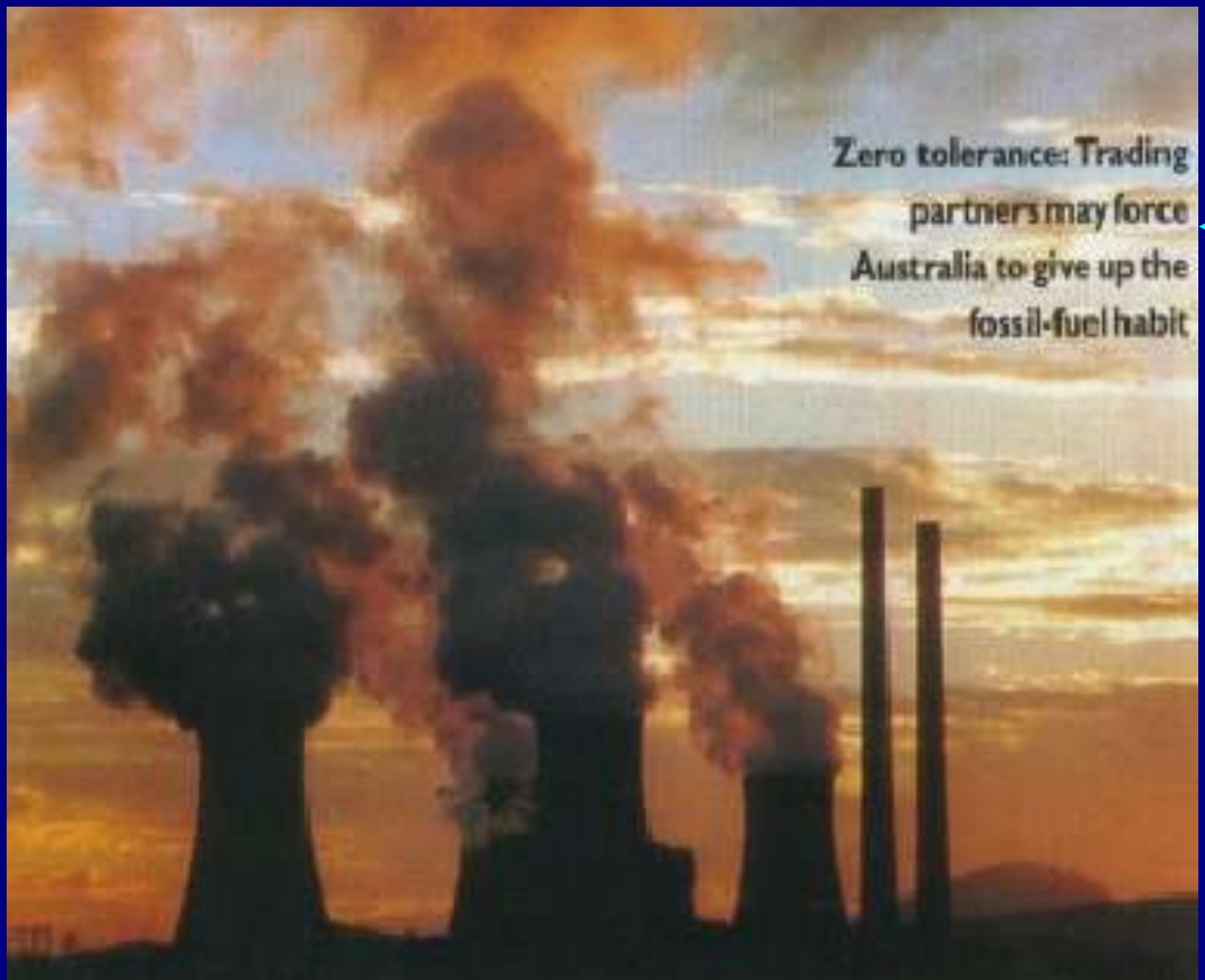
IS NUCLEAR POWER A GREENHOUSE SOLUTION?



My prediction
9 years ago! *

* Australia Urged To Consider N-Power – Business Review Weekly, *27 April 1998 p48*

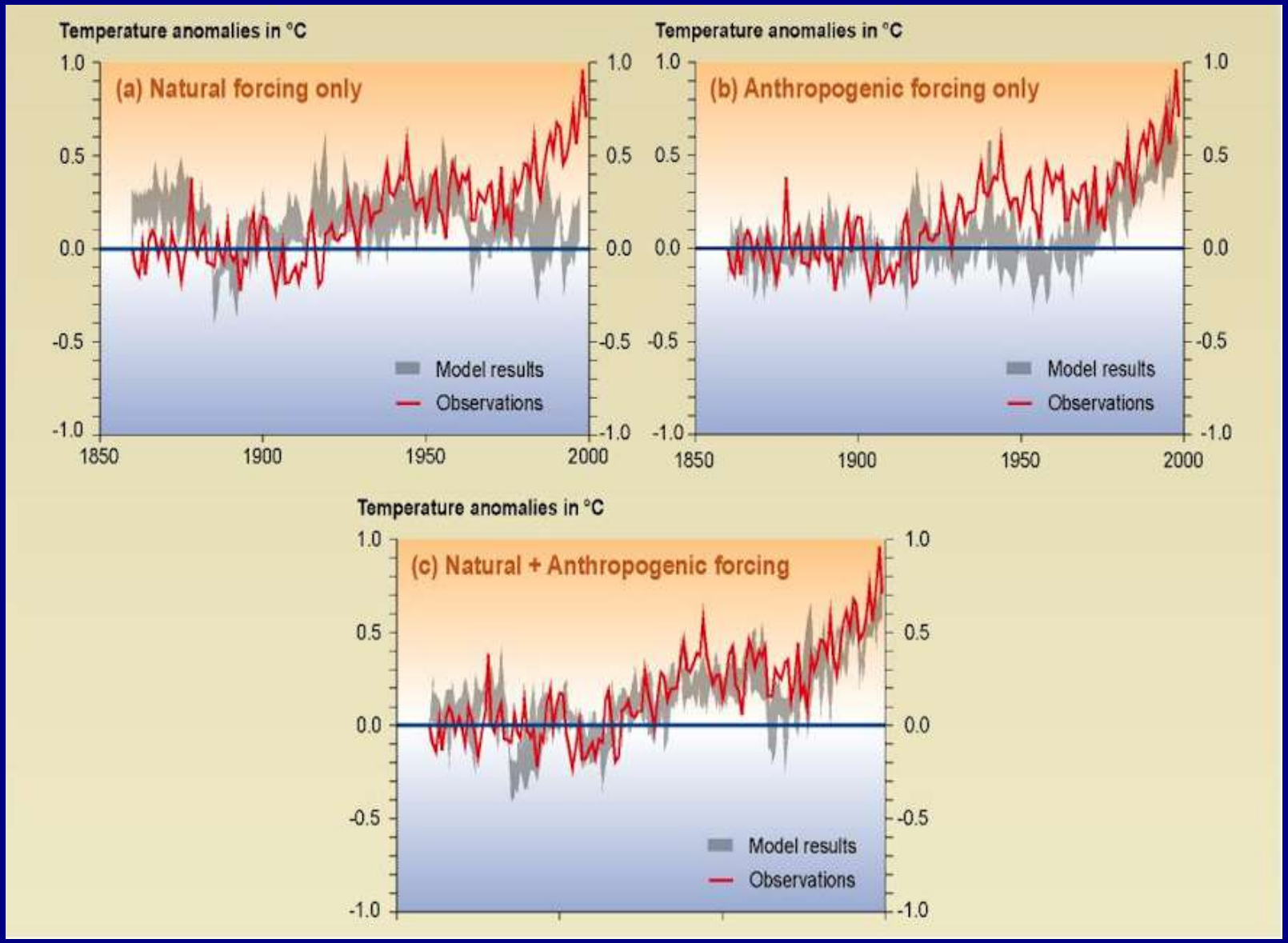
SO WHAT'S THE PROBLEM?

"The Era of Procrastination, of Half-Measures, of Soothing and Baffling Expedients, of Delays, is Coming to its Close.

In its Place We are Entering a Period of Consequences."

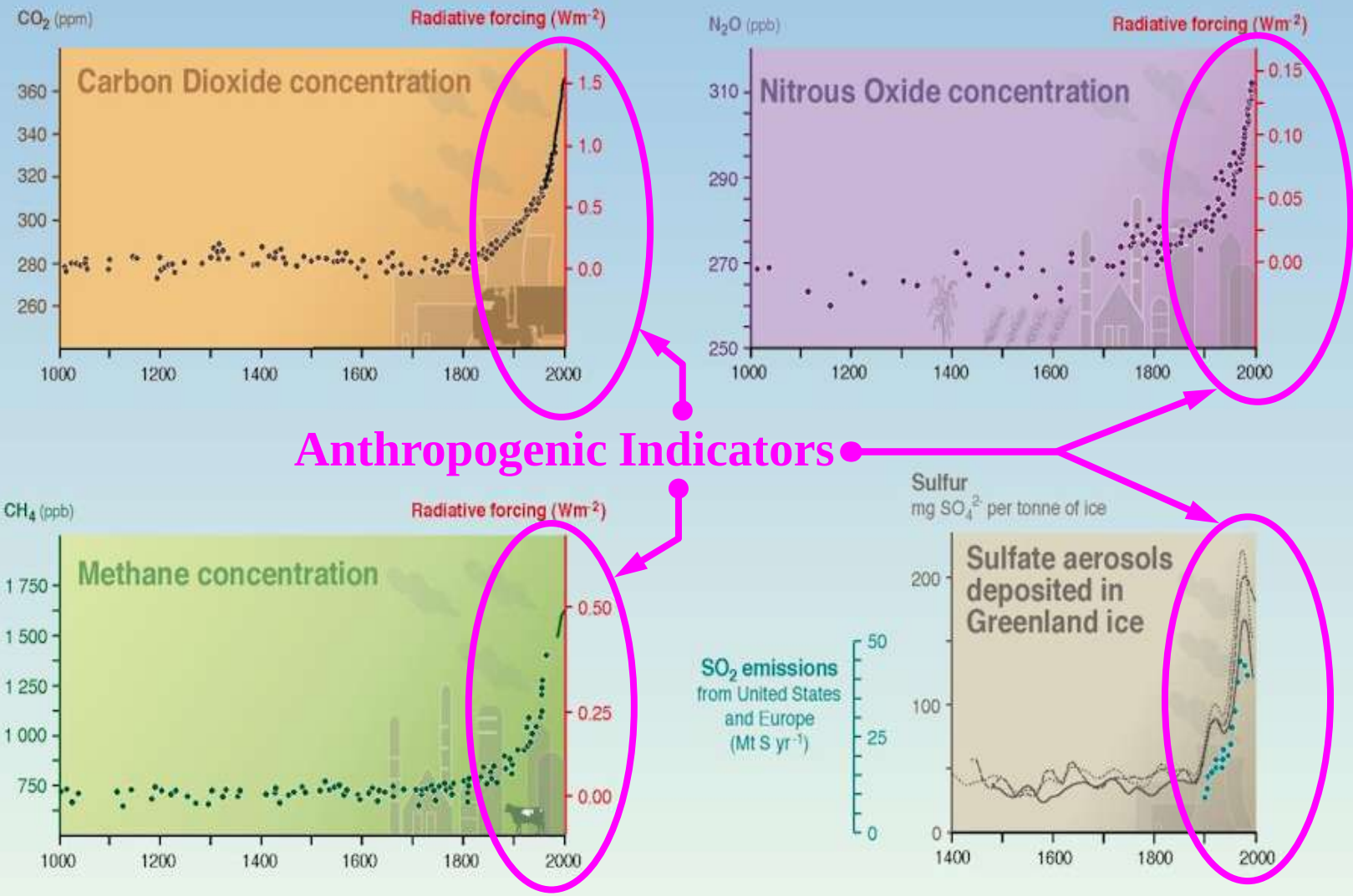
Sir Winston Churchill – November 12, 1936 : Al Gore – An Inconvenient Truth

OBSERVED & MODELLED SURFACE TEMPS 1850 – 2000



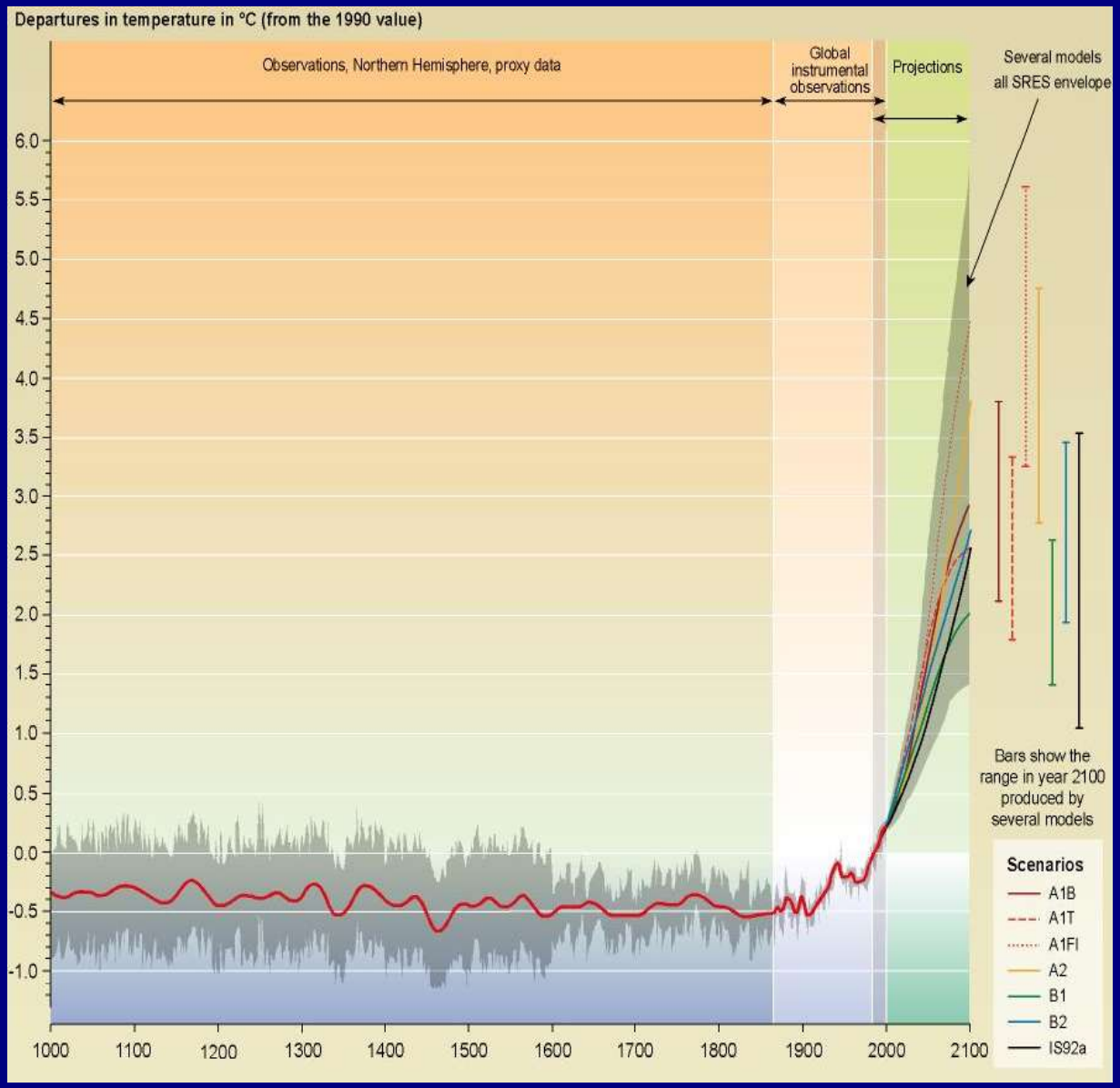
IPCC – International Panel for Climate Change

HUMAN INFLUENCE INDICATORS 1000 – 2000



IPCC – International Panel for Climate Change

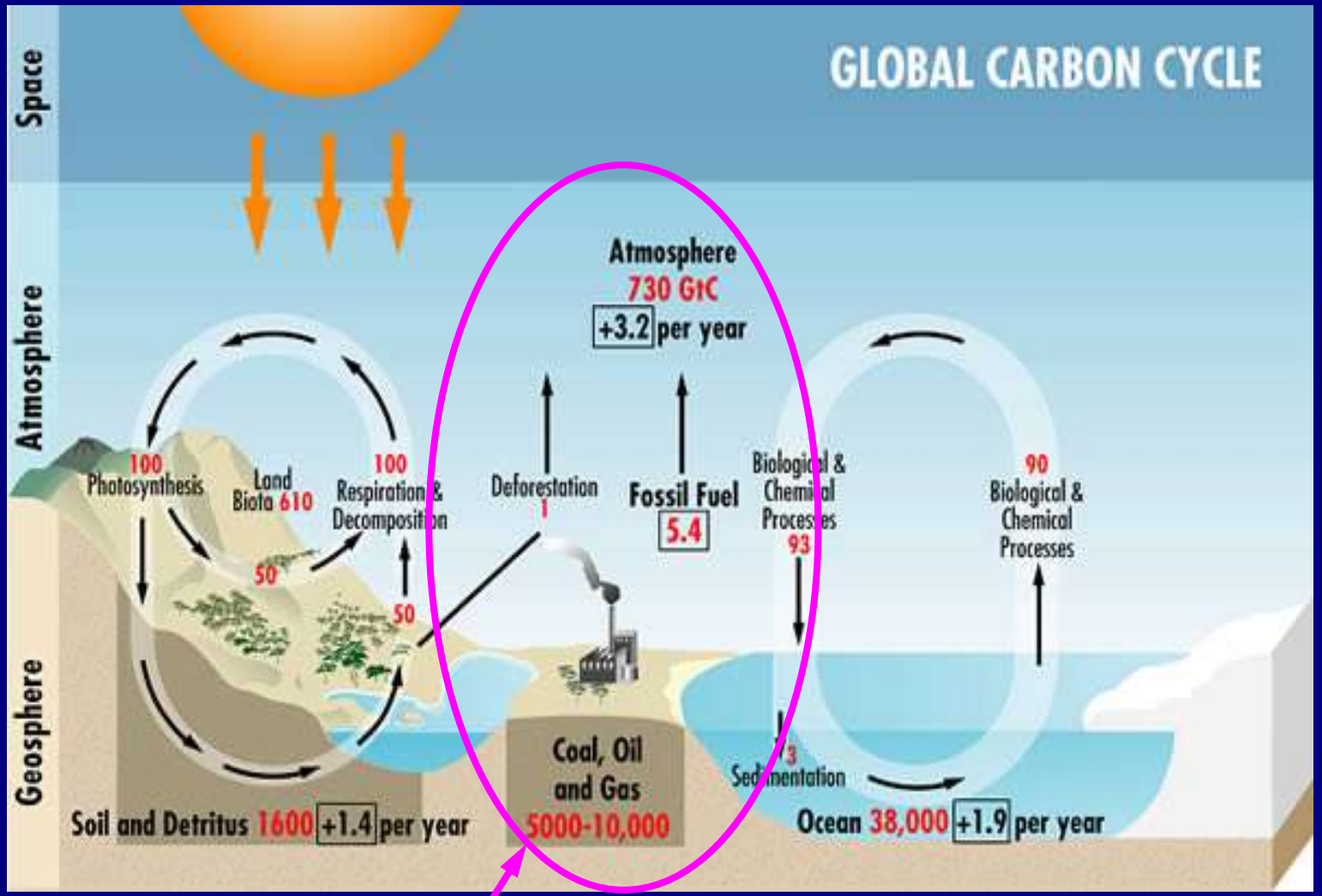
PREDICTED SURFACE TEMPERATURE RISE BY 2100



THE SCARY SCENARIO : 1.5 – 5.5 °C RISE BY 2100

IPCC – International Panel for Climate Change

GREENHOUSE AND CLIMATE CHANGE PROCESSES

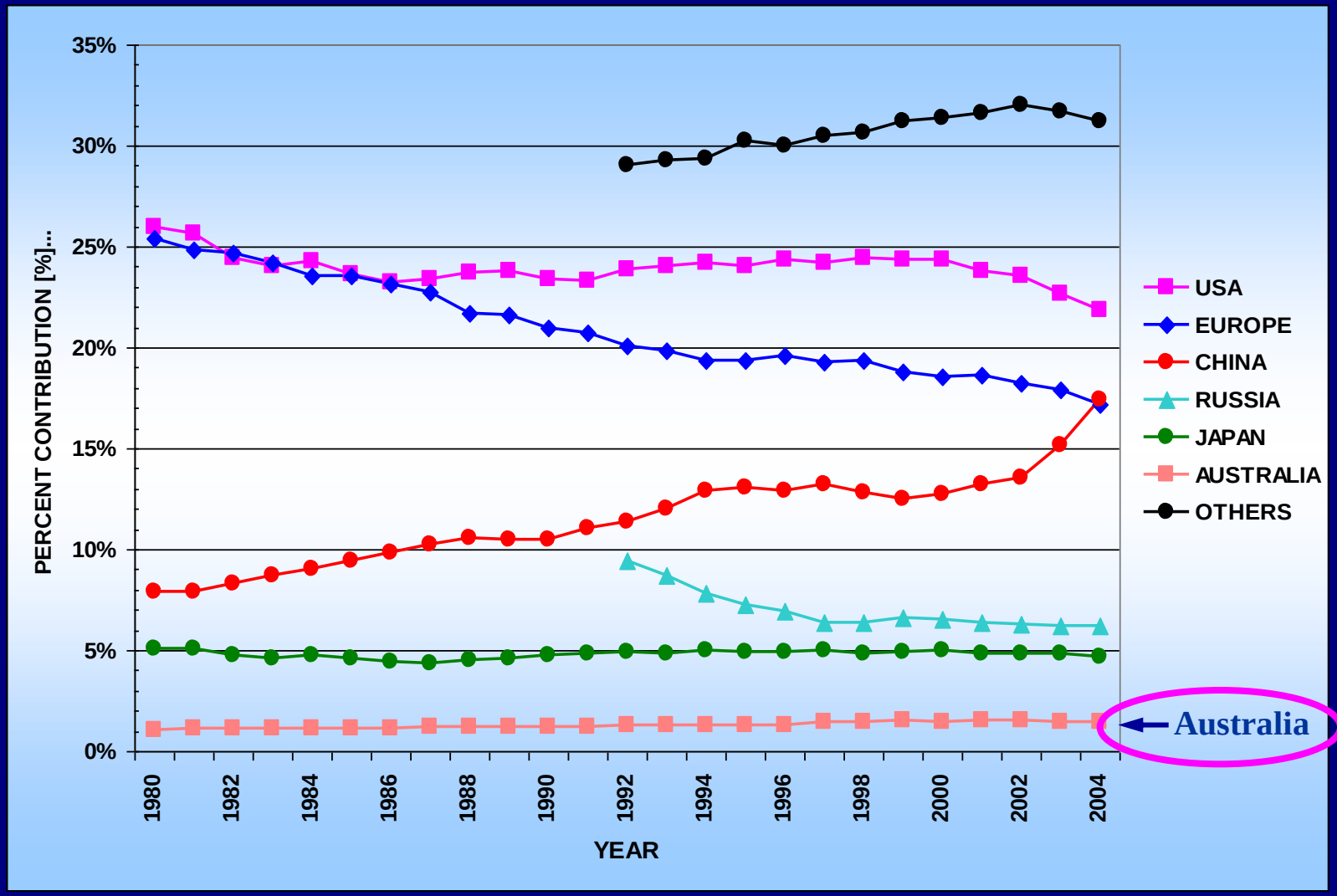


Source – Bureau of Meteorology : http://www.bom.gov.au/info/climate/change/gallery/index.shtml

Anthropogenic Contribution

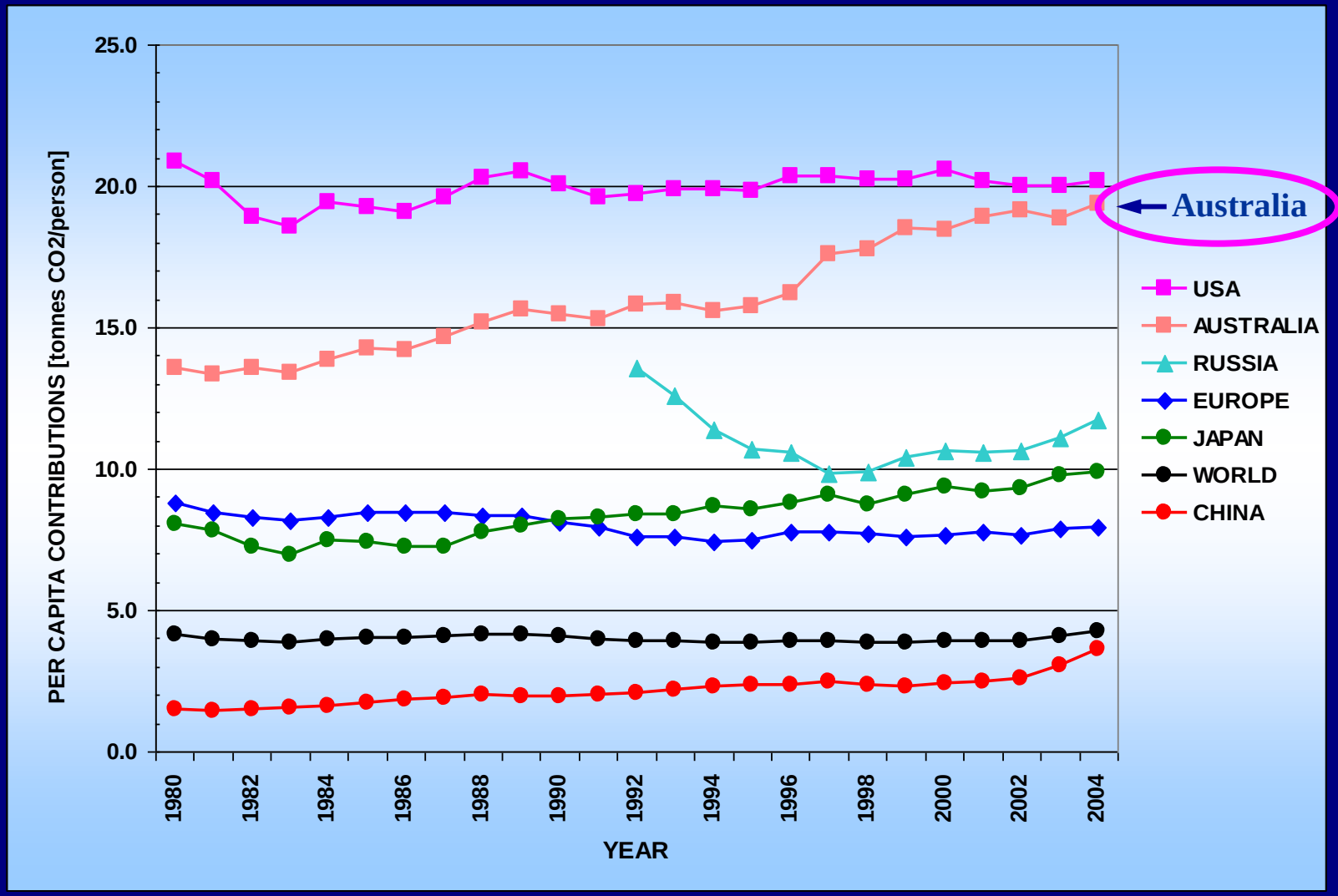
SO WHO ARE THE MAJOR EMITTORS OF GREENHOUSE GASES?

MAJOR GREENHOUSE GAS EMITTERS 1980 – 2004 [DEVELOPED COUNTRIES]



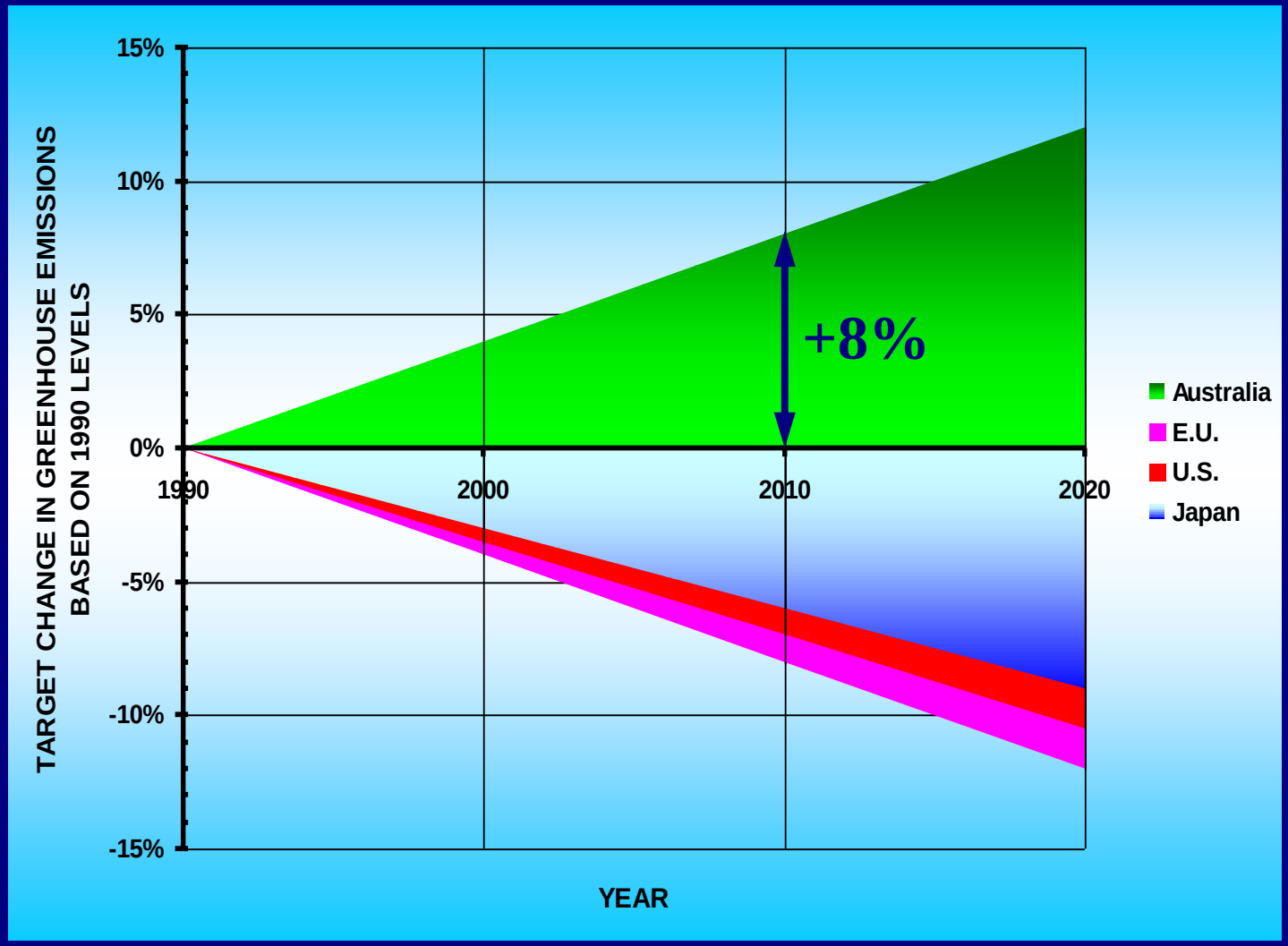
Source : IPCC

PER CAPITA GREENHOUSE GAS EMITTERS 1980 – 2004 [DEVELOPED COUNTRIES]



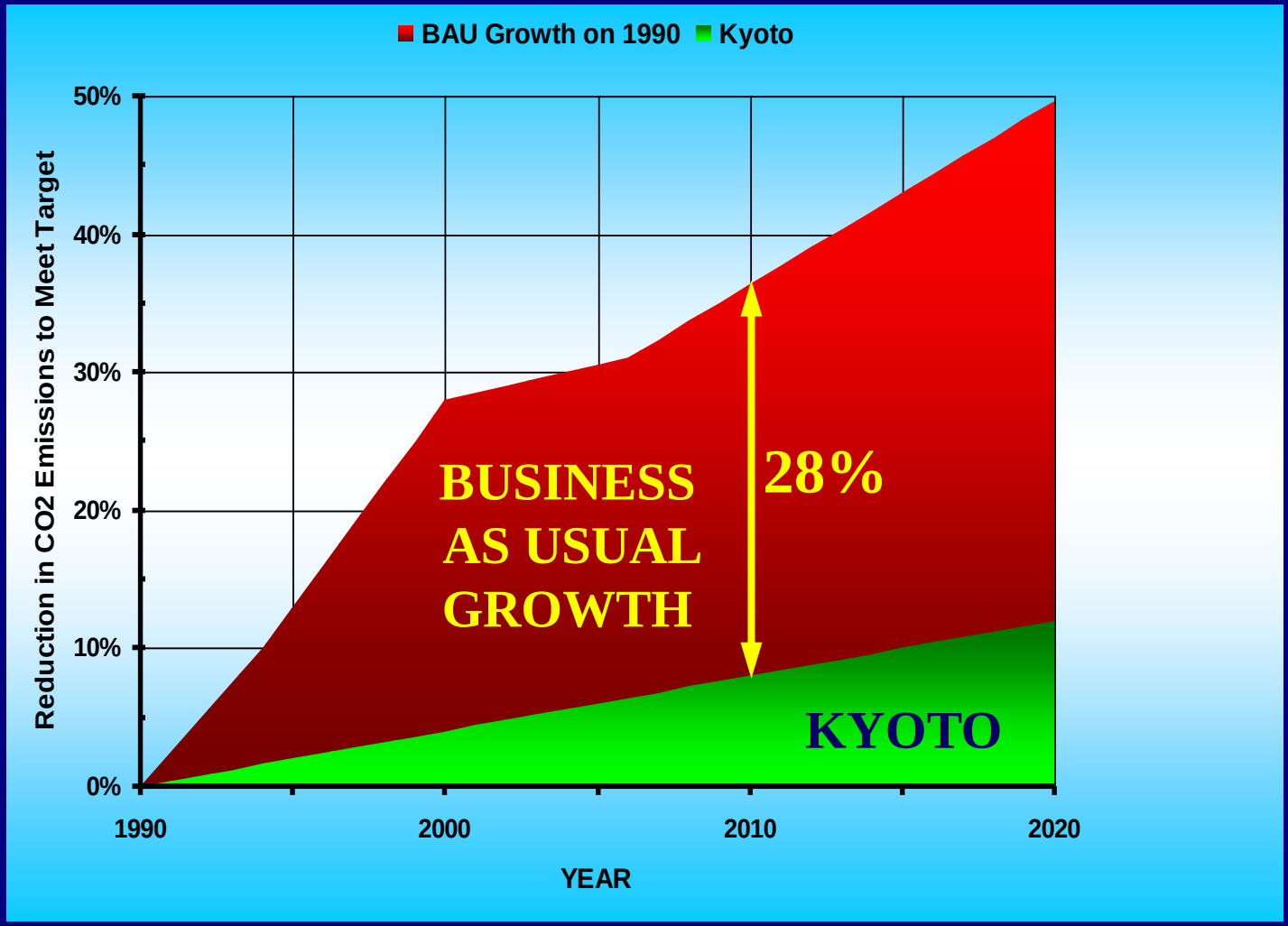
Source : IPCC

KYOTO ACCORD 1997 – GREENHOUSE EMISSION TARGETS FOR 2010 – 2012



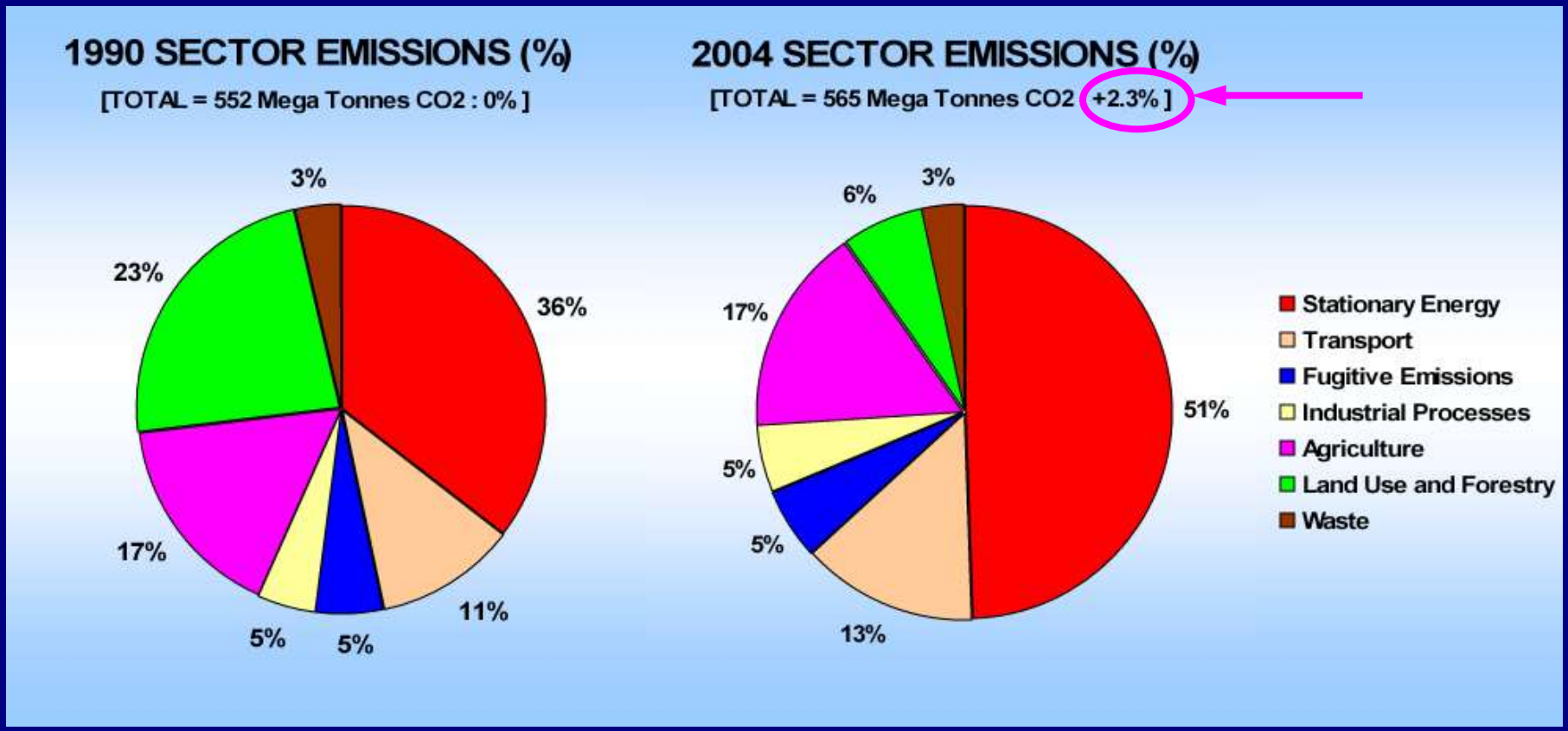
NOTE: AUSTRALIA IS NOT A SIGNATORY OF THE KYOTO ACCORD.

WE HAVE A PROJECTED 28% GREENHOUSE EMISSION REDUCTION TO ACHIEVE BY 2010 – 2012



NOTE: AUSTRALIA IS NOT A SIGNATORY OF THE KYOTO ACCORD.

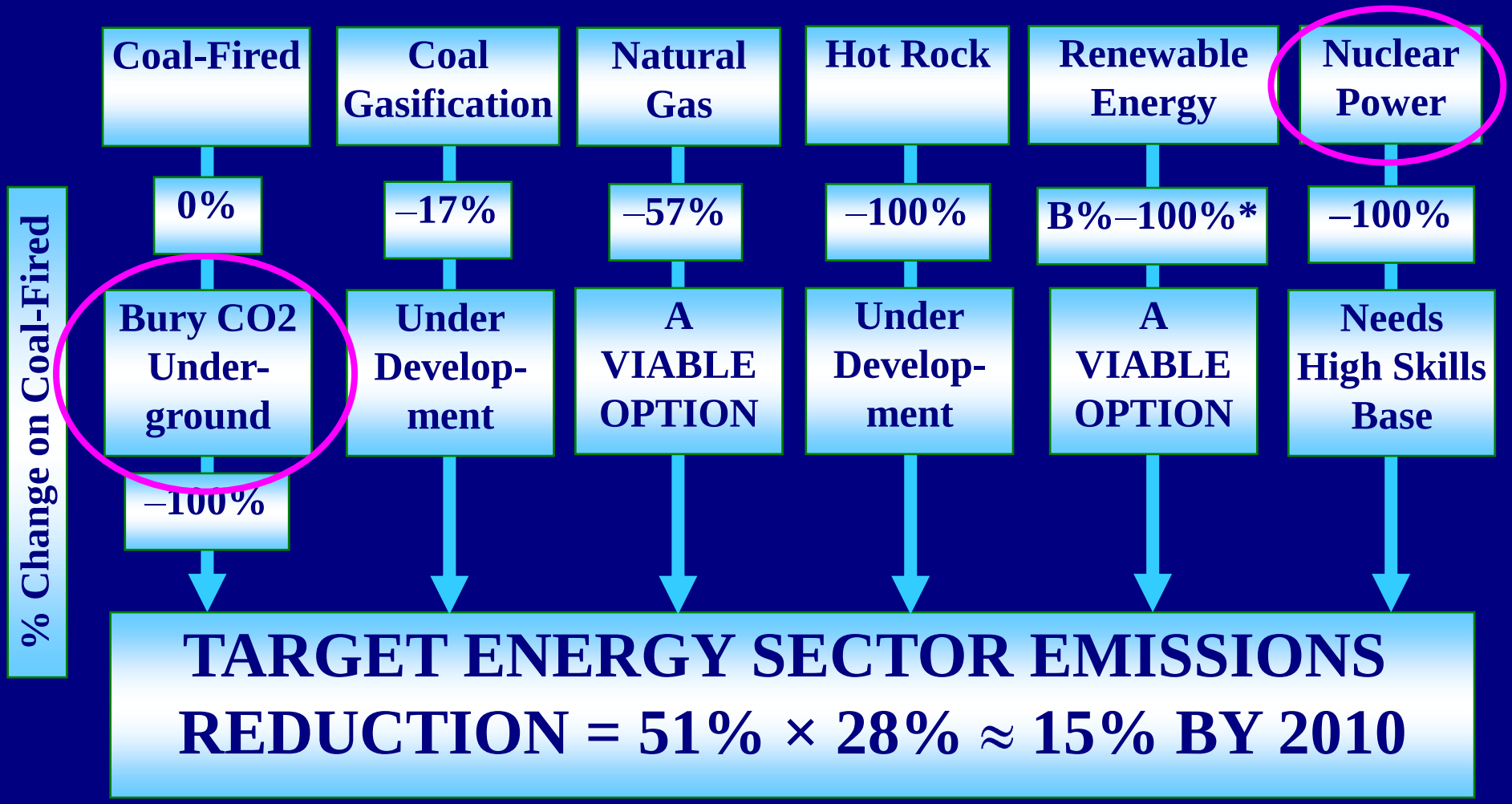
SECTOR GREENHOUSE EMISSIONS 1990 & 2004



- ENERGY SECTOR EMISSIONS HAVE *INCREASED* BY 15% FROM 1990 TO 2004
- REDUCED LAND USE/FORESTRY CLEARING HAS *DECREASED* EMISSIONS BY 17% FROM 1990 TO 2004

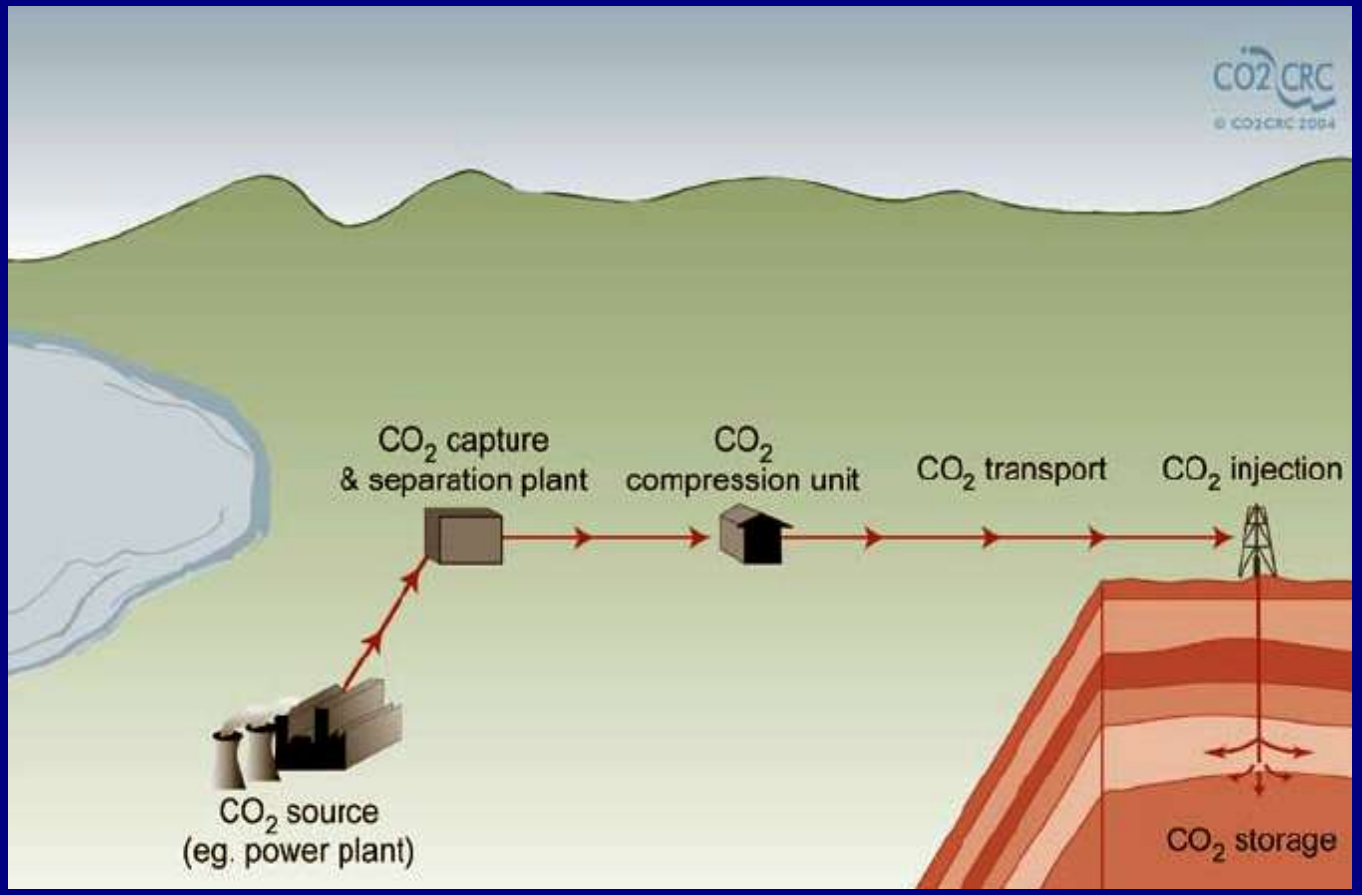
SO WHAT ARE OUR ‘SUSTAINABLE’ ENERGY OPTIONS?

OZ ELECTRICITY GENERATION OPTIONS



- Renewable Energy backup generation [B%] will determine the reduction achieved.

GEOSEQUESTRATION – STORING CO2 UNDERGROUND



"**sequester:** seclude, isolate, set apart … bind so that it cannot react … commit for safe keeping" (*Oxford Dictionary*).

Critics – An unproven "**immature technology**", long-term storage viability suspect … **little benefit if not retrofitted to existing power stations.**

THE NUCLEAR POWER OPTION REVISITED 35 YEARS ON.

OZ NUCLEAR POWER – A SOBERING HISTORY LESSON

1953	Atomic Energy Act enacted – Atomic Energy Commission (AAEC) established.
1958	HIFAR commissioned – work on small Gas-Cooled reactors (ABORIGINE).
1963	Policy change to Water Cooled Nuclear Reactors – AAEC staff seconded overseas and nuclear experts actively recruited from overseas.
1969	PM Gorton announces Jervis Bay Nuclear Reactor (JBNR) Project.
1971	Gorton replaced as PM by McMahon – JBNR Project deferred then cancelled (1972).
1981	PM Fraser shuts down AAEC Nuclear Power & Energy Program – Staff transferred to CSIRO or retrenched. LOSS OF NUCLEAR EXPERTISE!!
1984	PM Hawke shuts down AAEC Centrifuge Enrichment Program. MORE NUCLEAR EXPERTISE LOST!!
1987	Atomic Energy Act repealed, replaced by the ANSTO Act majoring on radio-isotope research for industrial and medical applications.

- OUR NUCLEAR POWER EXPERTISE BUILT UP OVER 30 YEARS AS A NATIONAL RESOURCE AT SOME CONSIDERABLE COST, WAS LOST!
- CAN WE TRUST OUR (LIBERAL & LABOUR) POLITICIANS A SECOND TIME AROUND 35 YEARS LATER??

THE ZIGGY SWITKOWSKI REPORT* – KEY FINDINGS

1	Expand our Uranium mining/export – current skills shortages, Government policies and legal prohibitions across States need addressing → uniform standards.
2	Future uranium conversion/enrichment/fuel fabrication → add $1.8 billion annually if uranium processed domestically – Regulatory impediments & high tech ENTRY barriers.
3	Nuclear power electricity generation is between 20–50% more costly than electricity generated by new coal-fired plant at current fossil fuel prices.
4	Nuclear electricity is unlikely to be delivered to the grid inside 10–15 years, with 15 years more likely – Single national nuclear regulator with skilled staff is required.
5	Deployment of nuclear power starting in 2020 could see 25 nuclear reactors producing about a third (33%) of the nation's electricity by 2050.
6	Since Three Mile Island (1979) & Chernobyl (1986) accidents, the new reactor designs are safer, more efficient, produce less waste, and have standardised operating procedures.
7	Investment in nuclear power plants would ease Australia's greenhouse gas emissions by between 8–17 % in 2050.
8	High-level waste disposal in deep (500–1200 m) underground repositories is a viable solution – we have suitable stable repository areas, but these are not needed until 2050.
9	Our nuclear power industry would not change the terrorist risks; nor would our energy grid become more vulnerable to terrorist attack.

* Uranium Mining, Processing and Nuclear Energy Review – Department of Prime Minister and Cabinet

THE ‘ZIGGY’ NUCLEAR SCENARIO – 25 NUCLEAR POWER PLANTS LIKE THIS ONE ON OUR SHORELINE?

Diablo Canyon Nuclear Plant – California, USA

NUCLEAR POWER – KEY PUBLIC CONCERNS

- NUCLEAR POWER PLANT SAFETY
- NUCLEAR POWER COSTS
- NUCLEAR SKILLS & EXPERTISE NEEDED

OTHER

- NUCLEAR REGULATORY INFRASTRUCTURE NEEDED
- CONSTRUCTION – ENGINEERING & TECHNOLOGY SKILLS & EXPERTISE.
- OPERATION – SAFETY & PUBLIC HEALTH MONITORING
- RADIOACTIVE WASTE MANAGEMENT – SYNROC?
- NUCLEAR PLANT DECOMMISSIONING & DISPOSAL
- NUCLEAR PROLIFERATION & TERRORISM

SAFETY – NUCLEAR POWER INTERNATIONALLY

- Currently 441 Nuclear Reactors operating worldwide [PWRs 61%];
- Nuclear Power generates 381GWe, equivalent to about 17% of the world's electricity;
- Nuclear Power has a high safety record compared with other energy industries:

  Accidents [1969 –2000] – Nuclear 1 (Chernobyl); Coal 1,221 (China 1,044); Hydro 11; Natural Gas 125; LPG 105.

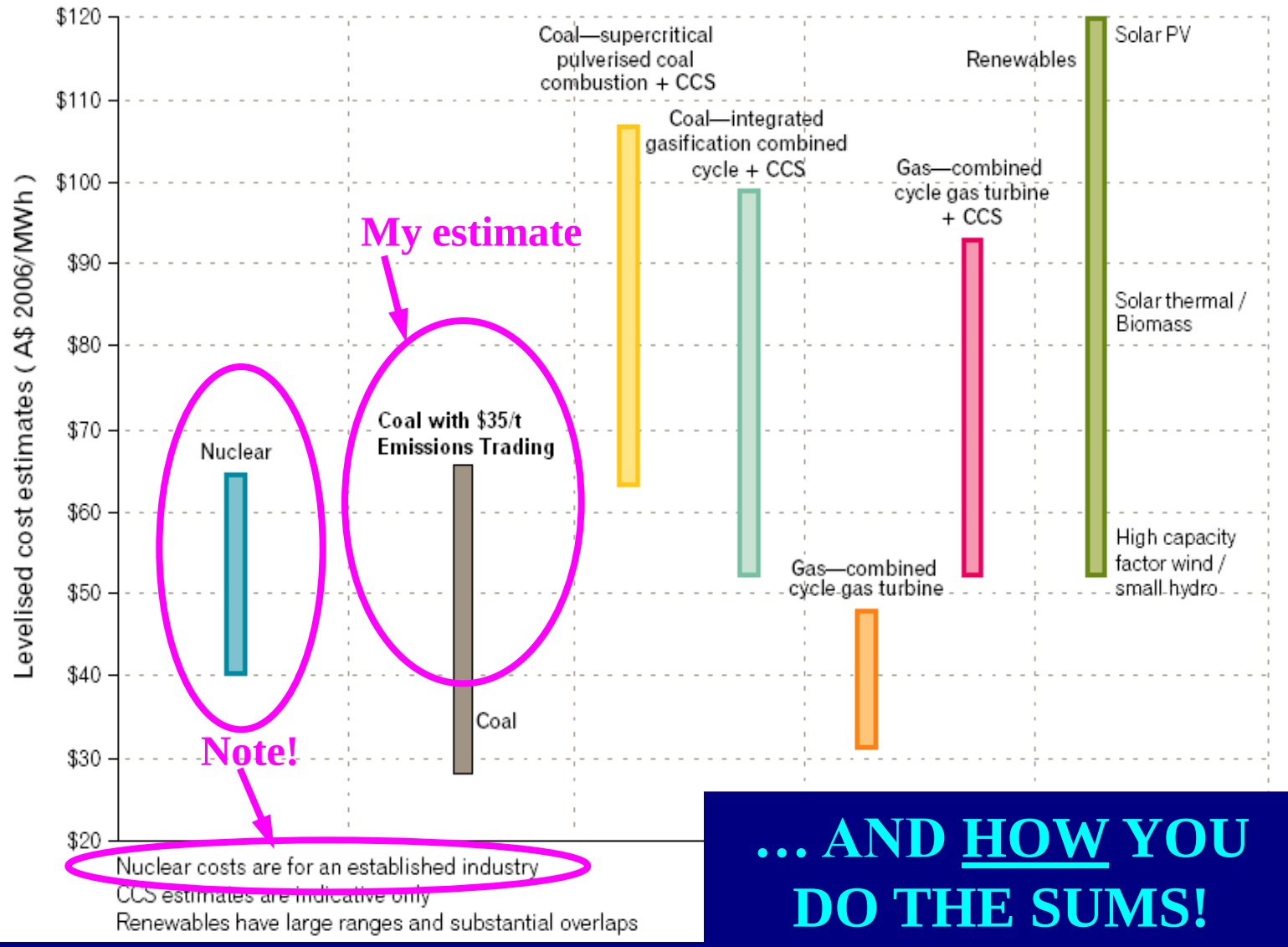
  Fatalities – 47 workers + 9 children (Chernobyl)* compared with Coal 25,107 (China 7,090), Hydro 29,938 & Natural Gas 1,978.

  Nuclear Incidents (since 2000) – 5, no deaths or injury [2 workers received a small radiation dose].

Sources: Uranium Mining, Processing and Nuclear Energy Review – Department of Prime Minister and Cabinet
* Wikipedia – Nuclear Fatalities

THE NUCLEAR OPTION – IT'S ALL ABOUT COST …

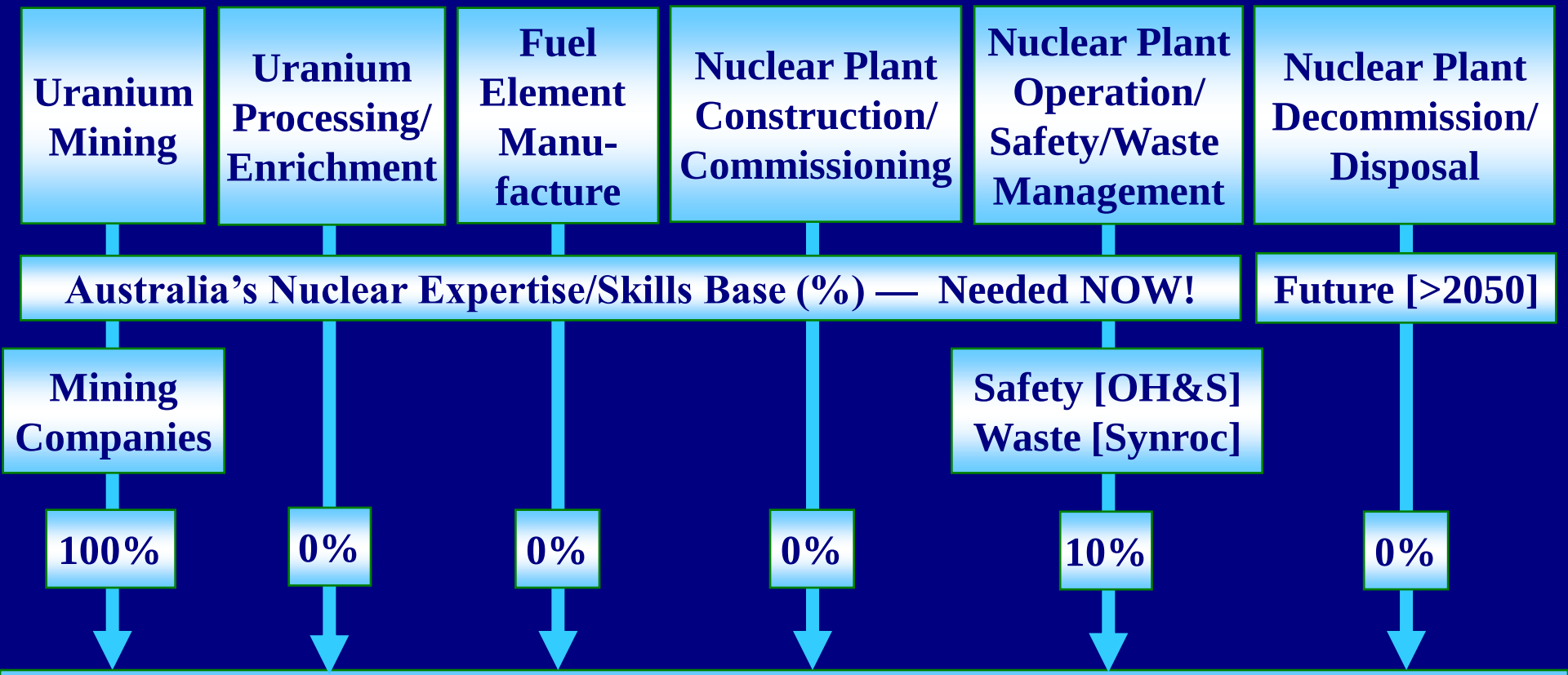
Figure 4.7 Levelised cost ranges for various technologies



… AND HOW YOU DO THE SUMS!

Ziggy Switkowski Report – Nov 2006

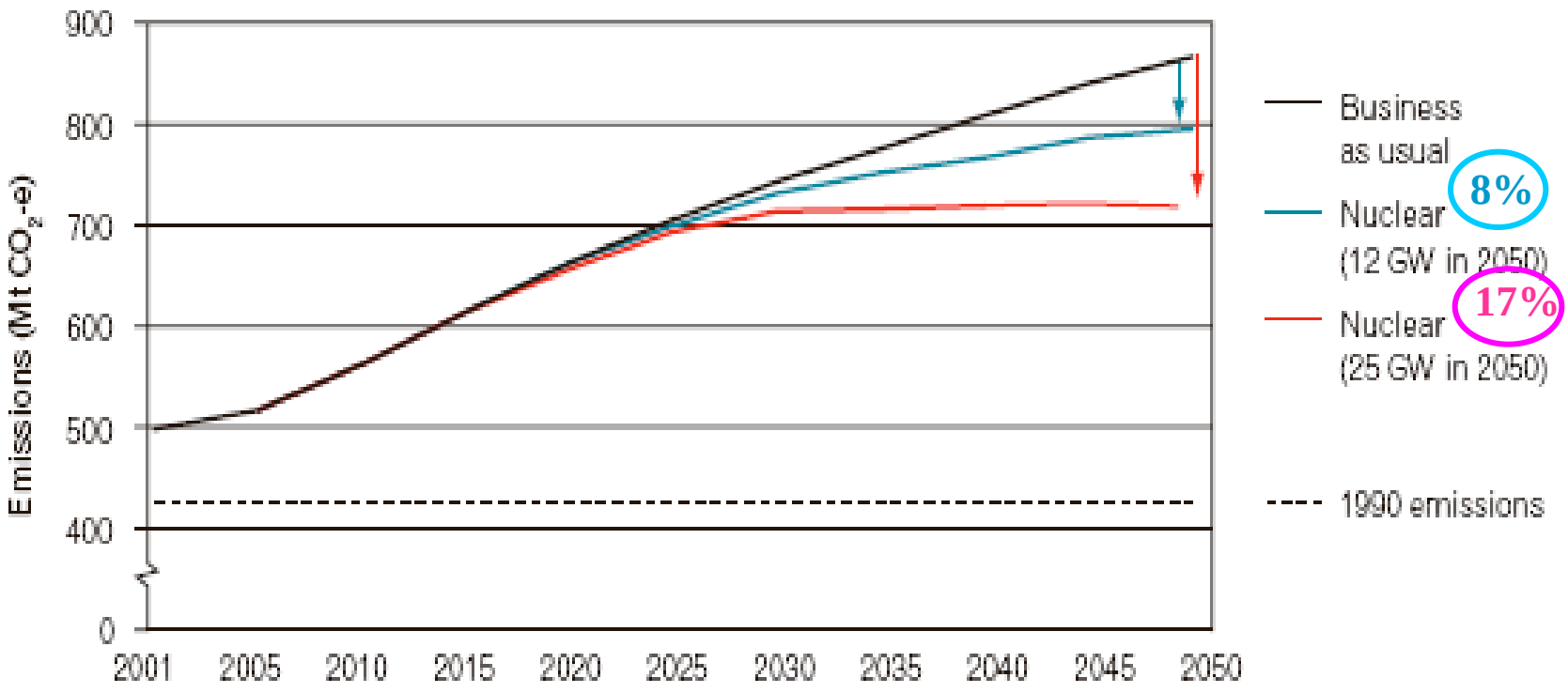
THE NUCLEAR FUEL CYCLE IS *VERY COMPLEX* – OUR NUCLEAR EXPERTISE/SKILLS AUDIT



TARGET : 20–25 NUCLEAR POWER STATIONS BY 2050
[12.5 GWe (~33%) → 8–17% Emissions Reduction]

SO… IS NUCLEAR POWER A GREENHOUSE SOLUTION FOR AUSTRALIA? [ZIGGY'S VIEW]

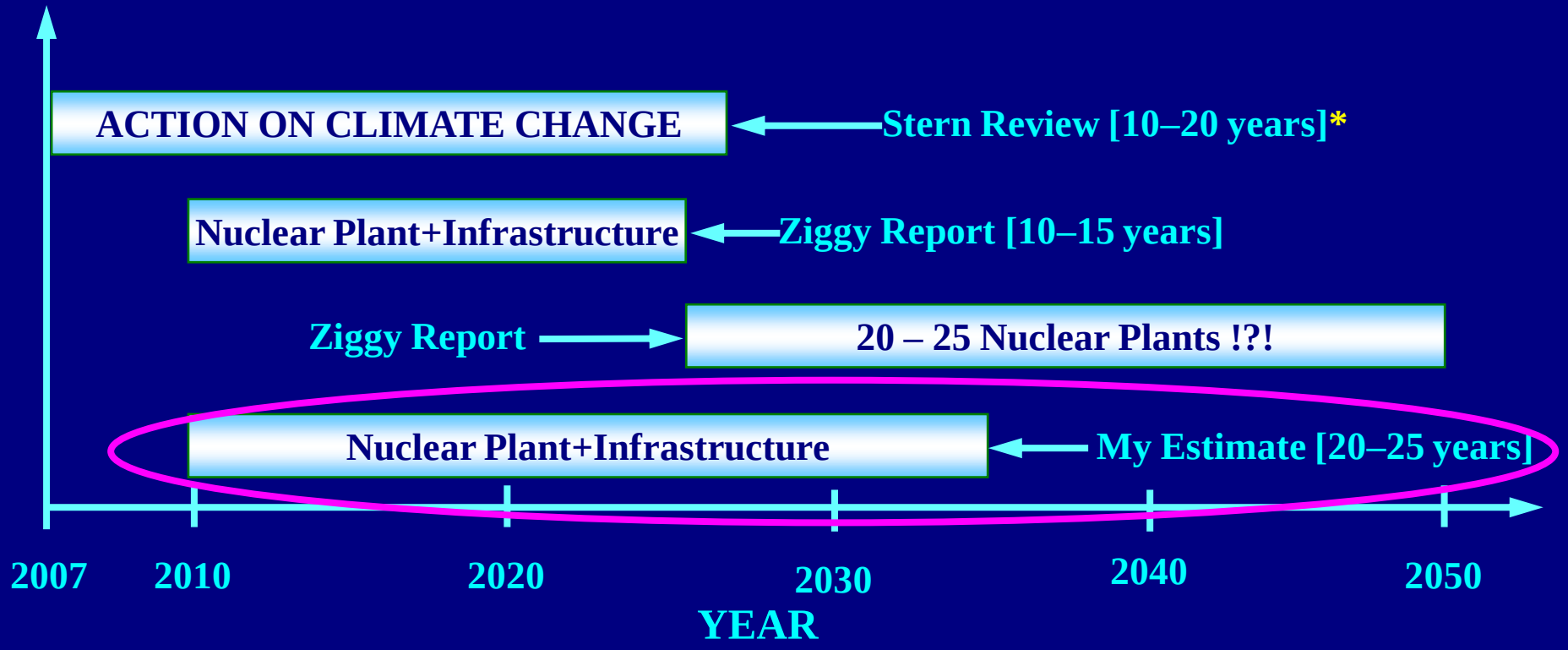
Figure 7.8 Potential to reduce Australia's emissions — illustrative scenarios to 2050



THE ZIGGY REPORT SAYS THIS SCENARIO SHOWS NUCLEAR POWER HAS THE POTENTIAL TO REDUCE EMISSIONS, BUT IN MY VIEW…

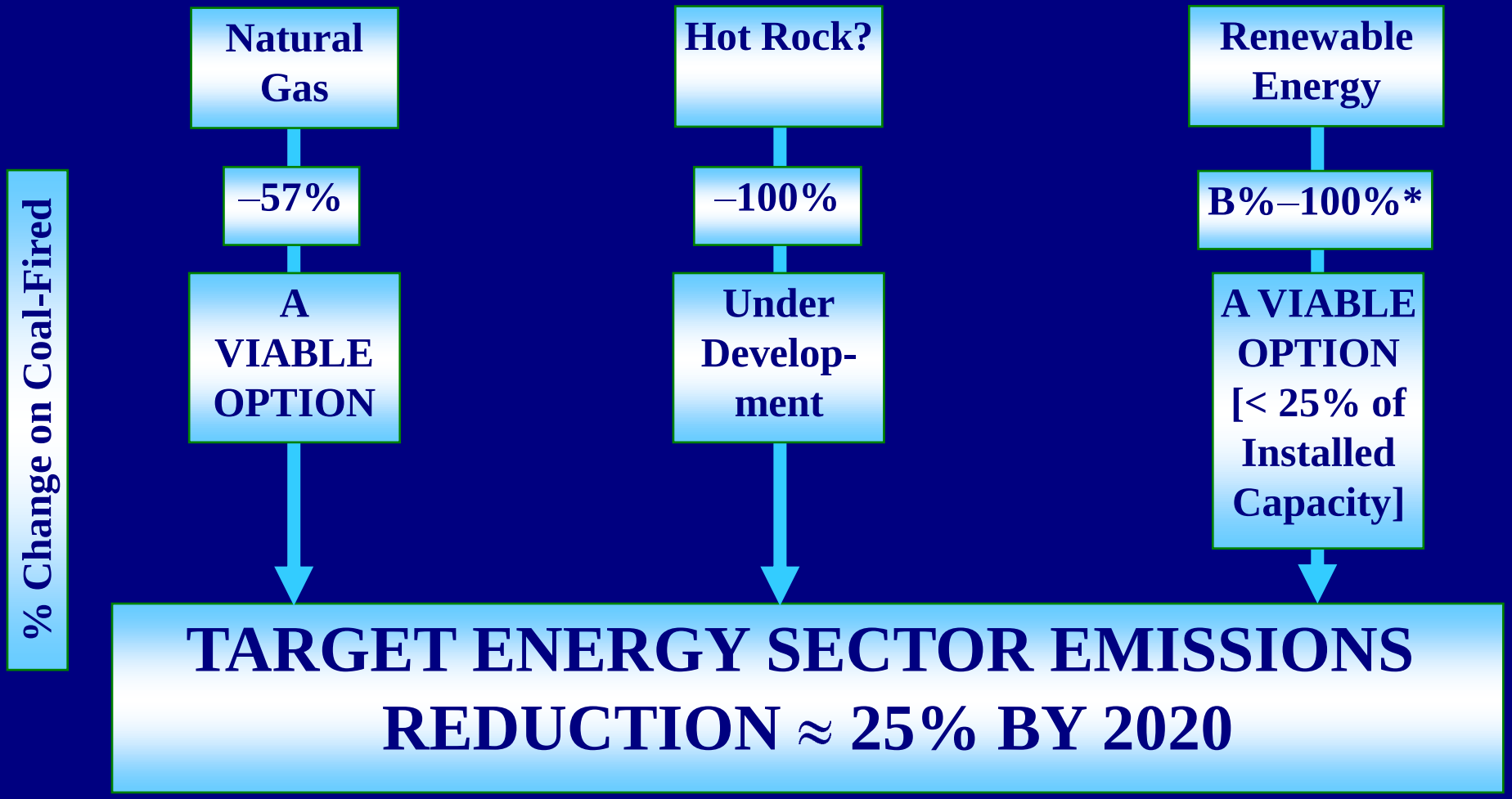
SO… IS NUCLEAR POWER A GREENHOUSE SOLUTION FOR AUSTRALIA? [MY VIEW]

…IN THE MEDIUM TERM, THE SHORT ANSWER IS NO BECAUSE OF THE DISPARATE TIMESCALES INVOLVED FOR NUCLEAR POWER TO MAKE A SIGNIFICANT REDUCTION IN AUSTRALIA'S GREENHOUSE GAS EMISSIONS WITHIN THE TARGET TIMEFRAME [10-20 YEARS], AND SO…



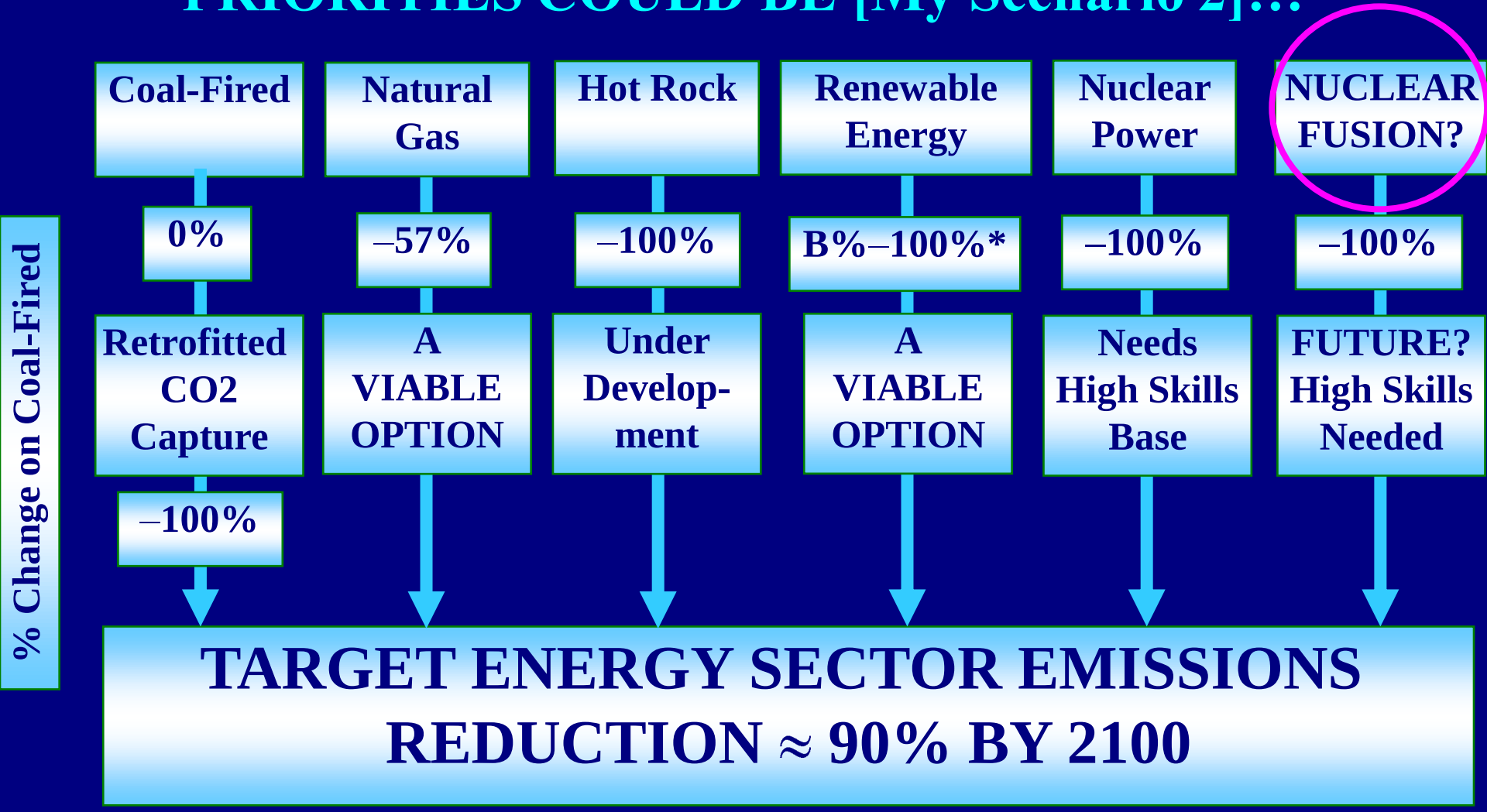
* Sir Nicholas Stern – "STERN REVIEW : The Economics of Climate Change", H M Treasury, UK, 30 October 2006

…WHICH MEANS OUR IMMEDIATE ENERGY PRIORITIES SHOULD BE [My Scenario 1]…



- Renewable Energy backup generation [B%] utilised will determine the reduction achieved.

…AND OUR MIX OF LONGER-TERM ENERGY PRIORITIES COULD BE [My Scenario 2]…



- Renewable Energy backup generation [B%] utilised will determine the reduction achieved.

SO WHERE DOES THE BUCK STOP IN ALL THIS?

WELL THE BUCK FIRSTLY STOPS NATIONALLY, BUT*...

"There are good people on both sides in politics who hold this issue at arm's length because, if they acknowledge it, then the MORAL IMPERATIVE TO MAKE BIG CHANGES IS INESCAPABLE"

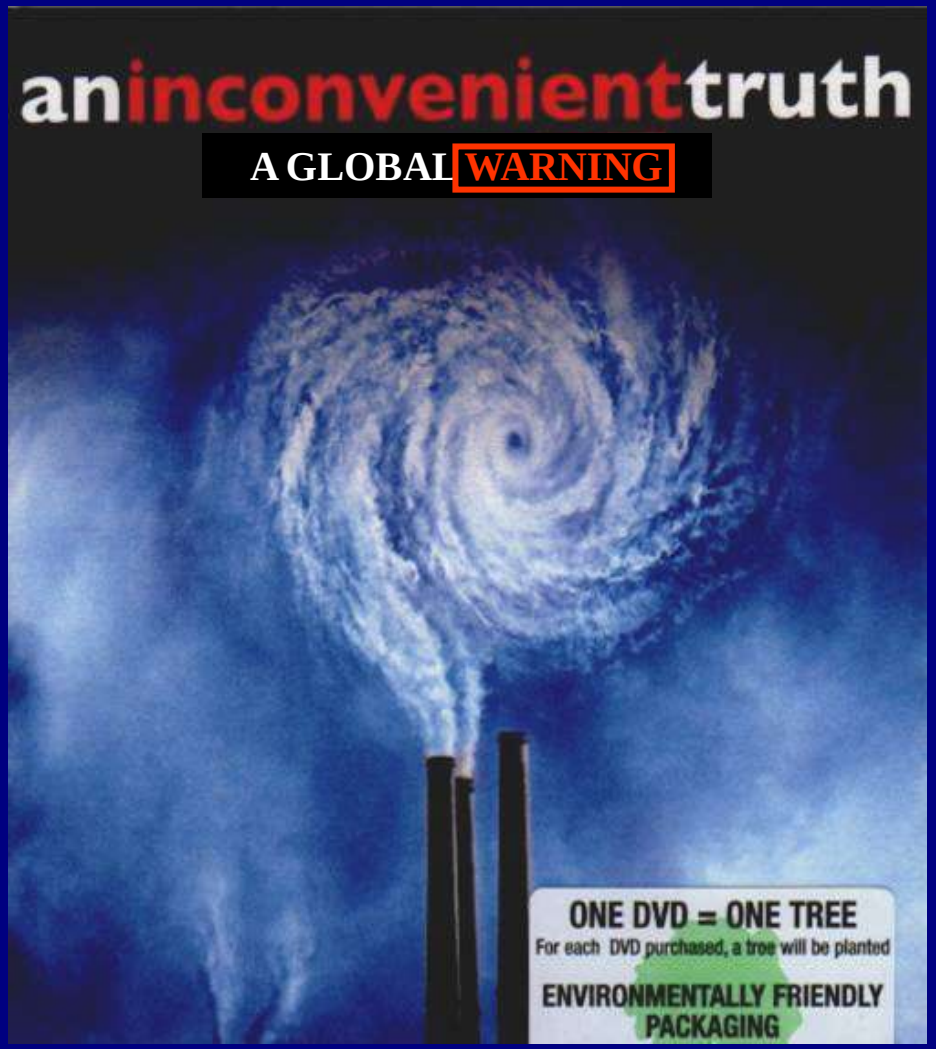
…AND THE BUCK ALSO STOPS PERSONALLY, BUT*…

"It is difficult to get someone to understand something when their lifestyle depends upon them NOT UNDERSTANDING IT."

*** Al Gore – "An Inconvenient Truth" [My rendition]**

…AFTER ALL, IT IS "AN INCONVENIENT TRUTH"

Want to do something to help stop Global Warming?



tenthingstodo

1. Change a light – use energy efficient globes.
2. Drive less.
3. Recycle more.
4. Check your tyres.
5. Use less hot water.
6. Avoid over-packaged goods.
7. Turn your thermostat 2^{o}C Down (winter) and 2^{o}C Up (summer).
8. Plant a tree.
9. Turn off electric lights/devices.
10. Be part of the solution.

… AND A FINAL THOUGHT…

Future generations may well have occasion to ask themselves, "What were our parents thinking? Why didn't they wake up when they had a chance?" WE have to hear that question from them, NOW!*

*** Al Gore – "An Inconvenient Truth"**

THE END

THANK YOU FOR YOUR KIND INVITATION & GRACIOUS HOSPITALITY

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http://www.engineersaustralia.org.au/shtrg

FOR "OZ SUSTAINABLE ENERGY" TALKS BY GUEST EXPERTS ON:

- WIND ENERGY
- HOT DRY ROCK ENERGY
- NUCLEAR ENERGY
- NATURAL GAS ENERGY
- HYDROGEN ENERGY
- SOLAR THERMAL ENERGY
- SOLAR PHOTOVOLTAIC
- WAVE ENERGY
- COAL GAS ENERGY