



Chernobyl

Is Nuclear Power the Answer?

If so, what is the
question?

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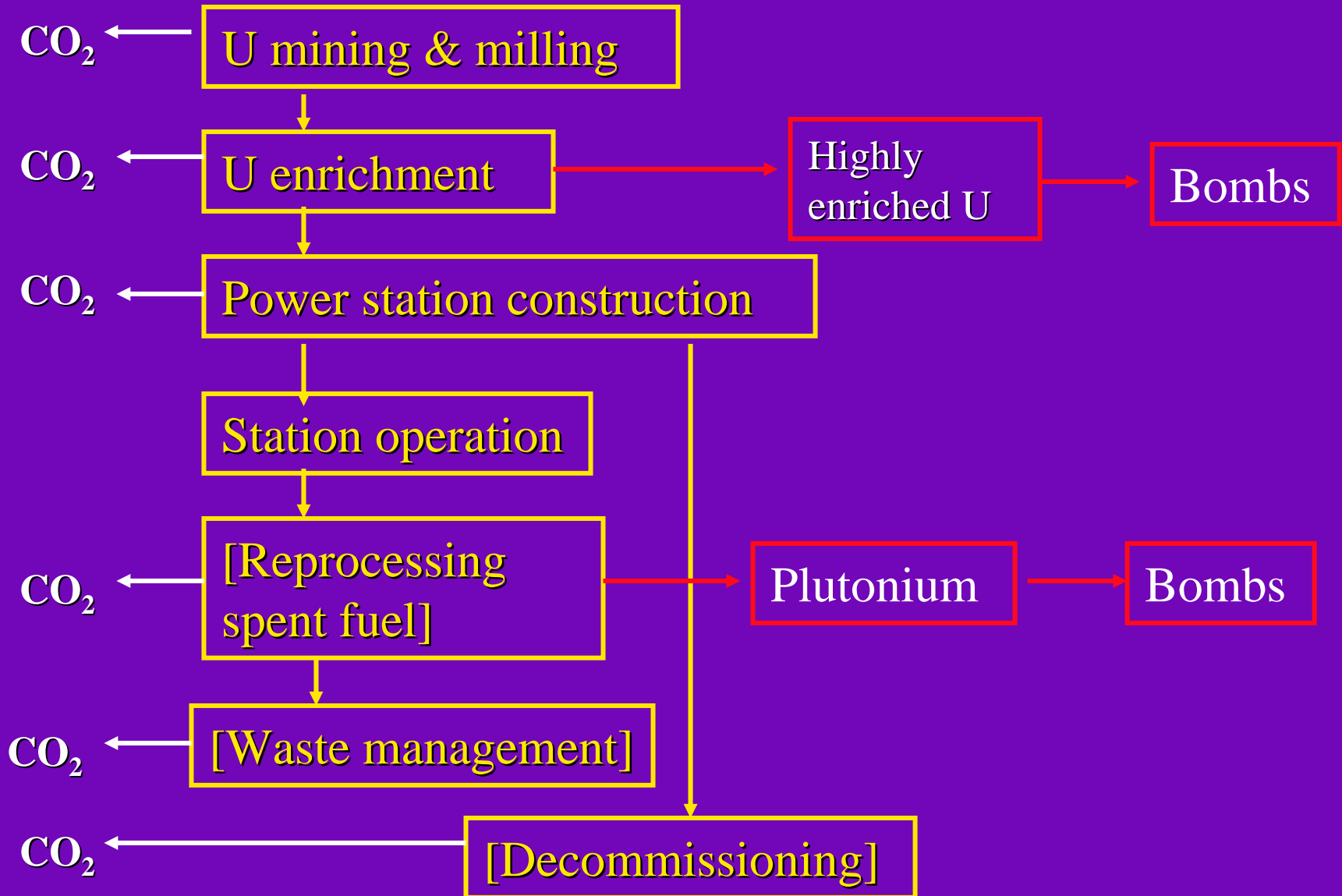
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CONCERNS ABOUT NUCLEAR ENERGY POST 2000: UNCHANGED OR WORSE THAN BEFORE

- Debate about its CO₂ emissions – NEW
- Proliferation of nuclear weapons via enrichment or reprocessing pathways – WORSE
- Superb terrorist target – WORSE
- Rare but devastating accidents – UNCHANGED
- Managing high-level wastes – UNCHANGED
- Managing low-level wastes: several cancers per year over several 100,000 years – UNCHANGED
- High cost – WORSE

NUCLEAR FUEL CHAIN



WEAPONS PROLIFERATION FROM NUCLEAR POWER

- Dr Theodore Taylor, leading US nuclear bomb designer, 1976: “With the spread of peaceful nuclear power, more and more countries have the opportunity to acquire bomb materials...”
- Dr Victor Gilinsky, US Nuclear Regulatory Commission, 1977: “it is possible to use this material (reactor-grade plutonium) for nuclear warheads at all levels of technical sophistication...Whatever we might once have thought, we now know that even simple designs, albeit with some uncertainties in yield, can serve as effective, highly powerful weapons...”
- US Department of Energy in 1997: “All of these grades of plutonium (fuel-grade and reactor grade) can be used to make nuclear weapons...”

–See www.ccnr.org/Findings_plute.html/.

PROLIFERATION BY AUSTRALIA?

- Needs either U enrichment or reprocessing of spent fuel.
- Several attempts post WWII culminated in aborted nuclear power station at Jervis Bay*
- Previously USA opposed Australia's attempts
- Now USA & Aust undermining Nuclear Non-Proliferation Treaty (NPT) -- U sales to India & Taiwan
- Aust in US-controlled Global Nuclear Energy Partnership (GNEP) --> gets spent fuel

Richard Broinowski 2003, *Fact or Fission*;

Wayne Reynolds 2000, *Australia's Bid for the Atomic Bomb*.

LONG-TERM WASTE MANAGEMENT: YUCCA MOUNTAIN, USA



- Site chosen by politics, not science
- Ridge of volcanic tuff
- Cost ~ US\$10 billion so far
- Estimated life-cycle cost US\$57 billion
- Long-term proof of safety does not exist
- Scandal over false certification.
- Unclear whether Yucca will ever open.
- Insufficient storage if it does.
- Can Australia do what USA has failed to do?

URANIUM MINING

- Export income less than that of cheese (Ian Lowe).
- Huge water use (Roxby Downs)
- Release of low-level radiation for several 100,000 years
- Helps build stocks of explosive for nuclear weapons overseas. E.g. would free up Chinese uranium for bombs.

URANIUM ENRICHMENT

- Nowadays done by gas centrifuge using much electricity in a large plant.
- Rhetoric of adding value to U mining, but...
- Global over-capacity of enrichment. USA building new centrifuge plant.
- The only way for Australia to break into market is via new technology.
- Classified new technology: laser enrichment by Silex Systems Ltd at Lucas Heights, Sydney.
- Small plant with potential for low-cost nuclear weapons.

NUCLEAR ECONOMICS

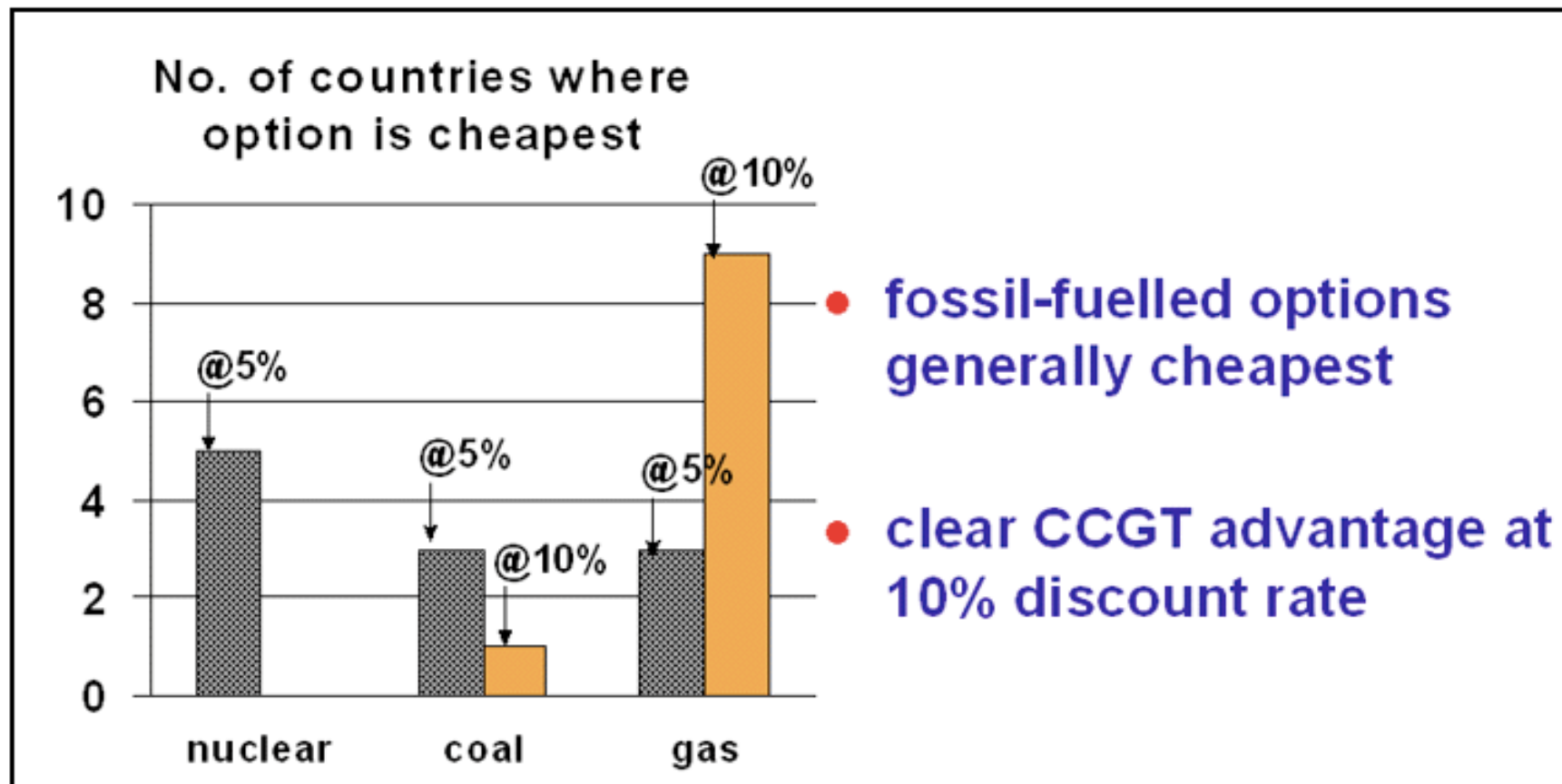
Claims that nuclear energy is cheap are based on hidden assumptions, e.g.:

- Huge subsidies ignored: R & D, enrichment, insurance liability, wastes, decommissioning
- Since nukes have high capital cost and low operating cost, nuclear proponents choose unrealistically low interest/discount rate or accounting method that shrinks interest & capital repayments
- Over-optimistic assumptions about performance:
capacity factor = $100 \times \text{average power} / \text{rated power}$

COMPARATIVE ECONOMICS OF NEW NUKES AT TWO DISCOUNT RATES: 5% & 10%

Projected Costs of Generating Electricity – Update 1998, Nuclear Energy Agency / International Energy Agency/OECD, Paris, 1998.

(Data supplied by nuclear industry.)



MORE REALISTIC NUCLEAR ECONOMICS FROM ELECTRICITY PRIVATISATION

UK

- Levy of up to £1.3 billion per year to subsidise nuclear in 1990s.
- Equivalent to subsidy of 3 p/kWh (A 6 c/kWh) of nuclear electricity generated.
- Total price of electricity from Sizewell B: 6 p/kWh (A 12 c/kWh)
- Compare average price of on-shore wind power in UK currently 3.5-4.5 p/kWh
- Add nuclear decommissioning estimated at £90 billion in 2006

MORE REALISTIC NUCLEAR ECONOMICS FROM ELECTRICITY PRIVATISATION

USA

- No new nuclear power stations since 1978, initially because of accident at Three Mile Island, subsequently because of poor economics.
- Pro-nuclear MIT (2003) study estimates new nuclear electricity at US 6.7–7.5 c/kwh (A 9–10 c/kWh).
- Wind power in USA is currently US 4.5-5.5 c/kWh at excellent sites (A 6.0-7.3 c/kWh)
- Accumulated subsidies to nuclear ~ US\$100 billion

MORE REALISTIC NUCLEAR ECONOMICS FROM ELECTRICITY PRIVATISATION

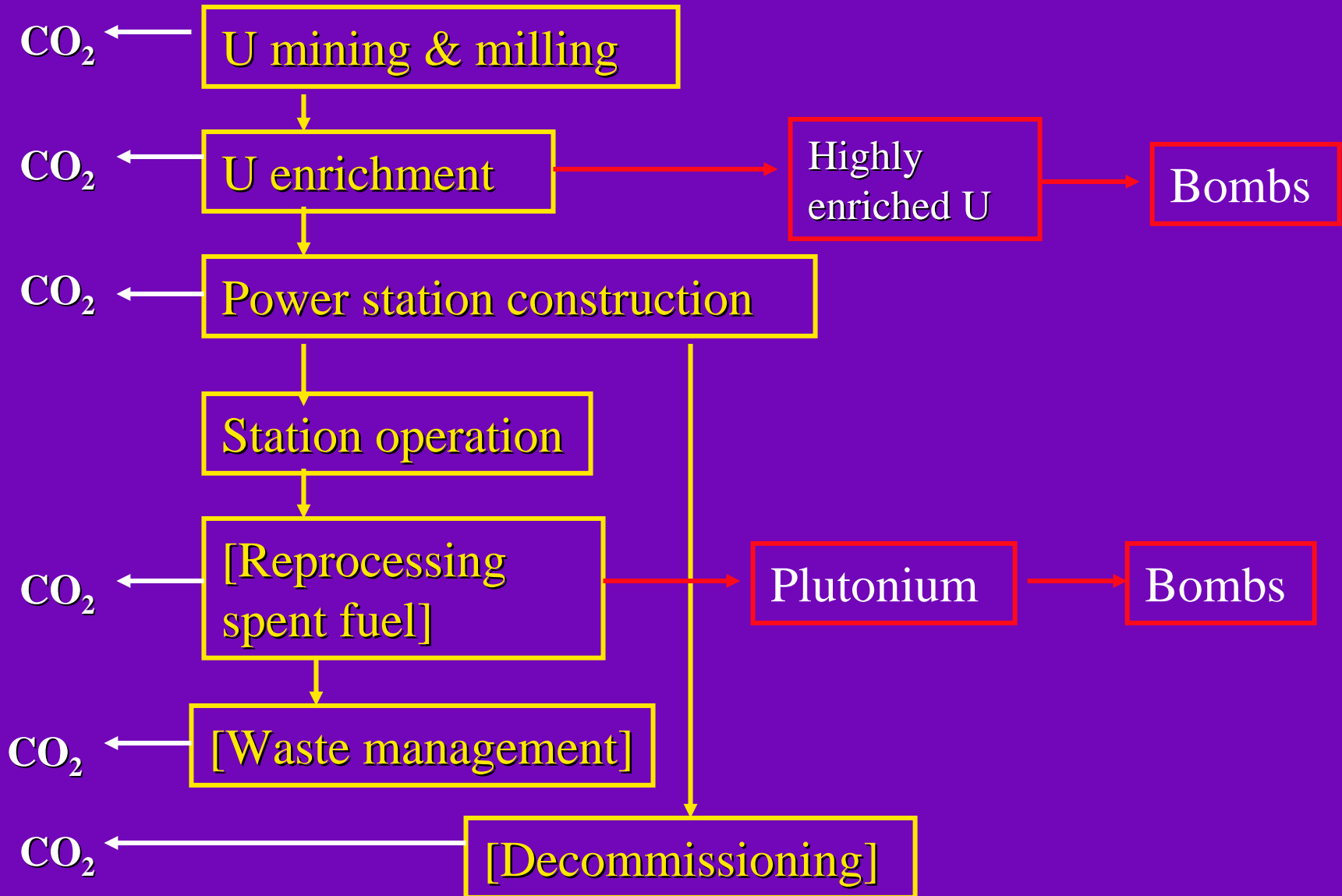
Finland

- The only new nuclear power station in western countries is being built in Finland.
- Nuclear supporters claim incorrectly that nuke is cost-effective under market conditions in Finland.
- But the developers are consortium with 40% ownership by Finnish Government.
- They are not selling electricity on the open market, but only to the consortium's members.
- This entails a very low interest/discount rate compared with market.

GITTUS REPORT TO ANSTO, 2006

- Examined economics of Westinghouse AP1000 (paper design)
- Claimed it would be economic in Australia, subject to the following conditions:
 - Either the government pays large subsidies on both capital & operating cost.
 - Or government makes large *unsecured* loan (= subsidy)
- In other words, “uneconomic without big subsidies.

NUCLEAR FUEL CHAIN



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 30-40 years)
- CO₂ emissions much less than gas-fired station's
- Reserves: several decades at current level of operation only

Low-grade U ore

Contains 0.01% or less of yellowcake

- Energy inputs substantial
- CO₂ emissions similar to gas-fired power station's
- Vast reserves of low- & very low-grade ore -- impossible to use

RESPONSE OF NUCLEAR PROPONENTS

- Obscure the difference between high-grade & low-grade uranium ore
- Cite a report from Swedish utility, Vattenfall, that obtains different results for high-grade ore
- But this report is unpublished -- only a brief summary is available.

OPTIONS FOR NUCLEAR ENERGY: 1

- Discover new reserves of *high-grade U ore*
- But even doubling reserves will only fuel one generation of power stations at double current usage rate

OPTIONS FOR NUCLEAR ENERGY: 2

- In theory fast breeder reactors 'breed' 50 times more fuel as plutonium.
- In practice fast breeders have been technical and economic disasters
- To extract the new plutonium, require chemical reprocessing of spent fuel.
- In practice reprocessing has been a technical and economic failure: 3 USA plants closed and Sellafield UK closed at least temporarily. Only La Hague (France) is operating

OPTIONS FOR NUCLEAR ENERGY: 3

- Develop new reactors and a nuclear fuel cycle that are fail-safe, proliferation-proof, economic and have low energy inputs when low-grade uranium ore is used.
- In practice, nuclear industry is talking about ‘Generation IV’ reactors that may be fail-safe and less open to proliferation, but is doing little:
 - Pebble bed prototype being built in S. Africa
 - Thorium breeder under development in India
 - Accelerator-driven thorium reactor is being researched.
- These proposed new reactors are not ready for commercial use

RISKS OF NUCLEAR ENERGY AS MEDIUM-TO-LONG TERM INVESTMENT

- Terrorist attack on reactor, reprocessing plant, or transportation inevitable. Solution: reduce no. of exposed sites.
- Proliferation of nuclear weapons from 'peaceful' nuclear energy continues:
 - Australian uranium has already provided nuclear explosives, directly or indirectly, to UK & France;
 - Exports to China & Taiwan (non-NPT); possibly India (non-NPT);
 - Previous exports to Japan, which could assemble bombs any time.
- Poor nuclear economics revealed by competitive markets, as already in UK.

CLEAN ENERGY FOR INDIA & CHINA

- China generates 2.3% of electricity from nuclear; plans to expand to 4% by 2020.
- Compare China's target for renewable electricity: 15% by 2020 (mostly wind power).
- China had 1.2 GW wind at end 2005. Its target is 5GW by 2010 & 30 GW by 2030
- China also has large bioenergy potential from existing crop residues.
- India already has 5 GW wind power, growing rapidly

CONCLUSION

- Nuclear power is not a long-term answer to human-induced climate change.
- It's even more dangerous than it was pre 11/9/2001.
- It's *not* cost-effective in almost any competitive market, even compared with wind power.

CONCLUSION ctd

Nuclear power *IS* a possible answer to the following questions being asked by the current Federal Gov't:

1. How can Federal Government divert attention away from its lack of a credible greenhouse response strategy?
2. How can the Federal Government split the Labor party?
3. How can Australia become “nuclear weapons ready”?



Rocky Point, Qld



Albany, WA



Christie Walk, Adelaide



Energy efficiency
Wind
Biomass
Solar

SUSTAINABLE
ENERGY

