Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



Nuclear power: *Magic Lantern or Pandora's Box?*

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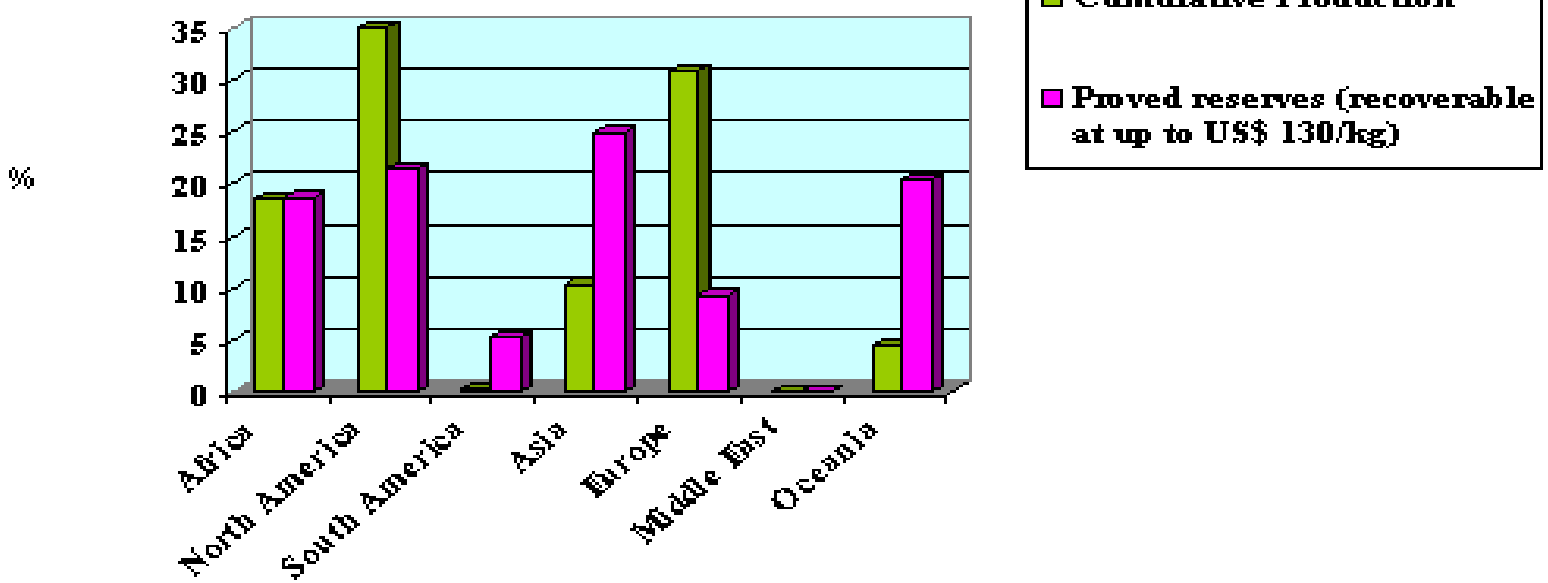
Why choose between supply-side options: *Why not use them all?*

- Challenges for the stationary energy sector:
  - Climate change & other risks
  - Energy security & cost (price volatility for fossil fuels)
  - Social expectations (developed & developing world)
  - Imperfect supply-side options & little interest in frugality
- Key questions for the stationary energy sector:
  - Can we learn to share a finite supply-side cake?
  - What size should the cake be and what should be in it?
  - How can we compare energy supply options?
  - What are acceptable risks?
  - Who should decide?

Uranium resources at end 1999 (www.worldenergy.org)

- Reasonably assured @ $130/kg: 3 MT
- Estimated additional @ $130/kg: 1 MT
- Estimated annual use in 2015: 0.05-0.08 MT
- Thus < 100 years supply with current technology

Figure 6.1: Cumulative production and proved reserves of uranium at end-1999 - regional distribution



Nuclear energy & CO2 emissions: *One perspective* (www.oprit.rug.nl/deenen)

- *"The use of nuclear power causes, at the end of the road and under the most favourable conditions, approximately one-third as much CO2-emission as gas-fired electricity production."*
- *"The rich uranium ores required to achieve this reduction are, however, so limited that if the entire present world electricity demand were to be provided by nuclear power, these ores would be exhausted within three years."*
- *"Use of the remaining poorer ores in nuclear reactors would produce more CO2 emission than burning fossil fuels directly."*

Note: A higher emission coefficient also implies a longer energy payback time

The energy conundrum

(IEA (2005), Energy Indicators for Sustainable Development)

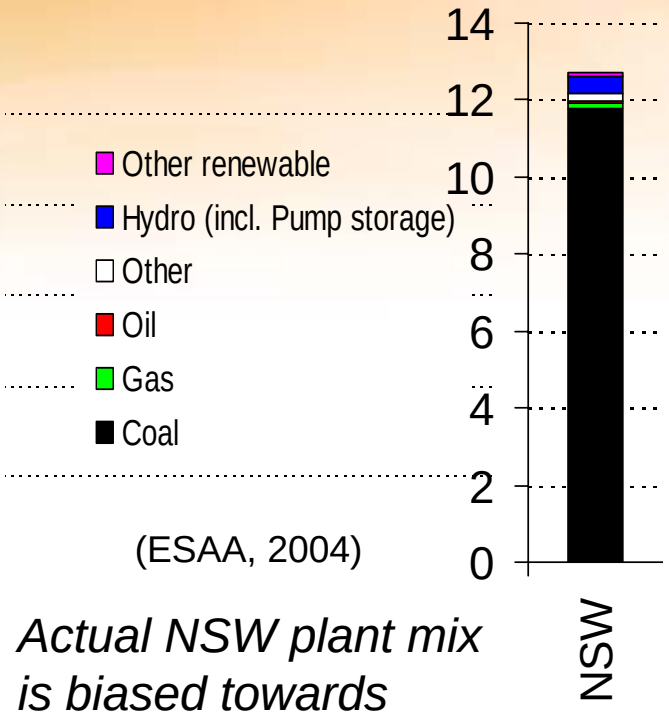
- There are no easy answers:
  - *"There is no energy production or conversion technology without risk or without waste…The use of nuclear power has created a number of concerns, such as the storage or disposal of high-level radioactive waste and the proliferation of nuclear weapons." (IEA, 2005, p1)*
- Why is nuclear power special?
  - *"Nuclear energy represents a special case in this context in that the scope of an accident could be potentially large…" (IEA, 2005, p38)*
  - *"A leak of highly radioactive nuclear fuel dissolved in concentrated nitric acid, enough to half fill an Olympic-size swimming pool, has forced the closure of Sellafield's Thorp reprocessing plant" (The Guardian, 9/5/05)*

Some opinions on nuclear power

- No worries :
  - *"Australia is probably the only developed country where, when you switch on the light, you are not getting some nuclear electricity to help lighten your way"* (www.uic.com.au)
  - *"Nuclear power, not necessarily for nuclear generation in Australia, but nuclear power is the short answer"* Robin Batterham, 19/5/05 (www.abc.net.au)
- Not so sure:
  - *"For a large expansion of nuclear power to succeed,four critical problems must be overcome: cost, safety, waste & proliferation"* (web.mit.edu/nuclearpower)
  - *"The world's got to debate whether uranium-derived power is more dangerous than coal"* Bob Carr, 2/6/05 (www.abc.net.au)
  - *"The British government viewpoint is that we must focus on renewables and energy efficiency..."* Sir David King, UK Chief Scientist (The Guardian, 11/5/05)
- No thanks:
  - *"Why would you go down the road of bringing in another source of energy like nuclear power, which does have long-term problems and long-term risks?"* Peter Beattie, Queensland Premier, 6/6/05 (www.abc.net.au)

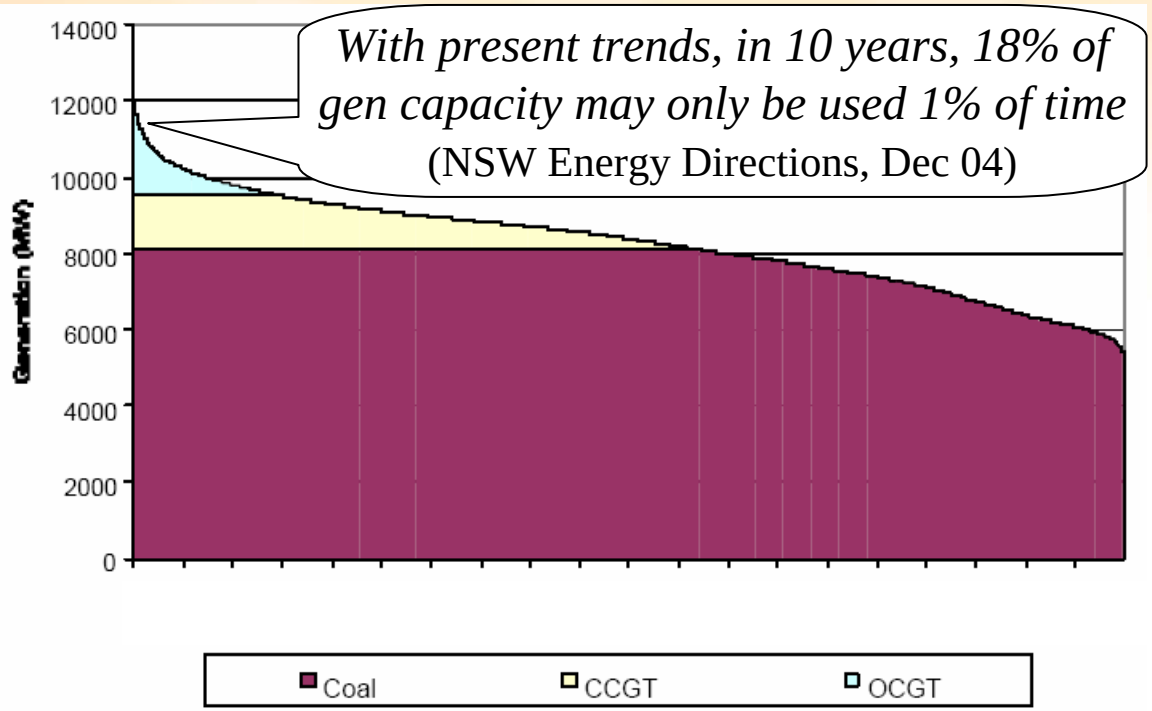
NSW does not need base load generation at present

"Mr Yeadon said the NSW Statement of System Opportunities indicated that over the next 10 years there was scope for a whole range of supply and demand-side projects, including renewable projects (such as wind and solar) and gas-fired plants." (NSW Govt. media release, 21/6/02)



(ESAA, 2004)

Actual NSW plant mix is biased towards base-load generation



IES "Optimal plant mix" for NSW (IES 2004 report to IPART)

Some opinions on terrorism & proliferation

- No worries (www.uic.com.au):
  - *"I anticipate that my children's, or perhaps my grandchildren's generation will come to look upon weapons as simply an initial aberration of the nuclear age, rather than a major characteristic of it."*
- Not so sure (web.mit.edu/nuclearpower):
  - *"Fuel cycles that involve the chemical reprocessing of spent fuel to separate weapons-usable plutonium and uranium … are of special concern,especially as nuclear power spreads around the world"*
- No thanks :
  - *"The existing [US] security regulations do not provide adequate protection [of nuclear power stations] against known terrorist threat capabilities."* (www.ucsusa.org)
  - *"…there's an emerging consensus between left and right, between Washington hawks and the peace movement, that the distinction between peaceful and military uses of nuclear energy is an illusion"* (www.abc.net.au/rn/talks/bbing/ Background Briefing, 22/5/05)

Failed discussions on the nuclear non-proliferation treaty (Reuters, 27/5/05)

- Mohamed ElBaredei, IAEA; 3 reasons for a treaty:
  - *"… the emergence of a nuclear black market, the determined efforts by more countries to acquire technology to produce the fissile material usable in nuclear weapons, and the clear desire of terrorists to acquire weapons of mass destruction"*
- Louis Charbonneau, Reuters reporter:
  - *"The danger of a nuclear holocaust may never have been greater, yet the 188 signatories to the global pact against nuclear weapons have rarely been more divided, arms experts and diplomats said."*

Some decision-making procedures

- Judicial:
  - Neutral, balanced, informed (in the ideal case)
- Commercial:
  - Decentralised self-interest subject to assigned (legal) accountability
- Political processes:
  - Compromise supported by a sufficient coalition
  - Often based on self-interest (what's in it for me?)
- Might makes right:
  - More common than we may like to admit

Properties of energy sector decisions

- Long-term infrastructure choices:
  - Asset lives of 50 years or more
- Large externalities (impacts on non-participants):
  - Climate change (fossil fuels)
  - Nuclear fuel cycle risks (nuclear power)
  - Various adverse impacts (renewable energy forms)
- Difficult to quantify risks:
  - Low probability, high impact
  - Non-stationary (history may not be a good predictor)
- Can be classified as ‘social experiments’:
  - Should only be undertaken with informed consent

The nuclear decision is a societal choice

- MIT report perspective:
  - *"Our audience is government,industry,and academic leaders with an interest in the management of* ***the interrelated set of technical, economic, environmental, and political issues that must be addressed*** *if large-scale deployment of new nuclear power generating facilities is to remain an option for providing a significant fraction of electricity supply in the middle of this century."* (MIT, 2003)
- Such decisions require broad societal discussion & informed consent:
  - The expert's role is to advise rather than decide

What decision-making procedures might be appropriate for nuclear power?

- Political compromise:
  - Too unstable to address long term issues, including nuclear fuel cycle risks & inter-generational impacts
- Commercial:
  - Difficult to achieve adequate accountability (the critical, high-impact risks are usually underwritten by the State)
- Judicial *(probably the best available option):*
  - The nuclear option has many serious caveats (MIT, 2003)
- Might makes right:
  - Totally inappropriate but all too plausible in this context

Conclusions

- If nuclear power is the right answer for Australia then we may have asked the wrong question:
  - *Cost, safety, waste & proliferation (MIT, 2003)*
  - *Requires very careful consideration of alternatives*
- A good question asks *how can we do no harm?*
  - *To the global ecosystem including the human population*
  - *Considering risks from the near- to the very long-term*
  - *Assessed judiciously with an informed public debate*
- The right answer starts with frugality, not with any magic supply-side bullet:
  - *Unfortunately, nuclear power may be just one more Pandora's Box*

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Many of our publications are available at:
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