Nuclear power and climate change

fact sheet
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A doubling of nuclear power would reduce global greenhouse emissions by only 5%.

Uranium is also a finite resource, just as fossil fuels are.

It is widely accepted that anthropogenic greenhouse gas emissions must be sharply reduced to avert climate change. However, nuclear power is at best a very partial, problematic and unnecessary response to climate change:

- A doubling of nuclear power would reduce global greenhouse emissions by about 5%. A much larger nuclear expansion program would pose enormous proliferation and security risks, and it would run up against the problem of limited known conventional uranium reserves.
- The serious hazards of civil nuclear programs - the repeatedly demonstrated contribution of civil nuclear programs to weapons proliferation, intractable waste management problems, and the risk of serious accidents.
- The availability of a plethora of clean energy options - renewable energy sources plus energy efficiency - which, combined, can meet energy demand and sharply reduce greenhouse emissions. (See for example the reports produced by the Clean Energy Future Group).[1]

This information paper addresses the first of those arguments - the limitations of nuclear power as a climate change abatement strategy.

A limited response

Nuclear power is used almost exclusively for electricity generation. (A very small number of reactors are used for heat co-generation and desalination.)

Electricity is responsible for less than one third of global greenhouse gas emissions. According to the Uranium Institute, the figure is "about 30%".[2] That fact alone puts pay to the simplistic view that nuclear power alone can 'solve' climate change. According to a senior energy analyst with the International Atomic Energy Agency, Alan McDonald: "Saying that nuclear power can solve global warming by itself is way over the top".[3]

Ian Hore-Lacy from the Uranium Information Centre (UIC) claims that a doubling of nuclear power would reduce greenhouse emissions in the power sector by 25%.[4] That figure is reduced to a 7.5% reduction if considering the impact on overall emissions rather than just the power sector. The figure needs to be further reduced because the UIC makes no allowance for the considerable time that would be required to double nuclear output. Electricity generation is projected to increase over the coming decades so the contribution of a fixed additional input of nuclear power has a relatively smaller impact. Overall, it is highly unlikely that a doubling of global nuclear power would reduce emissions by more than 5%.

Moreover, that modest climate dividend assumes that coal is the reference point. But compared to most renewable energy sources and to energy efficiency measures, nuclear power produces more greenhouse emissions per unit energy produced or saved, in addition to its legacy of nuclear waste and the weapons proliferation risks.[5]

Proliferation and security concerns

A very large increase in nuclear power, of the scale necessary to make a significant dent in greenhouse emissions, would create an enormous security and non-proliferation challenge. Feiveson[6] calculates that with a ten-fold increase in nuclear output, 700 tonnes of plutonium would be produced annually – sufficient for about 70,000 nuclear weapons (or 3.5 million weapons over a 50-year reactor lifespan).

The UN's Intergovernmental Panel on Climate Change has considered a scenario involving a ten-fold increase in nuclear power output over this century, and calculated that this could produce 50-100 thousand tonnes of plutonium.[7] The IPCC concluded that the security threat would be "colossal."

Former US Vice President Al Gore said in May 2006 that: "For eight years in the White House, every weapons-proliferation problem we dealt with was connected to a civilian reactor program. And if we ever got to the point where we wanted to use nuclear reactors to back out a lot of coal ... then we'd have to put them in so many places we'd run that proliferation risk right off the reasonability scale."[8]

A temporary response: limited conventional uranium reserves

A very large increase in nuclear output would run up against the problem of limited known conventional uranium reserves.

According to the Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA), the total known recoverable uranium reserves – reasonably assured reserves and estimated additional reserves which can be extracted at a cost of less than US$80/kg – amount to 3.5 million tones.[9] At the current rate of usage – 67,000 tonnes per year – these reserves will last for just over 50 years.

Of course, the nuclear power industry will not come to an immediate halt once the known low-cost reserves have been exhausted. Other relatively high-grade, low-cost ores will be discovered, and lower-grade ores can be used. The NEA and IAEA estimate the total of all conventional reserves to be about 14.4 million tones.[10] The OECD estimates that about 16 million tonnes of uranium are recoverable at costs less than US$260 per kilogram, including 12 million tonnes of "speculative resources".[11]

Uranium reserves in the range of 14-16 million tonnes would suffice for about 200 years at the current rate of consumption – but significantly less if nuclear power is to expand to the extent that it makes anything more than a minor contribution to climate change abatement.

Large amounts of uranium are also contained in 'unconventional sources' such as granite (4 parts per million), sedimentary rock (2 ppm) and seawater (up to 4000 million tonnes at 0.003 ppm).[12] It is doubtful whether uranium could be economically recovered from unconventional sources, and the extraction of uranium from such ultra-low-grade ores raises further concerns in relation to the amount of energy required to extract the uranium and the greenhouse emissions expended.

Further reading:

Ian Lowe, 2005, Is nuclear power part of Australia's global warming solutions?, Address to the National Press Club, www.acfonline.org.au/news.asp?news_id=582.

Friends of the Earth et al., 2005, Nuclear Power: No Solution to Climate Change, www.melbourne.foe.org.au/documents.htm.

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Brice Smith, 2006, Insurmountable Risks: The Dangers of Using Nuclear Power to Combat Global Climate Change, www.ieer.org/reports/insurmountablerisks.

Mycle Schneider (WISE Paris), April 2000, Climate Change and Nuclear Power, published by World Wide Fund for Nature, www.panda.org/downloads/climate_ change/fullnuclearreprotwwf.pdf.

References

1 Clean Energy Future Group, Australia-wide and state reports at wwf.org.au/ourwork/climatechange/cleanenergyfuture.

2 Uranium Institute, n.d., Responding to Global Climate Change: The Potential Contribution of Nuclear Power, www.world-nuclear.org/climate.htm.

3 Traub, James, June 13, 2004, 'The Netherworld of Nonproliferation', New York Times.

4 Hore-Lacy, Ian, May 04, 2006, 'Nuclear wagon gathers steam', Courier Mail. www.thecouriermail.news.com.au/story/0,20797,19021383-27197,00.html.

5 Friends of the Earth et al., 2005, 'Nuclear Power: No Solution to Climate Change', www.melbourne.foe.org.au/documents.htm.

6 Feiveson, Harold, 2001, *The Search for Proliferation-Resistant Nuclear Power*, The Journal of the Federation of American Scientists, September/October 2001, Volume 54, Number 5, www.fas.org/faspir/2001/v54n5/nuclear.htm.

7 Intergovernmental Panel on Climate Change, 1995, Climate Change 1995: *Impacts, Adaptations and Mitigation of Climate Change*: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change, R.T.Watson, M.C.Zinyowera, R.H.Moss (eds), Cambridge University Press: UK.

8 Roberts, David, May 09, 2006, 'Al Revere: An interview with accidental movie star Al Gore', www.grist.org/news/maindish/2006/05/09/roberts.

9 Nuclear Energy Agency (NEA) and International Atomic Energy Agency (IAEA), 2004, "Uranium 2003: Resources, Production and Demand". Paris: OECD.

10 NEA & IAEA, 2004, op cit.

11 Organisation for Economic Cooperation and Development, 1998, *Uranium 1997: Resources, Production and Demand*, Paris: OECD. See also: Fetter, Steve, 1999, Climate Change and the Transformation of World Energy Supply, Stanford University – Centre for International Security and Cooperation Report, cisac.stanford.edu/publications/10228.

12 Uranium Information Centre, 2004, *Supply of Uranium*, Nuclear Issues Briefing Paper # 75, www.uic.com.au/nip75.htm.

About the author:

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energyscience.org.au is a co-operative production by a group of concerned scientists, engineers and policy experts that seek to promote a balanced and informed discussion on the future energy options for Australia.
With increasing concern over the looming impact of global climate change the community needs to be aware of the issues involved. energyscience aims to provide reliable and evidence based information to our whole community

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