

Civilian Nuclear Power: 2008 and Beyond

Supplemental Research for the *Clout & Climate Change International War Game*

By Michael Horowitz



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Studies produced by the Organization for Economic Co-Operation and Development (OECD) consistently cite nuclear power, in combination with various forms of renewable energy, as a potential path to significant CO2 reductions. However, for a variety of reasons, some technical and some psychological, the global community in general and the United States have been reluctant to fully embrace the potential of civilian nuclear power. Here is a chart laying out the projected nuclear power use by the four *Clout and Climate Change* war game teams from 1990 to 2050:

	1990	% of total	2005	% of total	2015	% of total	2030	% of total	2050	% of total
China	0	0%	14	1%	32	1%	67	2%	179	3%
EU	207	13%	260	14%	239	13%	159	8%	92	4%
India	2	0.6%	5	0.9%	16	2%	33	3%	87	3%
USA	159	8%	211	9%	221	8%	243	8%	276	8%

However, while the continuation of past trends drives these projections, there are also some developments in the nuclear power area that could lead to its having a higher share of global energy production in upcoming years. In 2007, overall, nuclear energy provided for 21.6% of the electricity generated in OECD countries, a slight decline from 22.9% in 2006. While capacity increased in the United States, it declined in France and Japan, traditional nuclear power stalwarts. Twelve nuclear plants are currently expected to close by 2012, reducing nuclear power capacity by 7 GWe. However, the ongoing construction of fourteen plants with another thirteen committed to construction will increase capacity by 31.2 GWe, for a net increase of 24.2 GWe.² In China and India, the trends look similar. The 2007 World Energy Outlook projects that both China and India will expand their nuclear power capacity over the next decade. By 2020, China, India, Russia, Japan, South Korea and Ukraine plan to increase their nuclear power capacity by

¹ This briefing does not include nuclear fusion possibilities, which are discussed elsewhere.

² International Energy Agency/OECD, *Nuclear Energy Data: 2008 Edition*, Vol. 2008, Issue 5 (2008): 4.

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116 GW.³ However, those increases, even in combination with other renewable energy sources, will not significantly reduce the emissions of these countries.⁴

The biggest obstacle to a growth in nuclear power remains cost. At present, the cost-per-unit of nuclear power production is higher than for traditional fossil fuels. However, once the cost of mitigation and cleanup is factored in, nuclear power appears quite a bit more competitive, though a dramatic expansion of nuclear power would require a significant financial outlay at the outset.⁵ According to a 2003 MIT study, nuclear light water reactors operating at 85% capacity produce power at 6.7 cents per kilowatt hour. In contrast, pulverized coal plants produce at 4.2 cents per kilowatt hour and even natural gas powered plants with high oil prices only cost 5.7 cents per kilowatt hour.⁶ In an optimistic scenario with normal technological improvements and significant government investment, the MIT study estimates a reduction in the cost of nuclear power to only 4.2 cents per kilowatt hour. In a world of significant efforts to mitigate the release of CO₂, like a carbon tax, nuclear power would become even more cost competitive, though the degree depends on the size of the tax or related constraint.⁷ Subsequent studies and the rising price of oil make nuclear power appear even more cost competitive. The International Energy Agency and others now recommend large growth in nuclear power despite potential risks.⁸

A shift toward nuclear power, given cost issues, could help check the rising tide of CO₂ emissions. The BLUE scenario produced by the International Energy Agency, for example, suggests that planned increases in nuclear power could produce a 6% decrease in CO₂ while contributing up to 25% of power generation by 2050.⁹ While that may not seem like a lot, the BLUE scenario just presumes the continuation and expansion of current efforts, rather than a full-fledged nuclear power push. An even larger expansion of nuclear power, though not currently planned, could play an important role in shifting away from energy sources that produce CO₂ emissions.

³ International Energy Agency/OECD, *Energy Technology Perspectives 2008: Scenarios and Strategies to 2050*, Vol. 2008, Issue 10 (2008): 283.

⁴ International Energy Agency, *World Energy Outlook 2007: China and India Insights* (Paris, France: International Energy Agency, 2007): 54.

⁵ John Deutch (Chair), *The Future of Nuclear Power: An Interdisciplinary MIT Study* (Cambridge, MA: Massachusetts Institute of Technology, 2003).

⁶ *Ibid.*: 7.

⁷ *Ibid.*: 7-8.

⁸ International Energy Agency/OECD, *Energy Technology Perspectives 2008*: 290-291.

⁹ International Energy Agency/OECD, *Energy Technology Perspectives 2008*: 41-42.

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One important constraint on the development of nuclear power is the fear that countries could take the materials and knowledge gained from operating nuclear power plants to build nuclear weapons. Possible paths from nuclear power to nuclear weapons include spent fuel reprocessing, commercial enrichment facilities, and other means that could lead to unwanted countries and groups acquiring nuclear weapons or the knowledge to build them.¹⁰ Proliferation fears represent an important check on the expansion of nuclear power at present. Possible solutions include a strengthened International Atomic Energy Agency (IAEA), new regulations on the use of nuclear power plants, or a fuel bank system, among other proposals.¹¹

Two other significant barriers to an expansion of nuclear power, especially in the United States, remain: public fear over reactor meltdowns like Chernobyl and questions about waste disposal. Public fear over reactor safety is, in part, reasonable, but likely unfounded when it comes to worst case scenarios. Reprocessing reactors have had safety issues in the past. Moreover, nuclear plants, for the most part, are only as safe as the people working at the plants. Variations in worker quality could make some nuclear plants riskier than others for reasons having little to do with the technology.¹² This means a move to expand the use of nuclear power would face some obstacles. However, in a world where governments commit to expanding the use of nuclear power, they would also probably commit to enhanced safety regimes, mitigating the risks.¹³ The highly controversial Yucca Mountain disposal plan and the public debate it created also demonstrates the high levels of sensitivities surrounding these issues. Using nuclear power requires accepting higher levels of nuclear waste, which has to be disposed of somewhere. However, voters appear reticent to support the creation of nuclear waste disposal areas in their districts and states. Despite decades of discussion, the earliest Yucca Mountain would begin receiving nuclear waste is 2017.¹⁴

These issues could threaten any planned expansion of nuclear power. However, with new waves of international investment and interest from private industry, some degree of nuclear power expansion is probably inevitable.

¹⁰ Mary Beth Nitkin, et al., *Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power*, CRS Report for Congress, (Updated 8 March 2008): 2-3. For the IEA, the fear of reprocessing is a significant constraint on recommending even more growth in nuclear power. See International Energy Agency/OECD, *Energy Technology Perspectives 2008*: 68-69.

¹¹ Nitkin, et al., *Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power*: 35-37.

¹² Mark Holt, *Nuclear Energy Policy*, CRS Report for Congress (Updated 28 January 2008): 13-18.

¹³ Deutch, *The Future of Nuclear Power*: 9-10.

¹⁴ Holt, *Nuclear Energy Policy*: 19-20.