THE COMPETITIVENESS OF NEW DOMESTIC NUCLEAR POWER IN THE POST-EPACT, POST-KYOTO PROTOCOL ENVIRONMENT

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INTRODUCTION

The last few years have seen high-profile statements on the promise that nuclear power holds for stemming global warming by the likes of Greenpeace founder Patrick Moore, The Whole Earth Catalogue editor Stewart Brand, Friends of the Earth former chairman Hugh Montefore (now deceased), and Gaia theory creator James Lovelock. Such pronouncements by noted environmentalists certainly have buoyed the spirits of longer-term advocates for meeting projected domestic energy demand with new nuclear power generation. They have done little of substance, however, to address the fundamental market barriers that have plagued the domestic nuclear power industry since circumstances beyond the scope of this article coalesced to halt new facility construction in its tracks some three decades ago.

The market barriers to new nuclear generation have included, among other things, the tremendously high costs of constructing new power facilities; the substantial uncertainties and delays associated with domestic permitting efforts; the risks and frustrations surrounding the nuclear waste disposal quagmire exemplified by Yucca Mountain; and general Wall Street skepticism and a reluctance by individual CEOs to make what some perceive to be bet-the-company decisions on new unit construction.

This article briefly examines whether and to what extent the market environment for domestic nuclear power may be in the midst of a sea-change thanks in part not just to the global warming catalyst, but more particularly to the influences of the Energy Policy Act of 2005 and of the 2005 entry into force of the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

BACKGROUND

In focusing on *new* domestic nuclear power in this article, the importance and long-term successes of *existing* domestic nuclear power should not be overlooked. Stemming from pre-Three Mile Island days—mostly in the 1950s, 60s and 70s—utilities constructed more than one hundred nuclear power stations that are credited with supplying approximately one-fifth of domestic electricity generation today. Power uprates authorized by the Nuclear Regulatory Commission as well as other efficiency improvements have bought the domestic facilities' capacity factor to well over 90%—an astonishing accomplishment relative to the nuclear programs in many other countries.

Because the domestic nuclear plants have become so efficient, however, and because no new domestic nuclear facility has been constructed in decades, literally the *only* way nuclear power will help to meet projected *increases* in domestic electricity consumption (which the Department of Energy estimates will triple by 2050), is through a whole new phase of facility construction. Moreover, many of the existing nuclear facilities are approaching the end of their 40- to 50-year life span, and eventually will

have to be decommissioned, so just to maintain current levels of nuclear power output will require the construction of new plants.

The problem posed by new facility construction obviously is its tremendous up front cost. In reality, the projected costs vary widely depending upon what type of facility is constructed. Generally speaking, however, the up front cost of the types of facilities likely to be chosen for construction in the next decade or two (i.e., massive Generation II and Generation III reactors) will be formidable. New Generation IV plant designs such as pebble-bed reactors will be smaller facilities and will involve reduced capital outlays. Although a pebble-bed design reactor is being constructed as a demonstration plant in South Africa, estimates are that we are probably one or two decades away from commercial production of such facilities.

Moreover, facility construction, while a major cost component, will not be the only cost. Recent combined cost estimates for licensing, permitting, siting, construction loan interest, etc., has been as high as $2320 per kilowatt at the upper end. In addition, liability risks that must be insured against are significant in an industry built on harnessing nuclear power and handling special nuclear materials, spent fuels, high-level radioactive wastes, transuranics and other byproduct materials, all of which pose radiological hazards in the event of accidents or unfortunate events that history has proven can indeed happen.

Operating costs of nuclear power facilities are extremely low in comparison to up front construction and permitting costs, so large facilities carry with them an advantageous economy of scale. That fact makes it easier to justify and accomplish construction in countries where utilities are owned and easily financed by the government. For domestic, investor-owned utilities, however, the appetite for rapid returns in a capital market can serve to blind utilities from *la vista larga*.

Some critics point out that nuclear power is not truly competitive with other energy sources and therefore should not be pursued. For example, in a chapter entitled "Beyond Peak Oil" from Lester R. Brown's recent book, *Plan B 2.0; Rescuing a Planet Under Stress and a Civilization in Trouble* (Earth Policy Institute 2006), the author asserts:

> Although nuclear power has been getting some press attention as an alternative to fossil fuels, electricity from nuclear power plants is costly. On a level playing field with no taxpayer subsidies, nuclear power is dead. If utilities pay the full costs of nuclear waste disposal, of insurance against an accident, and of decommissioning plants that are worn out, the expense of nuclear power will take it out of the running.

Id., p. 39. These and other reasons, the author concludes, "virtually eliminates nuclear fission as a future energy source." *Id.*, p. 40.

At one level, the notion that nuclear power would not be competitive in an open market is borne out by the more thoroughly considered and oft-cited recent study from the Massachusetts Institute of Technology (MIT), *The Future of Nuclear Power: An*

Interdisciplinary MIT Study (2003). The MIT Study estimated that new light-water reactors would produce electricity at a cost of 6.7 cents per kilowatt-hour. By comparison, the study concluded that a new coal plant would produce electricity at a cost of 4.2 cents per kilowatt-hour, and a new gas-powered plant would produce electricity at a cost of approximately 5.8 cents per kilowatt hour (assuming relatively high gas prices endure).

Based on this analysis, the 2003 MIT Study found that "[i]n deregulated markets, nuclear power is not now cost competitive with coal and natural gas." The authors went on to challenge the industry to take advantage of and demonstrate opportunities to reduce new reactor construction costs. The MIT study also recommended that the government offer carbon emission credits and a sharing of "first mover" costs to allow a more competitive position. Other similar ideas emerged from DOE's Nuclear Power 2010 Initiative, including new design advance certifications, site banking and the theoretically more efficient "combined construction and operating license" (COL) process.

THE ENERGY POLICY ACT OF 2005

Following on the heels of the MIT Study, the Energy Policy Act of 2005 ("EPACT"), in addition to extending Price-Anderson, did several fairly significant things to provide incentives for the construction of advanced nuclear power plants. *See generally* M. Herlach and K. Zeswitz, "Nukes Ride Again; the Energy Policy Act Returns Nuclear Energy to Center Stage," Nuclear Energy (January 1, 2006).

First, it extended until 2025 the Price-Anderson Act of 1957. Price-Anderson was originally enacted when nuclear technologies were so new and uncertain that insurance companies balked at providing insurance to the industry, but its provisions remain important to the industry. Among other things, Price-Anderson: (a) limits liability for nuclear incidents resulting from operation of federally licensed private nuclear power plants; (b) establishes a regime of no-fault insurance coverage for the public in the event of a nuclear incident; and (c) provides certain indemnification opportunities associated with conducting licensed activities.

Second, EPACT provides "standby support" for construction of an "advanced nuclear facility" to address a common complaint from the industry about delays in the processes associated with licensing and permitting of facilities. Under these provisions, financial losses are covered for certain NRC-caused delays and for any operational delays resulting from litigation. Covered costs include, importantly, any principle or interest on project debts and delay-based costs of having to purchase power on the market to meet electricity supply contracts.

Third, EPACT provides for certain loan guarantees which DOE may extend for up to 80 percent of project costs for a broad range of technologies—including advanced nuclear facilities—that reduce greenhouse gas emissions.

Fourth, EPACT makes qualifying advanced nuclear power facilities eligible for production tax credits starting at 1.8 cents per kilowatt-hour of electricity generation. Meeting the eligibility for the tax credits, however, can be a tricky proposition.

Fifth, EPACT improves upon special tax incentives that were originally adopted in 1984 relating to the utilities' setting aside of reserve funding for the decommissioning of facilities. Specifically, the Act now allows a tax deduction for reserve fund set-asides sufficient to cover the present value of 100% of projected decommissioning costs.

Last, but not least, EPACT contains an array of provisions offering billions of dollars of support for nuclear and hydrogen energy research and development. The provisions, for example, encourage a Generation IV Nuclear Energy System Initiative to develop promising new reactor designs for commercial application. Other provisions authorize funding for DOE's Nuclear Power 2010 program and provide cost sharing programs to encourage the construction of new plants. Still other provisions direct DOE to pursue a broad-ranging study of the reliability and security of existing nuclear plants.

Soon after EPACT was enacted, a spokesman at the Nuclear Energy Institute reported that the industry is getting what it needs from EPACT, which is a jumpstart for new facility construction. *See* "Power Surge: Renewed Interest in Nuclear Energy," *Environmental Health Perspectives*, Vol. 113, No. 11 (November 2003). According to the spokesman, "The industry's interest is very real." *Id.*

Indeed, despite the reluctance of *individual* executives to "bet the company" on new power units, the EPACT incentives and relatively favorable overall climate for nuclear energy appear to be bringing *consortia* together and springing them into action, led by Dominion Resources, Exelon and Entergy, and the Tennessee Valley Authority. The NuStart Energy Development consortium, which is the largest consortium under DOE's Nuclear Power 2010 program, has already selected sites for advanced nuclear

reactors designed, respectively, by Westinghouse and General Electric. Other utilities and recently-formed joined ventures, such as UniStar Nuclear, are also moving toward licensing and construction of other advanced nuclear reactor designs.

THE KYOTO PROTOCOL

One might question whether the Kyoto Protocol's effectiveness in 2005 has any influence on or relevance at all to the domestic nuclear industry given that the United States is not even bound by Kyoto. The answer appears to be that it does.

The Kyoto Protocol was a 1997 treaty agreement among ratifying countries to reduce the emission of greenhouse gases in order to slow the process of climatic change using the vehicles of greenhouse gas emission permits and the trading of carbon emission credits. According to a spokesman of the International Atomic Energy Association ("IAEA"), until the Kyoto Protocol, the environmental externalities value of nuclear energy could not be translated into financial terms. Now, however, obtaining greenhouse gas emission permits for a new coal-fired plant in Europe can cost more than the coal itself. Domestic investors may see the writing on the wall.

While the United States' withdrawal from the Kyoto discussions may have delayed the internalization of environmental consequences of the domestic fossil fuels industries, one way or another the taxing or pricing of carbon emissions appears to be an inevitable political endgame in the global warming debate. According to two of the authors of the MIT Study, moreover, "[n]uclear power becomes distinctly favored economically if carbon emissions are priced." *See* Deutch & Moniz, "The Nuclear

Option," *Scientific American*, Vol. 295, Issue 3, pp. 76-83. The authors in that article assert that coal-powered electricity costs could reach 9.0 cents per kilowatt-hour, and gas-fired electricity costs could reach 7.9 cents per kilowatt-hour based on various carbon pricing assumptions. The MIT Study, as discussed above, concluded that electricity generated from new nuclear power facilities would cost 6.7 cents per kilowatt-hour, and the authors believe that certain measures could drop that cost to approximately 5.5 cents per kilowatt-hour.

Moreover, the authors conclude that the capture and sequestration of carbon by fossil-fuel plants would not drastically change the competitiveness analysis. While sequestration might avoid a putative carbon tax, the cost of doing that contributes to the internalization of the environmental cost in the same way. *Id.*, citing Socolow, "Can We Bury Global Warming?," *Scientific American* (July 2005).

CONCLUSION

It is no secret that emerging world powers such as France, Japan, China, India, Italy and others have gotten behind nuclear energy in a big way. In France, for example, over 75 percent of domestic electricity demand is supplied by nuclear energy, plus France exports lots of nuclear-generated electricity to its European neighbors. Tiny Japan has more than half the number of existing nuclear stations that are on vast American soils, and supplies 34 percent of its electric energy demand. China and Russia each have embarked on major expansions of their nuclear programs.

While the United States has lagged behind these countries in terms of finding the way to *new* nuclear power generation from new facility construction, the fact that *existing* domestic nuclear facilities are doing their job admirably in the domestic energy supply mix has allowed the nuclear industry to demonstrate a record of efficiency, and nuclear power facilities are a treasured asset in many utility portfolios. However, they are aging and will increasing reach the decommissioning stage as projected energy demand rises in the coming decades.

Thanks to EPACT's well-crafted incentives and the increasing trend toward observance of the environmental costs of greenhouse gas emissions as reflected in the Kyoto Protocol, it appears to be inevitable that new nuclear power generation will increasingly become viewed as a competitive alternative to fossil fuel consumption and worth the risk of direct investments and research dollars to assure a vibrant, safe and environmentally manageable nuclear industry among the mix of other clean energy alternatives which, together with traditional fuels, will assist with meeting future energy demands.