

Honey, I Shrunk the Renaissance: Nuclear Revival, Climate Change, and Reality

The “nuclear renaissance” has proven to be a promotion that cannot pass economic muster. If taxpayer support for a few first mover reactors won’t lead to meaningful climate legislation, it’s time to pull the plug.

by Peter Bradford

“When we act, we create our own reality. And while you’re studying that reality . . . we’ll act again, creating other new realities, which you can study too, and that’s how things will sort out. We’re history’s actors . . . and you, all of you, will be left to just study what we do.”

—Ron Suskind, *Faith, Certainty and the Presidency of George W. Bush*,
N.Y. Times Magazine, Oct. 17, 2004.

This quotation, anonymous in the original article,
has since been attributed to Karl Rove.

For the second time in a generation, the nuclear industry is undergoing a breathtaking transit from overblown hope to crushing disappointment. Once again this cycle is taking place in the context of

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claims that we must have many more new reactors than we are likely to get to avert an overwhelming existential threat – oil imports in the 1970s, and climate change today.

Many in Washington are determined to ignore or override the latest market verdict against new nuclear reactors. Republicans in particular still insist on the need to build 100 new reactors by 2030. Democrats, while setting no such socialistic quotas, flirt with financing mechanisms that would open taxpayer wallets to virtually unlimited exposure to the risks of new nuclear power – risks that private investors want no part of.¹

¹ In the thirty-two years since enactment of the Public Utilities Regulatory Policies Act, not a single new reactor has bid in the hundreds of

The good news is that this time reality has set in before hundreds of billions of dollars have been spent to build plants fated eventually to be canceled or to come on line at costs far above the costs of providing the same energy services in other ways.

There's time to survey the wreckage, to learn from it, and to reaffirm a commitment to nuclear policy as part of an energy policy that serves the public, rather than plunging off on yet another expensive effort to do it the other way around.

Where have all the reactors gone?

The 18 applications to build 27 new reactors that were on file at the Nuclear Regulatory Commission in January 2009 (with five more applications for seven units expected by the end of 2010) were hailed by a compliant press to constitute “a nuclear renaissance.” The original 27 have dwindled to 20 now. All of the proposals are afflicted with some combination of cost overrun and delay. Most are being pursued at extremely cautious rates of expenditure. In no case has a builder made a firm decision to go forward.

This U.S. “nuclear renaissance” took form in the early years of the Bush Administration. In 2001, the so-called “Cheney Energy Plan” recommended that “the President support the expansion of nuclear energy in the United States as a major component of our national energy policy.” Early in 2002 the Department of Energy announced a program entitled

competitive processes through which most electricity generation is now purchased. The same is true in all other countries that use competitive power procurement to decide which types of generation to build.

“Nuclear Power 2010,” the goal of which was to have at least two new reactors completed by the end of 2010. Building on this start, the nuclear industry trade association in 2003 announced a target of 50,000 MW from 40-50 new nuclear units by 2020.²

That same year, an MIT task force produced a report entitled “The Future of Nuclear Power,”³ which acknowledged that new reactors were uneconomic compared to coal and natural gas. The report estimated the cost of electricity from a new reactor at 6.7 cents per kWh in 2002 dollars, compared with 4.2 cents/kWh from pulverized coal, and a range (depending on natural gas prices) between 3.8 and 5.6 cents/kWh from gas-fired plants. The report did not evaluate energy efficiency, renewable energy, or ways to reduce greenhouse gas emissions outside of the electric sector.

The report also suggested four steps that could – if all were successful – reduce the cost of new nuclear to 4.2 cents/kWh, equal to new coal.⁴ No similar savings were postulated

² Richard Myers, Senior Director, Nuclear Energy Institute, *Nuclear Power's Role in Reducing Greenhouse Gas Emissions*, Oct. 22, 2003 (oral and slide presentation, slide 24, at http://www.cleanair-coolplanet.org/cpc/documents/2003_seminar_nuclear_power.pdf).

³ <http://web.mit.edu/nuclearpower/pdf/nuclearpower-full.pdf>

⁴ The four steps were a 25 percent reduction in construction costs, a reduction in construction time from five to four years, a reduction in operating costs and a reduction in cost of capital. The industry has reduced operating costs substantially in the last 20 years, primarily by reducing down time from about 30 percent to less

to occur as to coal or gas plants. Possible legislation increasing the cost of greenhouse gas emissions also favored new nuclear in relation to the alternatives reviewed by MIT, though was not applied to energy efficiency or forms of renewable energy.

Other studies in the same time frame estimated the cost of new reactors to be lower than the MIT report. As Mark Cooper has shown,⁵ these 2001-03 estimates were significantly below the costs of the last reactors completed from the previous round of construction. They were also to prove to be much lower than the industry's own estimates, once potential builders were required to testify in regulatory proceedings that would set the allowable amounts to be collected from customers.

In the years before the higher estimates came out, the low estimates became a key basis for congressional optimism in devising a package of incentives for new reactors. But while low cost and risk estimates might embolden Congress to support new nuclear, these same estimates would cause that prospective congressional support to be pegged too low to be much help. Ultimately Congress would have to double down or admit that the whole venture had been a mistake, an old dilemma that seems to have only one outcome.

than 10 percent. Additional reductions will be more difficult, because the plants must close periodically for refueling and maintenance.

⁵ See, e.g., Mark Cooper, *Policy Challenges to New Reactor Construction: Cost Escalation and Crowding Out Alternatives*, at 13, Ex. II-6, http://www.vermontlaw.edu/Documents/IEE/20100909_cooperStudy.pdf.

The 2003 MIT report recommended that production tax credits be given to “a few first mover plants,” under the assumption that new reactors would soon have to prove themselves to be economically competitive and capable of attracting private capital. A further benefit to production tax credits is that they require production, not just the spending of money on a plant that is later cancelled, as half of all the nuclear plants that received construction permits in the U.S. have been.

In 2005, Congress enacted something close to the MIT recommendation. A production tax credit of 1.8 cents/kWh was to be made available to the first 6000 megawatts of new nuclear generation, and a number of lesser subsidies were also put in place. To be eligible for most of this support, applications for new licenses had to be filed at the Nuclear Regulatory Commission by the end of 2008.

But Congress had inadvertently called the industry's bluff. Production tax credits were useless in stimulating financing of facilities that had a substantial chance of being cancelled before they produced anything. That risk has to be borne by someone other than sophisticated investors, and so began the

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search for the proverbial “dumb money,” in this case funding from taxpayers – protected by the Department of Energy – or customers – protected by state utility regulators.

Over the next two years, Congress funded a program of federal loan guarantees for new reactors to the tune of \$18.5 billion dollars. In addition, several southeastern states were induced to pass laws assuring that customers would be charged the cost of financing new reactors and would have to pay for them even if they were canceled or experienced substantial cost overruns. With natural gas prices then above the high end of the MIT forecasts, the rush of applicants to the NRC was on.

The renaissance euphoria was ill-founded. The power markets that had come to dominate power supply procurement in much of the U.S. (largely as a result of past nuclear cost disappointments) required investors to take the risk of poor performance. Loan guarantees of \$18.5 billion proved to be enough for only two nuclear sites. In the Southeast, willingness of customers to pay higher rates to support a plant that might (or might not) actually come on line many years later was untested.

Much of the press found the “nuclear renaissance” story line too compelling to be derailed by underlying economic reality.⁶ For

⁶ There were, of course, exceptions, notably Mariah Blake and Kate Shepperd at *Mother Jones* and Christian Parenti at *The Nation*. Among major media, Matt Wald at *the New York Times*, Steve Mufson at the *Washington Post* and the editorial board of the *Los Angeles Times* were not taken in. Television on the other hand was solidly in renaissance country.

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one thing, a few environmentalists could be found to attest to the error of their former reservations about nuclear power. The most featured was Patrick Moore. Despite his two decades as a timber and chemical industry spokesman, Moore’s CV managed to persuade the media to refer to him incorrectly as “a founder of Greenpeace.”⁷ Moore and ex-EPA administrator Christine Whitman headed up the Clean and Safe Energy Coalition (CasEnergy) a Nuclear Energy Institute front group largely staffed by the public relations firm Hill & Knowlton. The media proved unable to resist Moore’s story line and rarely described CasEnergy accurately.

The nuclear industry rushed to build political capital from the newly filed license applications. Well publicized conferences for potential contractors and others who might derive economic benefit were held in the vicinity of the announced plant sites. Meetings with newspapers and labor unions touted the economic benefits. Powerful local constituencies for the renaissance were thus created in many congressional districts throughout the U.S.

⁷ Greenpeace was founded in 1970. Moore joined in 1971. He was its President in the late 1970s and left Greenpeace in 1986.

In the southeastern U.S., regulated utilities interested in building new reactors moved to take advantage of newly enacted state laws that shifted risks to customers in ways not replicable in states where electricity is sold through power markets. Six coastal states, from South Carolina westward to Louisiana, became the prospective hosts of 16 new reactors, of which 12 were canceled, suspended or greatly delayed within 24 months.

The most dramatic fiasco has unfolded in Florida. In 2008 the Florida Public Service Commission was quick to certify the need for four new reactors in the 2016 time frame. Controversy over the related rate increases has since made a political football of the Florida Commission. Estimated completion of the new reactors has been delayed at least five years and their cost estimates have increased substantially.⁸

⁸ Only Twain or Mencken could do justice to the events that continue to unfold in the Sunshine State, where utility commissioners must be chosen from a list approved by a nominating council consisting entirely of the same state legislators who passed Florida's law boosting nuclear construction. In rapid sequence, Governor Crist – in the midst of a difficult senate campaign – admonished the PSC not to approve everything the two utilities seeking to build nuclear plants were asking for. The PSC then voted down much of the requested increases. The nominating council, for the most part friendly to one of Crist's opponents, refused to renominate the four commissioners who voted against the increase. It is not clear what the nominating council consider to be sound qualification. One of those seated and then unseated over the space of a few months operated a strip club while the nominating council said he was working for a county sheriff, <http://www.postonpolitics.com/2009/10/crist-utility-reg-pick-owns-hot-panhandle-nightclub->

Because the rush of NRC applications was driven by the arbitrary 2008 deadline for federal incentives rather than by any real need for power, no new applications have come in for more than a year. All of those once scheduled for 2010 have been pushed into 2011, but 2011 is a synonym for “probably not.” A graph of renaissance applications looks like a drawing of a python that has swallowed a pig – a flat line, a bulge and a flat line – scarcely the pattern for a sustainable revival.

This artificial rush for licenses for individual projects has unsettled the NRC's new one-step licensing process, once touted by the industry as a likely source of cost reductions. The former two-step process left much of the licensing review until the plant was almost complete, a process with obvious shortcomings but necessary in the case of projects that made many changes during construction. The new process contemplates “standard” designs to be approved in generic rulemakings, in advance of individual projects applications. These designs would then be referenced in site-specific proceedings, in which the designs would not be subject to challenge. Once the site-specific license issued, no further licensing review would be needed, as long as the project is built as licensed.

Several industry leaders advised a slow pace of initial applications while the new licensing process was tested.⁹

doesnt-work-for-sheriff/. Governor Crist defended the nominee, asking “what's wrong with owning a small business?”

⁹ In January 2008, then-NRC Chair Dale Klein stated a preference for a scenario in which

Like MIT's suggested "few first mover" plants, this wisdom went unheeded both in the industry and in the Congress. When the 2008 site-specific gold rush was complete, most standard designs were still years from approval, but the NRC was forced to divert scarce staff to the docketing and review of the site-specific license applications. To make matters worse, both the generic designs and the site-specific applications were incomplete or flawed in ways that required further delay and revision.

Complicating matters further, precipitous declines in projected electricity market prices have left prospective nuclear plant builders needing to seek profit selling nuclear kWh costing twelve cents or more into markets with costs about half of that on average. Only much higher prices for fossil-fueled electricity or massive subsidy can revive hopes for new reactors in these markets. Even then, the falling cost of low carbon competitors, especially energy efficiency, means that new nuclear may not be competitive for a long time. Exelon CEO John Rowe told Bloomberg News "We think natural gas will stay cheap for a very long time. ... As long as natural gas is anywhere near current price forecasts, you can't economically build a merchant nuclear plant."¹⁰ Builders of

construction "started small," with one demonstration pressurized water reactor and one boiling water reactor, allowing the NRC to put its "A-Team" on each project. In April, the Nuclear Energy Institute's Senior Vice President (now CEO) Marvin Fertel told an American Bar Association conference that he hoped the industry would advance a first group of new reactors consisting of no more than "four to eight units."

¹⁰ The article, found at <http://www.dailyherald.com/story/?id=406979>,

projects in states with active power markets now acknowledge that federal loan guarantees alone will not be enough to enable them to go forward. While Constellation Energy alluded to disputes over loan guarantee terms in its October 9, 2010 decision to "shelve" its Calvert Cliffs project, the project's real economic problem is that the risks are too great and that power will be too expensive to sell.¹¹

continues, "Rowe said that the price of natural gas would have to rise to \$8 per million British thermal units and permits for emitting a ton of carbon dioxide would have to be \$25 to make the power prices from new merchant reactors competitive with gas-fueled plants ... Absent a price on carbon dioxide emissions, gas would have to rise to \$9 or \$9.50 to make the reactors economically attractive, Rowe said." Exelon's estimate of the unfavorable position of new nuclear reactors versus other low carbon alternatives is set forth in Rowe's May speech to Resources for the Future entitled "Fixing the Carbon Problem without Breaking the Economy," especially the two chart exhibits.

¹¹ Hence Constellation's astonishing claim (as reported in the Oct. 9 *New York Times*) that a DOE requirement that the builders commit to finishing the project and buying 75 percent of the output is "too onerous." Constellation Energy CEO Mayo Shattuck III stated on July 30, 2010, "[T]he conditional loan guarantee is a necessary hurdle, but not the only one which must be addressed before any shovel goes into the ground. ... The market signals to build a baseload plant of any kind – let alone nuclear – have suffered significantly since we started the project four years ago. ... Natural gas is now under \$5 [per thousand cubic feet], not at \$8, and the expectations for carbon pricing in the marketplace keep getting pushed back. Demand destruction has been pronounced, while interest in demand response has increased. At the same time, due to the global push for new nuclear, construction costs have not fallen at the same pace as fuel and power prices."

Democrats supported new reactors in part to gain Republican support for a climate change bill. But the Democrats' bargaining was so inept that they became nuclear Sancho Panzas to Republican Don Quixotes.

Washington's resolute reaction to the shrinking renaissance affirms the brilliance of Hans Christian Anderson's ending to his fable "The Emperor's New Clothes":

"But he has nothing on!" everybody shouted at last. And the emperor shivered, for it seemed to him that they were right; but he thought within himself, "I must go through with the procession." And so he carried himself still more proudly, and the chamberlains walked along holding the train which wasn't there at all.

Some in Congress blamed regulators for the situation.¹² Others asserted that the

<http://www.eenews.net/public/climatewire/2010/07/30/1>.

The rejection of new nuclear reactors by the power markets that emerged from PURPA in the 1980s and electric restructuring in the 1990s is poignant, for it was largely the nuclear cost overruns of the 1980s (and the desire of large industrial customers to avoid those costs by shopping for electricity) that brought on PURPA and electric restructuring in the first place.

¹² For example, Congressmen Joe Barton and Greg Waldren demanded that NRC Chair Gregory Jaczko "explain his resistance to nuclear

Department of Energy's slowness in processing loan guarantee requests was to blame. The Administration's withdrawal of the Yucca Mountain application was cited by some as outweighing President Obama's strong verbal support for additional nuclear power.

Throughout 2010, the Senate has struggled to reinflate the renaissance. For Republicans, this is faith-based energy policy. They promised 45 reactors by 2030 in the 2008 presidential campaign. Having lost, and with nuclear economics worsening by the week, they doubled down, proposing a goal of 100 new reactors by 2030.¹³

For Democrats, extensive support for new reactors was viewed in part as bait with which to troll for Republican support for climate change legislation. However, Democratic bargaining – if it can be called that – has been so inept that Democrats have become nuclear Sancho Panzas to the Republican Don Quixotes (a metaphor enhanced by the vigor with which lead Republican spokesman Lamar Alexander actually does fulminate against windmills).

Even after Republican Senator Lindsay Graham announced that he would not support what until then been the Kerry-Lieberman-Graham climate bill, Kerry and Lieberman put forth a bill that was top-

power," <http://republicans.energycommerce.house.gov/News/PRArticle.aspx?NewsID=7353>.

¹³ See, e.g., Senator Alexander's "Blueprint for 100 New Nuclear Power Plants in 20 Years," issued on behalf of the Republican Senate Republican Conference, July 13, 2009.

heavy with nuclear subsidies and licensing shortcuts. The Administration, for its part, continued to utter open-ended endorsements of new nuclear without acknowledging the need for limits on the extent of subsidies or of the shortcomings of overly expensive nuclear power as a climate change buffer or a cost-effective creator of new jobs.

Energy Secretary Steven Chu's contribution has been an uncritical embrace of the concept of loan guarantees, likening them to co-signing for one's child's automobile. He has added his expectation that once the first few plants come on line, "on time and on budget," private capital will become available. But this won't happen as long as "on budget" also means "more than twice the market price." Whether Chu's position that the industry must become self-sufficient after an initial round of support will survive either the current congressional debates or the inevitable failure of the industry to do so is a topic on which dignified silence remains the order of the day.

Did the nuclear renaissance jump, or was it pushed?

In truth, the nuclear renaissance has always consisted of the number of plants that government was willing to build. This is true not only in the United States but also in every other country now building new nuclear units.¹⁴ The 2003 MIT study put the best

¹⁴ There are 60 new reactors currently under construction in the world. Twenty-three are in China, 11 in Russia, five in Korea, four in India. None of these four countries chooses its nuclear capacity through free market processes. No other country has more than two.

possible face on the rationale for federal support with its list of possible cost reductions that would ensue.¹⁵ But at today's nuclear cost estimates and the price of alternatives, these are not nearly enough to make new nuclear competitive. This remains true under any price on carbon likely to emerge from legislation along the lines of the Waxman-Markey bill passed in 2009 by the House.

The struggle for a nuclear renaissance has been and remains a struggle over allocation of economic risk. U.S. power markets allocate that risk to investors and lenders, who will not put up the money for new nuclear. The aforementioned southeastern states decided to allocate that risk to their customers, some of whom have begun to rebel. Congress is being asked to allocate it to taxpayers. However, with each new reactor requiring the allocation of close to \$100 in risk exposure to every family in

¹⁵ MIT has produced two further works urging incentives for first mover plants. The 2010 undertaking "The Future of the Nuclear Fuel Cycle" defined "first mover plants" as the first 7-10, with the subsidies ended at that point. The quality of the economic analysis in the MIT work declines over time, with the 2010 volume merely reiterating a cost estimate from its 2009 update of 8.4 cents per kWh (based on \$4000/kW installed capacity costs in 2007 dollars) despite the fact that the industry's own low estimates range upwards from 11 cents/kWh. MIT has now abandoned its 2003 insistence that production tax credits are superior to loan guarantees and compares eventual new nuclear favorably to natural gas "at fuel prices characteristic of most of the last decade." Serious analysts of gas prices, however, do not use any such yardstick because they foresee extended low gas prices resulting from increased supplies.

America, this is proving a tough sell.



The next generation? Or a stillborn renaissance?

What next?

Surely it is time to abandon the demand of many in the industry and in Congress for taxpayer financing for an immediate full blown nuclear renaissance. The industry must first prove that it can deliver cost-effective reductions in greenhouse gas emissions. Its ability to lay a claim on the public purse rests entirely on the proposition that it has a significant role to play in combating climate change. That claim in turn rests on the proposition that new plants can be built at a cost that will enable nuclear power to compete well enough to attract private capital.

There are excellent reasons to doubt these claims. Even within the industry, some innovators are pushing forward next-generation designs for small reactors, for travelling wave reactors, for thorium-based fuel cycles, for converter reactors running on nuclear waste. These proposals call into question the wisdom and feasibility of trying to base a revival on locking into an

unwavering commitment to standardizing current designs.

Those who assert that the problem of climate change is so urgent that “we have to do everything” (or, another popular substitute for serious thought, “seek silver birdshot, not silver bullets”) overlook the fact that we can never afford to do everything. The urgency of world hunger doesn’t compel us to fight it with caviar, no matter how nourishing fish eggs might be. Spending large sums on elegant solutions (especially those with side effects) that provide little relief will diminish what we can spend on more promising approaches.

But if a modest demonstration program is what it takes to achieve some movement on meaningful climate change legislation, perhaps some consensus could form around a commitment to support half a dozen new reactors and no more – a coalition between those who think such a demonstration will reignite a self-sustaining nuclear industry and those who are sure that it will not. What has been missing has been a clear commitment to the proposition that if these plants fail to pass meaningful market tests, that’s the end of it. It’s time to try other things – perhaps including other nuclear things – but at least things that move us further along the road to meaningful greenhouse gas emissions than this pointless struggle over a fictitious renaissance. ■