

Is Nuclear Power a Solution to Global Warming and Rising Energy Prices? October 6, 2006

Speaker Abstracts

Ed Cummins

The investment in both time and money in a new nuclear power plant design demands resource commitments on the order of \$500 million over a period of approximately fifteen years. When this design maturity is reached, there remains a need to achieve a licensing maturity which demands an incremental commitment of about five years and \$50 million. For some designs, the licensing time commitment can be parallel with the design period. A power company that commits to a new nuclear plant today can expect plant commercialization in 8–10 years, depending on the design selected and licensing maturity of the selected plant design. The next generation of nuclear plants, therefore, are the plants that are currently being licensed and marketed. An assessment of the design and licensing maturity of current plants (AP1000, ABWR, ESBWR, EPR, ARC1000, and APWR) will be discussed, as will a general assessment of the maturity of new designs such as PBMR, IRIS, and Generation IV concepts.

The major conclusion is that the long lead times for plant commercialization indicate that the plants for the “next generation” are the plants being licensed today. It will fall to future generations to implement new design concepts.

Judi Greenwald

Addressing the challenge of global climate change will require a sustained and comprehensive commitment to climate-friendly policies and investments throughout the world. Such policies and investments must be focused on enabling a transition to a low-carbon economy through a significant reduction in annual greenhouse gas (GHG) emissions by 2050. A commonly stated goal is to stabilize the atmospheric concentration of carbon dioxide (CO₂) at twice its pre-industrial level—that is, 550 parts per million or less. Such a “decarbonization” in the context of increasing global demand for energy would necessitate an increase of roughly 100–300 percent of present-day worldwide “primary power” consumption from non-CO₂-emitting sources such as renewables, nuclear power, the use of fossil fuels with carbon capture and sequestration, and energy efficiency improvements.

Accordingly, it is important to consider any and all low-carbon technology options—including nuclear power—as potential contributors to a low-carbon future. Due to the long-lived nature of capital stock in the energy sector and the effect that early choices have on future GHG emissions, it is important to focus serious policy and investment attention on low-carbon energy sources as soon as possible. Public policies that put a price on GHG emissions will have a major impact on the cost of nuclear power compared to other power sources. However, if nuclear power is to play an important role in meeting the long-term climate and energy challenges facing the world, it must address several daunting issues: proliferation, waste disposal, cost, and safety. The Pew Center is

supportive of designing public policies and making public investments to solve nuclear power's problems. However, it remains to be seen whether these challenges can be dealt with to the satisfaction of the public so that nuclear power could play a major role in a low-carbon future.

Paul Joskow

Investment in new nuclear generating capacity depends upon whether potential investors expect that electricity produced from nuclear power plants will be less costly than power produced from substitute generation sources, especially coal. The economic attractiveness of nuclear power investments depends upon expected construction costs, financing costs, the competitive and economic regulatory framework in different states, the credibility of the new Nuclear Regulatory Commission (NRC) licensing framework, risk-sharing arrangements between investors and vendors, future regulations governing CO₂ emissions, government subsidies, public acceptance, and other considerations. There is significant uncertainty about many of these factors. The first tranche of investments in new nuclear plants will be heavily influenced by incentives contained in the Energy Policy Act of 2005 and are likely to be on existing sites and in states that have not adopted competitive electricity market models. The most important long-run considerations are likely to be whether new nuclear plants can be constructed at prices at or below \$2000/kilowatt, and when the United States adopts policies to place a price on CO₂ emissions.

Edwin Lyman

If nuclear energy is to play a significant role in the future, the unique safety and security risks posed by nuclear energy technologies must be fully addressed. If a Chernobyl-scale catastrophe were to occur in the United States, whether caused by a severe accident or a terrorist attack, the public would have little appetite for an expansion of nuclear power. Therefore, development of reactor designs that have greatly enhanced safety margins relative to current designs should be a priority.

However, safety enhancements usually cost money. But in the drive to increase the economic competitiveness of nuclear plants, most of the reactor designs that have been recently certified or are undergoing review by the Nuclear Regulatory Commission (NRC) have been developed with an eye toward greatly reduced capital costs. In some cases, this has resulted in reduced safety margins. Although these designs are estimated to have a much smaller probability of experiencing a core meltdown than current reactors, these estimates are based on calculations that have large uncertainties. Moreover, no matter how low the accident risk of a reactor design may appear, the reactor is still vulnerable to sabotage. While the NRC has enacted a new policy that requires consideration of security issues in reactor design, it is not clear that the policy will be implemented soon enough to have a significant impact on the next generation of plants.

Looking further ahead, the Department of Energy (DOE) has proposed a major change in the U.S. approach to nuclear energy (the "Global Nuclear Energy Partnership") that would involve the deployment of reprocessing plants to extract plutonium and other

potentially usable materials from spent nuclear fuel, and fast-neutron reactors that would use fuel fabricated from these materials. In addition to the enormous cost to taxpayers and the proliferation and nuclear terrorism risks of such a scheme, there are also serious safety risks associated with both reprocessing plants and fast reactors. If the DOE forges ahead with this plan, it would greatly increase risk and would likely engender massive public opposition, making the prospects for a sustainable increase in nuclear energy generation even more remote.

Ernest J. Moniz

The MIT interdisciplinary study on “The Future of Nuclear Power” was published in 2003 and stimulated considerable debate. The study focused on technology and policy options that would enable nuclear power to be deployed at a scale large enough to materially impact greenhouse gas emissions. In these remarks, I will review and update the study’s principal findings and recommendations with regard to nuclear power economics, nuclear waste management and the role of spent fuel reprocessing, and nuclear weapons proliferation risks associated with global nuclear fuel cycle expansion. I will also discuss highest priority actions for the United States.

Christopher Paine

Existing nuclear power plants can compete favorably with fossil-fuel plants because they have relatively low operation, maintenance, and fuel costs, and their excessive capital costs have long since been forcibly absorbed by ratepayers and bondholders. But the continuing high construction costs of new nuclear power plants make them uneconomical, and there have been no successful nuclear plant orders in the United States since 1973. The most economically efficient way to address the risks of new nuclear power plants is to internalize the costs of avoiding or mitigating these risks in the market price of electricity and fuels. The United States can do this effectively by regulating both carbon dioxide emissions and the unique risks posed by the nuclear fuel cycle, and by letting the “invisible hand” of the market deliver the lowest-cost technologies for providing energy services that meet minimum universal criteria for environmental sustainability, public health, and energy security.

The nuclear industry to date has rejected this “level playing field” approach. Despite public expenditures of some \$85 billion on civilian nuclear development over the last half century, nuclear lobbyists continue aggressively to seek and obtain additional federal subsidies, so that investors in new nuclear power plants can earn a return on what would otherwise be a dubious commercial investment. A national global warming emissions cap-and-trade system would materially assist the economic case for nuclear power, but the nuclear industry has not yet been willing to openly advocate for such a system. This suggests either that the industry privately lacks confidence in its own optimistic claims that nuclear energy is economically qualified to play a major future role in displacing carbon, or that big companies prefer U.S. taxpayers to shoulder the lion’s share of the near-term risk while they carefully orchestrate a future tradable carbon allowance framework that lets them use these subsidized new nuclear plants to prolong the profitability of their polluting coal-fired plants.

If subsidized “first mover” nuclear power plants fail to produce major design and production innovations that significantly reduce the high capital cost of subsequent nuclear power plants, then private investors will return to looking unfavorably on the industry once the current tax credits expire. The cost growth already occurring in the new Areva “Euro-reactor” under construction in Finland is not encouraging. A likely total project cost near or above \$4 billion for this new reactor is certain to scare U.S. utilities and capital investors from making an aggressive new commitments to nuclear energy. A national cap on carbon emissions would certainly help reduce nuclear’s significant current cost differential with large coal- and gas-fired power plants, but it will not ensure that nuclear power stays competitive with smaller, simpler, cheaper, cleaner, faster, and more flexible distributed sources of electric power generation.

Charles W. Pennington

The next generation of nuclear plants will be another generation with spent nuclear fuel. How do the storage and transport considerations with spent fuel affect the implementation of NewGen? Does present storage and transport safety of spent fuel bode well for the generation to come? What policy issues and public perceptions must be addressed, starting now?

My presentation will offer an overview and assessment of where we are today on spent fuel storage and transport, then proceed to look at how we fix that special “nuclear inertia” which may become involved in the public and political embracing of NewGen that current polling cannot yet discern.

William Tucker

“Terrestrial energy” is a term that redefines nuclear power in conjunction with solar energy. Nuclear energy is our only source of energy that is *not* derived from the sun. Oil, gas, and coal are all fossilized solar energy. Wind, hydro, and photovoltaics are all driven by solar energy. But nuclear power stands apart. It is derived from the earth. The radioactive breakdown of uranium and thorium within the earth are its source of internal heat, which raises the temperature of the earth’s core to 6,000 degrees Fahrenheit, the same as the surface of the sun. “Geothermal” energy sites occur where groundwater comes in contact with the earth’s radioactive heat, producing steam. A nuclear reactor is simply a geothermal site brought under better control.

Terrestrial energy—“nuclear reactors”—provides the world’s best base load electric power. Nuclear reactors can run for almost two years without stopping. Solar electricity, on the other hand, is extremely intermittent and unpredictable. Fortunately, it peaks when it is most needed—on hot summer afternoons when air conditioning demands are the highest. Together, the nuclear and solar industries should form an alliance to bring the externalities of fossil fuel burning under control by supporting a national carbon emissions trading system. Together, the two industries can rescue the planet from the threat of global warming.