

The Future of Nuclear Power in the United States

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The future of nuclear power in the United States appears good. There is a renewed interest in the technology from all sectors of the population – the politicians, the government, opinion leaders, the industry, and the public. However, today there are still no utilities in the United States that are willing to build already approved and certified advanced light water reactors. Recently, the newly named Chief Executive Officer of one of the larger nuclear utilities, Southern Company, repeated that new nuclear plants were not in his plans for new generation. In the United States, you have probably read that there are significant shortages of electric generation in California with blackouts occurring. Today, there is no utility or generating company considering building a nuclear plant to meet the demand in California. The public perception of nuclear energy in the United States is generally positive in terms of supporting the continued operation of existing nuclear plants and for new plants but not in their backyard.

It is important to understand why utilities or generating companies are not considering new nuclear plants. The most common reasons given are that they are too expensive to build; take too long to build; are a pain in the neck to operate in a regulatory environment that is too uncertain; they are not competitive relative to natural gas; and the financial community thinks they are too risky. This list is quite overwhelming even for the most courageous CEO and board of directors of a company.

However, there are also many reasons for building new nuclear plants. The price of natural gas continues to increase on world markets. This increase in price is causing tremendous hardships on people and businesses in terms of what they are paying for electricity. In California for example, the price of electricity has increased by over a factor of three in the last year and going higher. In the deregulated market, price stability is very important for companies who sell and buy electricity and for the economy. Two US utilities in California are on the verge of bankruptcy due to increasing electricity prices, in part driven by the high price of natural gas. What nuclear offers is fuel price stability that will

shelter the producer and consumer from volatile fuel prices that drive the cost of electricity from fossil plants.

There is also the emerging and slowly more believable issue of global warming despite President Bush's recent assertion that it is not important. While it is very hard to prove that the increasing global concentration of CO₂ is causing global warming, it is an undeniable fact that CO₂ concentrations are dramatically increasing in the environment. Does this cause global warming? I do not know. What I do know is that the ice sheets in the arctic regions of the planet are visibly melting. Is that a problem? Many people think it is. It is also undeniable that nuclear plants do not introduce any measurable quantities of CO₂ into the environment. At some point, this message of the environmentalists will be heard in policy circles and the environmentalists will see that to stabilize the emissions of CO₂ and other greenhouse gases, the only major source of energy is nuclear energy. They know this now, but they can not accept nuclear energy yet. My prediction is that they will sooner or later.

What is the real problem then? My opinion is that we simply do not have a **product** that addresses the concerns of the utilities and meets the expectations of the public for a "safe" nuclear energy plant. The biggest concern of the generators is that new nuclear plants are not competitive on a cost per kilowatt-hour basis. Even if competitive on this basis, the traditional utility accounting of levelized cost over the life of the plant is no longer the way new investments are judged in a deregulated market. What companies are looking for are internal rates of return on their investments and how to earn money right away without putting a large amount at risk for a long time without any earnings. This implies that we need to build plants faster – in two to three years from start of construction to operation; that the initial investment can not be measured in terms of billions, but millions; the plants must be simple to operate and maintain such that the staffing is small and that the ongoing operations and maintenance costs must be low; and that the plants must be demonstrably safe for the regulator and public to be confident in the technology. These are just a few of the criteria that define the new nuclear energy plant **product** that might have a chance of actually being built.

In the United States, there is a renewed interest in nuclear energy research. In the last three years, the Congress of the United States has appropriated about \$ 25 million each

year under the Nuclear Energy Research Initiative (NERI) for universities, national laboratories and industries to identify promising new nuclear energy technologies. This program was largely undirected with no objective relative to development and deployment. Under pressure from the American Nuclear Society and others who actually want to see nuclear plants built, Congress funded a “Roadmap” to develop “Generation IV” nuclear plants. Generation IV plants are defined as new nuclear plants that are competitive, safe, proliferation resistant, address nuclear waste disposal problems and are sustainable for the long term. For reference, Generation III plants are those advanced light water reactors that have been certified, but for the US market are too expensive such as the ABWR, System 80+, and AP 600.

The unfortunate aspect of the Roadmap is that it is focused on having technology available in the 2020 to 2030 time frame, well beyond the interest of utilities and the need for power. In response, the DOE included an element of the Roadmap that is entitled “Near Term Deployment” which is focused on deployment in the 5 to 10 year period but it will be left largely to the private sector to develop.

The technologies under consideration for the 2030 time frame include the advanced versions of water, liquid metal, including sodium and lead/lead bismuth, gas and others. The purpose is to identify what research is necessary that needs to be supported by the government to allow the private sector to develop the technology for commercialization. The two year process calls for identifying those technologies that can meet the Generation IV criteria by assembling whatever information is available and then down-selecting to several that the government will support in terms of research for private sector deployment in twenty to thirty years. The process recently started with a workshop of technical experts in Denver. It is planned to include international members from those countries that have agreed to participate at the next meeting in May.

A champion for nuclear energy and nuclear science and the contribution that both can make to society is Senator Domenici from the state of New Mexico. I am sure that his name is familiar to most of you. The Senator called for a new nuclear paradigm in 1997 in terms of assuring that nuclear science, technology and energy played its proper role in society. Senator Domenici has followed up on his commitment to see that nuclear energy

is given a fair chance to compete. The Senator is the sponsor of a major new piece of legislation which calls for, among many other things:

1. An evaluation of what it would take to complete unfinished nuclear plants;
2. An aggressive deployment strategy for Generation IV nuclear plants;
3. An improvement in Nuclear Regulatory Commission licensing procedures for advanced nuclear energy plants;
4. Environmental credits for nuclear generation;
5. Early site demonstration programs. and most interestingly;
6. A provision that withholds federal funds from domestic and international organizations that exclude nuclear energy from consideration in projects they support.

If this bill is enacted, it will provide a strong indicator of congressional support for nuclear energy that is essential for its future deployment. The support, in my opinion is there. All it needs is some leadership to focus it. What amazes me in my visits to members of Congress and in discussions with opinion leaders all over the country is how they perceive nuclear energy. Most will tell you that they support nuclear energy, but their constituents don't. What is surprising is that public opinion polls show that the public supports nuclear energy so where do these leaders get their information – from the people who contact them – mostly the opponents.

If one examines the energy policy of the new administration in Washington, it is clear that President Bush wants to drill for more oil, gas and mine coal. In response to concerns about a lack of a cohesive energy policy, President Bush convened a special cabinet level task force under Vice President Cheney to develop an energy policy for the nation. Recent statements by the Vice President and other leaders of Congress suggest that there will be a strong nuclear element in future US energy policy to address energy, economy and environmental needs.

This new interest in nuclear energy by the Bush/Cheney administration has an interesting and instructive origin. At a briefing held by the vice president with republican members of Congress on the work of his task force on energy, he was questioned why there was **not** a role for nuclear energy mentioned. He was surprised by the question and asked the

audience whether they felt that nuclear should be given a major role. Over 75% of the 40 members of Congress in attendance stood up and said **yes**. Cheney was shocked to say the least. The lesson learned from this story is that even our highest political leaders are often unaware of the support for nuclear energy even in political circles. What it takes is leadership. Hopefully we will see leadership on this issue in the United States which will transform nuclear energy from an option of “last resort” to an energy source of choice.

I am excited and optimistic about the future for nuclear energy in the United States. It is important that we have a product that meets economic and safety expectations of the public. The US efforts are aimed in that direction. You may have read that at least one US utility wants to build a new nuclear plant. Exelon under the leadership of Corbin McNeill is supporting the South African pebble bed reactor project which is striving to start construction of a new 115 Mwe high temperature helium gas reactor in the next two years. If this project is successful, Exelon has significant expansion plans in the United States. At present, our Nuclear Regulatory Commission is reviewing what it would take to review their application should it be filed. At MIT we are working on this type of reactor as well in addition to many other advanced reactor concepts including fast spectrum gas reactors, lead or lead bismuth, advanced water fuel cycle plants to name just a few.

In summary, I believe we are truly on the verge of a renewal of nuclear energy because political leaders are unafraid of speaking in favor of this obvious option to address energy and environmental needs. We are working on a **product** that can be competitive and demonstrably safe that will gain the support from responsible environmental organizations and the public. Our challenge is to develop the technology to allow for trouble free deployment.