Budapest Speech
April 19, 2007

New Nuclear Generation and U.S. Fuel Cycle Policy

These are interesting and exciting times to be in the business of producing and selling electricity in the United States. They are important times as well. Electric demand is growing and much of the existing generating capacity is aging. Simply using current trends, it is projected that electric demand in the U.S. will require the addition of at least 45 percent additional generating capacity over the next 25 years. It is a time for making important decisions. Important decisions about how to meet that demand. Important decisions about the types and amount of investments needed to ensure we meet that demand as precisely as we can.

Because there are so many variables and uncertainties associated with trying to predict the future, each of these decisions must be based on assumptions and beliefs. As you survey the wide array of stakeholders in this discussion, not unexpectedly, you get a wide array of opinions and viewpoints. At one end of the spectrum are those who would recommend using a traditional portfolio of generating options – coal, gas, nuclear – making their decisions using the well-established integrated resource planning approach.

On the other end of the spectrum, there are those who advocate, as one senior policy advisor for a United States Senator told me, that there is no need to build any new coal or nuclear plants, because he believes a combination of renewable sources, conservation and energy efficiency will cover all of the country's electric energy needs for the foreseeable future. That is a pretty broad spectrum when you consider the relative level and type of investments on either end. And, of course as we all well know, these decisions are being made under an umbrella of concern about the effects of greenhouse gas emissions on our climate.

As we play out these various scenarios with respect to nuclear energy – after all this is a nuclear conference – there are two distinct ends to the range of opportunities. On one end there is a scenario with little or no construction of new nuclear generating facilities, with the current fleet being operated to the end of its current life and then retired. Call it an unforced nuclear phase-out. At the other end is a scenario where the contribution of renewable energy sources is limited, and anticipated gains from energy efficiency and conservation initiatives fall far short of expectations. Additionally, future legislation in the U.S. might place heavy constraints on the use of fossil fuels, thereby making them highly unattractive as an energy source. Under this scenario, the use of nuclear power would be expanded dramatically, not only becoming the dominant source of electric power, but also producing process heat for uses such as hydrogen generation and oil sand reclamation. In this scenario, there is also a longer-term migration from thermal reactors to fast spectrum reactors that can both breed new fuel and burn long-lived actinides.

Either of these scenarios is conceivably possible; but, the more likely scenario may actually fall somewhere between the two. The Electric Power Research Institute and others have published what I have heard referred to as wedge charts that show how a portfolio of initiatives can bring carbon emissions back to current levels over the next 25 years. These scenarios propose a balanced role for nuclear power that I would characterize as extended nuclear power, with current technologies advancing well into this century.

This scenario already appears to be playing out its early stage in the U.S., where utilities have announced plans for as many as 30 new nuclear units at approximately 20 sites. In February 2005, my company—Duke Energy—publicly announced that we had initiated planning efforts to evaluate the preparation of an application for a new nuclear plant to serve our customers in North Carolina and South Carolina. We have subsequently selected the

Westinghouse AP1000 reactor technology, selected a site in South Carolina—and are currently on track for submitting an application for a combined construction and operating license to the U.S. Nuclear Regulatory Commission prior to the end of the year for this plant—the William States Lee III Nuclear Station.

But again, we really don't know today precisely what will happen in the future, so we know we may have to adjust our plans as our initial assumptions either materialize or don't play out. We will all make those adjustments, with individual players each having varying degrees of success, based on how closely their assumptions matched real-world results and how effectively they applied those assumptions in their planning. That is simply the business we are in and how it works.

But my objective today is not to try and look into a crystal ball and predict a future energy supply mix, or even focus explicitly on the potential role of nuclear power in that mix. What I would like us to think about today goes beyond just the nuclear power scenarios—I want us to think about how each of these potential scenarios plays out in terms of the overall nuclear fuel cycle policy in the U.S.—and more specifically, the approach to the back end of the fuel cycle. Just as we know that the future role of nuclear power in the U.S. is not a fixed solution, neither can we let ourselves think there is a fixed solution to the question of used fuel management and high-level radioactive waste disposal. With respect to the nuclear fuel cycle, we need alternative back-end strategies that can be aligned with the potential array of roles that nuclear power can play in the future.

On one hand, if the future of nuclear power in the U.S. is simply running the existing fleet of power reactors to the end of their current economic lives, then the most logical approach to the back end of the fuel cycle is to remain solely focused on the completion of the licensing and construction of the Yucca Mountain repository in Nevada. We would amend the current politically-established capacity limit and license the facility to accept all commercial and defense used fuel and high-level waste that scientific data says it can. Studies have shown that Yucca Mountain can potentially accept all of the used fuel the current U.S. fleet will produce. We will commit to watch it and monitor the performance of the repository for the next few centuries and then close the door and walk away. End of story, for both nuclear power and its legacy waste. Looking back to the 1980s, when the Nuclear Waste Policy Act was enacted in the shadow of the accident at Three Mile Island Unit 2, it may well have been the right decision for that time in the

U.S. Yucca Mountain is well suited for used fuel storage—no scientific evidence has surfaced that demonstrates otherwise. From a final waste disposal standpoint, the public will be well protected by this approach.

Now, if we consider the other end of the future nuclear range of opportunities and consider a scenario where nuclear power expands to whatever practical limit it reaches, then the appropriate back-end fuel cycle strategy could be very different. In this scenario, fissile materials are recovered from spent fuel from thermal reactors and used in fast spectrum reactors that not only produce additional fuel, but also to destroy radiotoxic actinides. The amount of long-lived minor actinides buried in a geologic repository is minimized, as is the heat load per metric ton of heavy metal disposed in the facility.

This actually sounds a lot like the U.S. Department of Energy's Global Nuclear Energy Partnership, or GNEP, program, where it states that with the accelerated deployment of advanced fuel cycle fuel technologies and fast spectrum reactors, the Yucca Mountain repository will have sufficient capacity to serve the country for the rest of this century. In this scenario, Yucca Mountain is again the back-end solution.

But faced with the practical reality of actually meeting electric demand and addressing global climate change issues at the same time, most energy planners would reach the conclusion that nuclear power from thermal spectrum reactors will continue to play an extended role throughout the better part of at least the 21st century, and that accelerated, near-term deployment of fast spectrum reactors is not very realistic or probable. This takes us to the middle of the road scenario, which actually leads to a back-end strategy that is different from those at either end, which was just Yucca Mountain, and only Yucca Mountain.

Under a scenario where the contribution of nuclear power from thermal reactors increases over the next century, both front-end and back-end issues become much more significant than they are in either the nuclear phase-out or rapid expansion scenario. Simply assuming that natural uranium will remain plentiful and economically priced, and that spent fuel rods can continue to stack up, is probably not the wisest front-end or back-end approach.

In the extended light water reactor scenario, recycling of low enrichment fuel becomes a very real and useful tool in supporting a sustainable nuclear fuel cycle. The MOX fuel and recovered uranium from recycling operations can re-supply 25 percent of the domestic U.S. requirements, while at the same time reduce the volume of waste stored as fuel assemblies by a factor of eight. In considering the sustainability benefits alone, if the existing inventory of U.S. commercial used fuel in storage pools and dry storage casks today were to be recycled, it would displace the need for 250 million pounds of new uranium. This is sufficient new fuel to supply the current U.S. fleet of commercial power reactors for seven years. If we are going to actively pursue a "nuclear renaissance," then the recycling of low enrichment fuel needs to be strongly reconsidered.

In the Global Nuclear Energy Partnership program, recycling of MOX fuel into thermal spectrum reactors is not considered. When you dig deeper and ask for the reason why, you find the answer is tied to waste disposal – recycling of MOX into thermal spectrum reactors is not considered in the GNEP plan because it doesn't provide a significant heat load benefit to the proposed Yucca Mountain repository. Recycling doesn't reduce the heat sufficiently to meaningfully expand the facility's capacity and avoid the need for a second repository this century. This logic reveals what I believe is the single greatest flaw in the way the U.S. has been thinking about the back end of the fuel cycle. The U.S. mindset is that all roads must lead to Yucca Mountain. They do not all lead to Yucca Mountain; and, should not all lead to Yucca Mountain.

Yucca Mountain is a fine location for the type of engineered, very long-term monitoring and storage facility needed for used nuclear fuel; however, it may not be the optimum location for the disposal of vitrified wastes from fuel recycling. Rather than a hard rock formation positioned above the groundwater, as is the case for Yucca Mountain, a salt bed formation below potential drinking water supplies could well make more sense both technically and economically for the permanent isolation of wastes in vitrified glass form.

This type of geologic formation was actually studied in the early 1980s before the unilateral decision was made in 1987 to solely develop the Yucca Mountain facility. It is time to go back and reconsider one or more of those sites, not as a replacement for Yucca Mountain as a spent fuel repository, but as an alternative repository for the disposal of vitrified glass wastes that would be produced from fuel recycling. Yucca Mountain licensing should continue, as the very difficult final determination of its suitability for such a function is an important element in future decision making. A decision regarding construction of the facility should be delayed until a detailed assessment of the future role of nuclear power and future nuclear waste policy in the U.S. is established.

Simply put, if the U.S. is not going to deploy a new fleet of nuclear power plants, then Yucca Mountain construction should precede full speed ahead. But, if nuclear power is going to make a continuing major contribution to the U.S. electric supply for the next century and recycling can be successfully deployed, with a designated repository for the glass wastes, then Yucca Mountain construction can be delayed, reserving the facility for spent MOX and any other fuel that may not be recycled and requires direct disposal. If nuclear power's contribution to the energy supply expands and fast spectrum reactors can be and are ultimately deployed to both produce energy and destroy higher order actinides, then the construction of the Yucca Mountain repository may be deferred even further.

Since I am suggesting reconsideration of recycling, there is a second reason the GNEP program does not propose recycling of MOX into thermal reactors, and that is related to certain beliefs regarding nonproliferation. I would like to take a moment to address this, but first let me say that I have a strong respect and reverence for the need to prevent the proliferation of nuclear weapons. That is a serious and important mission, and cannot and must not be dismissed lightly. However, I struggle to understand an argument that the deployment of fuel recycling in the U.S. would have any material impact on global nuclear weapons proliferation.

In fact, non-proliferation objectives are actually advanced with recycling. As I stated earlier, the recycling of spent fuel into MOX reduces the stockpile of plutonium containing fuel rods by a factor of eight. Spent fuel can be safely transported to a recycling complex in its current theft- and diversion-resistant state. Using existing technologies, a dilute stream of plutonium containing material—not a pure plutonium stream—would be produced and fabricated into MOX fuel assemblies, which can be safely and securely returned to reactor sites and irradiated to the same nonproliferation standard as the spent fuel it replaced. These technologies and approaches already exist and are being used elsewhere today, and can be effectively and securely used to reduce the stockpile of spent fuel rods containing plutonium.

In 1977, President Jimmy Carter may have believed a decision by the U.S. not to recycle nuclear fuel would have a unilateral influence on the rest of the world to do the same. History has not proven this correct. Rather, the international nonproliferation and safeguards regime as applied to fuel cycle facilities has been effective in dissuading potential proliferators—notably, there is no historic example of proliferation through the diversion of special nuclear materials from the commercial nuclear fuel cycle. Where proliferation has occurred, it has been done with the use of facilities that are not subject to international safeguards. It is time for the U.S. to re-evaluate its policy regarding nuclear fuel recycling, and then statutorily align that policy with its policy regarding the deployment of a new fleet of nuclear power reactors.

I've spoken conceptually about what a back-end nuclear fuel cycle strategy that aligns with a nuclear power policy could look like for the U.S. Now I'd like to speak briefly about the reality of actually moving forward. I do not believe that ***any*** of the scenarios I have referenced can be achieved with the current structure of the Civilian Radioactive Waste Management Program in the U.S. Department of Energy, and with the program being subject to the annual U.S. Congressional appropriations process. That includes even a strictly Yucca Mountain approach. U.S. NRC Commissioner Ed McGaffigan recently editorialized on the difficulties the Department of Energy has faced and failed to overcome, and I must agree with him completely. Successful implementation of ***any*** high level waste management strategy will require fundamental changes to the governance structure of the program.

Responsibility for execution of the waste program, and accountability for performing the technical and economic analyses, should be transferred to a newly created, government-chartered corporation. The program should not be “privatized,” but rather run by applying private sector governance principles in a government corporation. There are several successful models to consider. In today’s structure for example, the Tennessee Valley Authority has a governing board of part-time directors, who have the authority to recruit and select the leadership of the organization, as well as provide appropriate governance over critical decisions. A similar approach for management of the U.S. high level waste program can create accountability for results that has been lacking, by avoiding the revolving door of management and direction the waste program experiences today with each change in administration and corresponding change in energy secretary. My personal opinion is that the current program director, Ward Sproat, is doing an excellent job in carrying out his mission as it is defined today However, we all must recognize that the probability of sustaining that effort as presidents, energy secretaries and program directors change in the next election cycle is very, very low.

Governance and leadership continuity is not the only obstacle to successful development and execution of a nuclear waste management program. The funding process is broken as well. Funding must be provided based on program requirements and obligations, not on politics. The members of the U.S. Congress today have many conflicting objectives and priorities; the responsible appropriation of the waste fees should not be subjected to those conflicts. To isolate the fund from those conflicts, I propose the creation of a Nuclear Waste Fund Commission, consisting of five full-time members, whose sole function is the management of access to the nuclear waste fees and the interest earned from the existing corpus. These monies are not general tax revenues, they are fees paid by regulated retail electric customers and wholesale electric generators. To date, more than $28 billion U.S. dollars has been committed to this fund through direct payments and accrued interests. This money should not be treated as general tax revenues. The Nuclear Waste Fund Commission should be nominated by the governors of those states in which spent nuclear fuel is stored, and should exclusively represent the interests of those who have contributed and continue to contribute to the waste fund.

This type of check and balance between the waste corporation and a waste fund commission can represent good fiscal control. Management must be checked by the board, and the board checked by the commission. Decisions need to be tested, and accountability always demonstrated. In my opinion, while more difficult in execution, the separation of programmatic decision making from funding authority is needed to assure that “good government” is always practiced.

We have important decisions to make. Decisions regarding energy supply and environmental stewardship. Decisions regarding future global security. These decisions have direct implications regarding U.S. nuclear waste policy and direction. We have choices, and we have choices to make. If we are going to be prepared and capable of making informed, rational decisions, aligned with the overall energy policy, we must open our minds to different approaches to the U.S. nuclear fuel cycle, and we must retool and restructure the decision-making authorities within the U.S.

I hope the thoughts and ideas I have shared today will accelerate the generation and sharing of additional ideas as to how we can best accomplish these objectives. Thank you for your time and attention.