Economics of Reprocessing and Recycling Nuclear Fuel

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Geoffrey Rothwell: Education and Teaching

- Graduated from Hanford High School, Richland, Washington, 1971
- Ph.D. in Economics, University of California, Berkeley, 1985
- Post-Doctoral Fellow, California Institute of Technology, 1985-1986
- Senior Lecturer, Stanford University, 1986-present
- Director of Honors Programs, Department of Economics, Stanford University, 1999-present
- Associate Director, Public Policy Program, Stanford University, 2003-present

Geoffrey Rothwell: DOE Contracts

- **Chief Economist, Economic Modeling Working Group of the Generation IV International Forum, GIF (2003-2012), supported by DOE-NE**
- **Chief Economist, Economic Analysis Working Group, Global Nuclear Energy Partnership, GNEP (2007-2008) with Idaho National Laboratory, supported by DOE-NE**
- **Independent Contractor with Pacific Northwest National Laboratory-Battelle Energy Alliance (2008-present) supported by DOE-NA**
- **Independent Contractor with University of Chicago-Argonne National Laboratory (2010-present) supported by DOE-NE**

Bottom Line: Optimize Repository Resources under Budget Constraints

- **See statement, "Economics of Reprocessing and Recycling Nuclear Fuel" from Chapter VI, "Policy Review Panel on Spent Nuclear Reactor Fuel Reprocessing and Recycling," Johns Hopkins University, The Paul H. Nitze School of Advanced International Studies, Global Energy and Environment Initiative**

- **Bottom line: All alternative fuel cycles for Light Water Reactor used fuel (and DOE HLW) require geologic sequestration, so focus on finding a repository site; when found, optimize reprocessing and recycling to best use U.S. repository and budget resources**

Economics of MOX Recycle

The costs of "Once-through" and "MOX recycle" (with aqueous reprocessing and Mixed Uranium and Plutonium Oxide fuel fabrication) are similar under two crucial assumptions:

- **(1) The cost of capital is less than 3%, implying that the U.S. government will be required to finance the building of all MOX facilities and accept all risk, and**
- **(2) Used MOX is never placed in a geologic repository, but instead is stored for recycle in fast reactors**

Economics of Fast Reactor Recycle

The costs of "Fast Reactor recycle" (with the burning of actinides, including plutonium) are too uncertain at this time. This uncertainty arises from (among other known and unknown unknowns):

- **(1) the unknown commercial availability date**
- **(2) the unknown actinide burn-up rate (the percentage of actinides reduced with each pass through a Fast Reactor)**
- **(3) the cost of qualifying fuels of various actinide compositions as the actinides are burned.**

What can be done now?

To facilitate interim storage, Congress should strike the following language from the Nuclear Waste Policy Act (1982) with Amendments:

"Sec. 148 (d) Licensing conditions. Any license issued by the NRC for a Monitored Retrievable Storage facility under this section shall provide that - (1) construction of such facility may not begin until the NRC has issued a license for the construction of a repository under section 115(d); (2) construction of such facility . . . shall be prohibited during such time as . . . construction of the repository ceases; . . . such facility at any one time may not exceed 15,000 MTHM."

What can be done soon?

- **Optimize Light Water Reactor operations and fuel cycle to reduce used fuel**
- **Reconsider the economics of MOX reprocessing and fuel fabrication after MOX facilities at the Savannah River Site (under construction) have been completed and MOX fuel is used by U.S. utilities on a commercial basis (without additional operating subsidies).**
- **Reduce uncertainties in Fast Reactor recycle through a consistent, long-term U.S. government commitment to advanced reactor and fuel cycle research, development, demonstration, and deployment.**