

Advanced Fuel Cycle Initiative (AFCI)



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Recent History of DOE's Advanced Fuel Cycle Research

- **1999 - Accelerator Transmutation of Waste (ATW):** Roadmap issued by RW, outlined use of high-powered proton accelerators for destruction of all actinides from spent fuel
- **2000 - ATW:** research program initiated to explore transmutation technology (\$9M)
- **2001 - Advanced Accelerator Applications (AAA) Program launched:** combined ATW with Accelerator Production of Tritium (APT) Program to optimize use of resources (\$34M-NE, \$34M-DP)
- **2002 - AAA refocused to AFCI:** emphasis on reactor based systems, accelerator transmutation focused on “fuel burn” role to minimize toxicity and support Generation IV (Gen IV) fuel development (\$50M)
- **2003 - AFCI establishes new management structure:** National Technical Directors, Technical Integrator, and integrates with Gen IV for fuel cycle development (\$58M)
- **2004 - AFCI Budget Request:** (\$63M):
 - Senate mark - \$78M
 - House mark - \$58.5M



Advanced Fuel Cycle Initiative *Proliferation-Resistant Nuclear Future*

Develop fuel cycle technologies that:

- Enable recovery of the energy value from commercial spent nuclear fuel
- Reduce the radio-toxicity of high-level nuclear waste bound for geologic disposal
- Reduce the inventories of civilian plutonium in the U.S.
- Enable more effective use of the currently proposed geologic repository and reduce the cost of geologic disposal

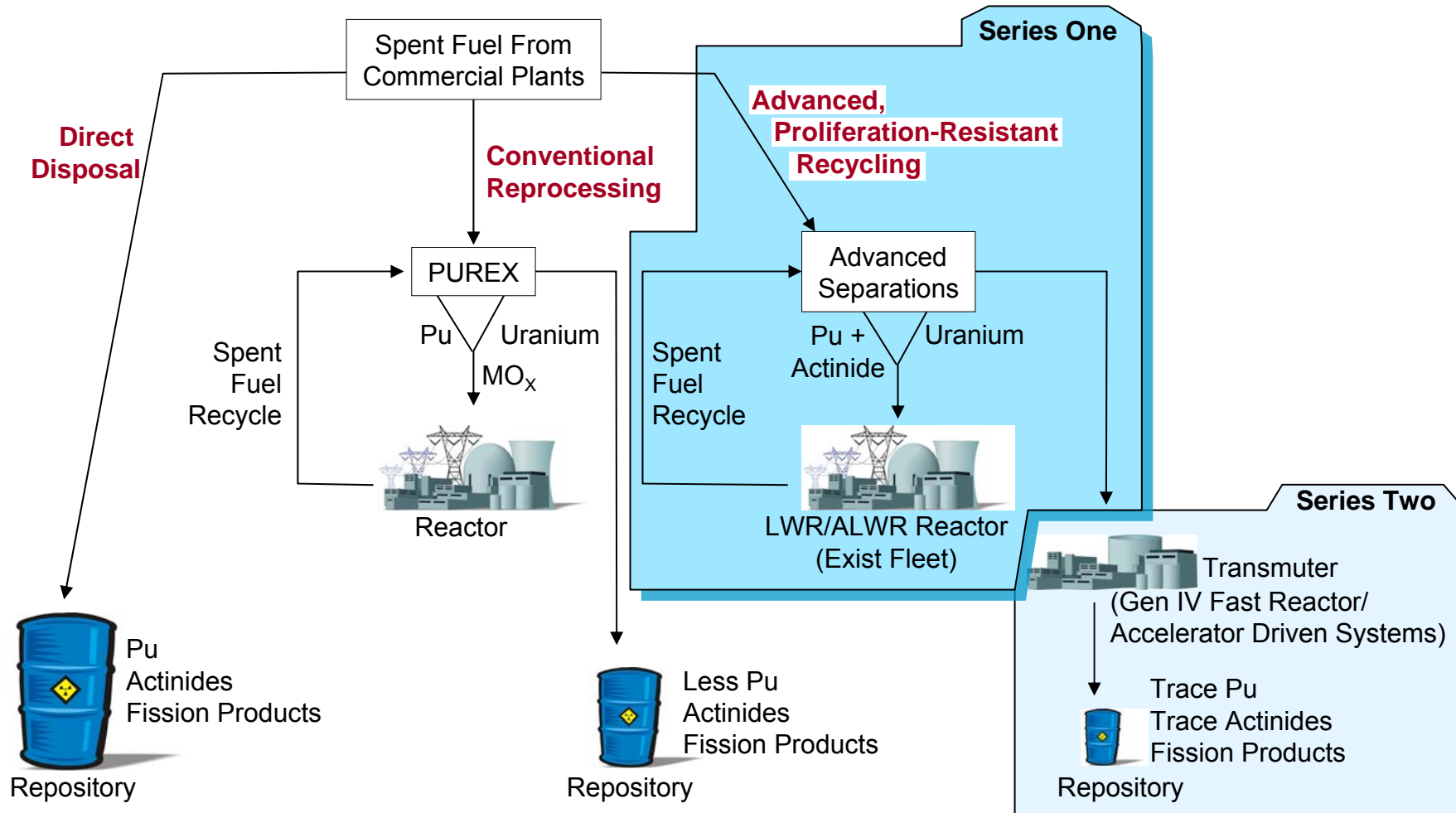
January 2003



http://www.nuclear.gov/AFCI_RptCong2003.pdf



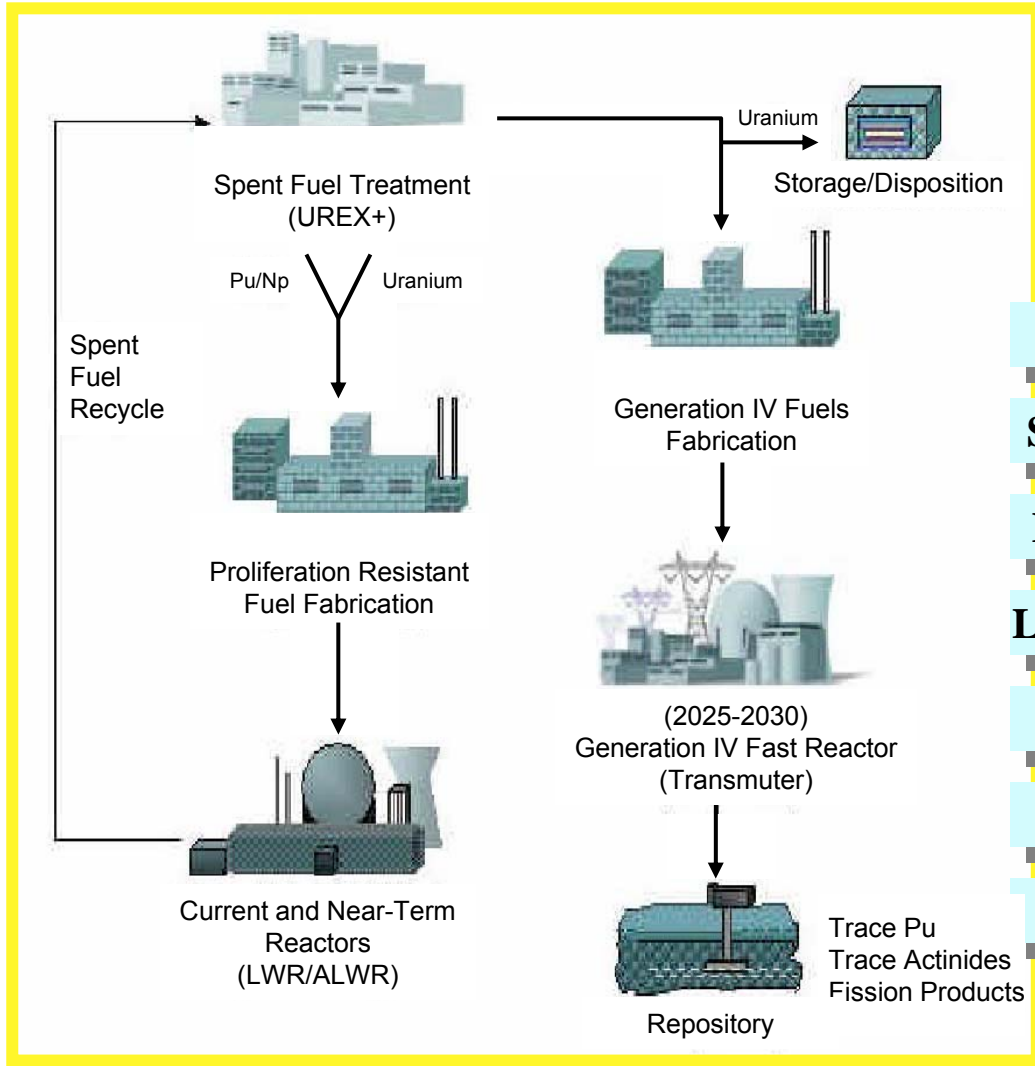
Approaches to Spent Fuel Management





AFCI Development Program

Series One and Two Benefit Comparison



- Volume reduction
- Short-term decay heat
- Long-term decay heat
- Long-term proliferation
- Environmental risk
- Radio-toxicity
- Criticality

	Series One	Series Two
Volume reduction	✓	
Short-term decay heat	✓	
Long-term decay heat		✓
Long-term proliferation	✓	✓
Environmental risk	✓	✓
Radio-toxicity		✓
Criticality	✓	✓

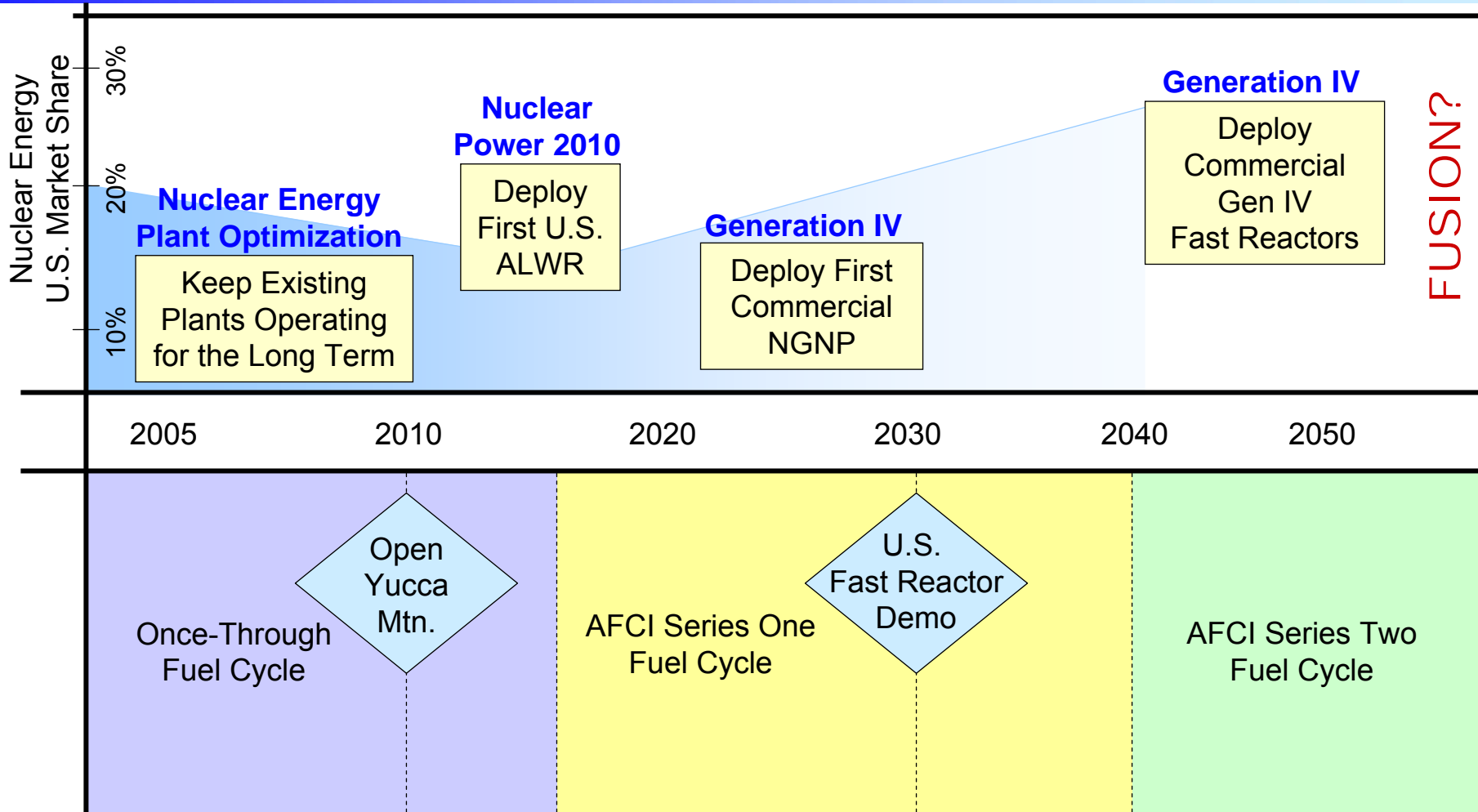


Resulting Outcome of Successful AFCI Program

- ⌚ **Contribute to reducing costs and optimizing use of Yucca Mountain geologic repository**
- ⌚ **Reduce or eliminate technical need for a second geologic repository (support 2007 Secretarial recommendation to Congress)**
- ⌚ **Confirm advanced fuel cycle designs required for successful deployment of Generation IV nuclear energy systems**
- ⌚ **Permit decision in next five years if an ADS system is needed to complement reactor technology to achieve significant waste benefit transmutation**
- ⌚ **Realize significant cost savings through successful international collaboration**

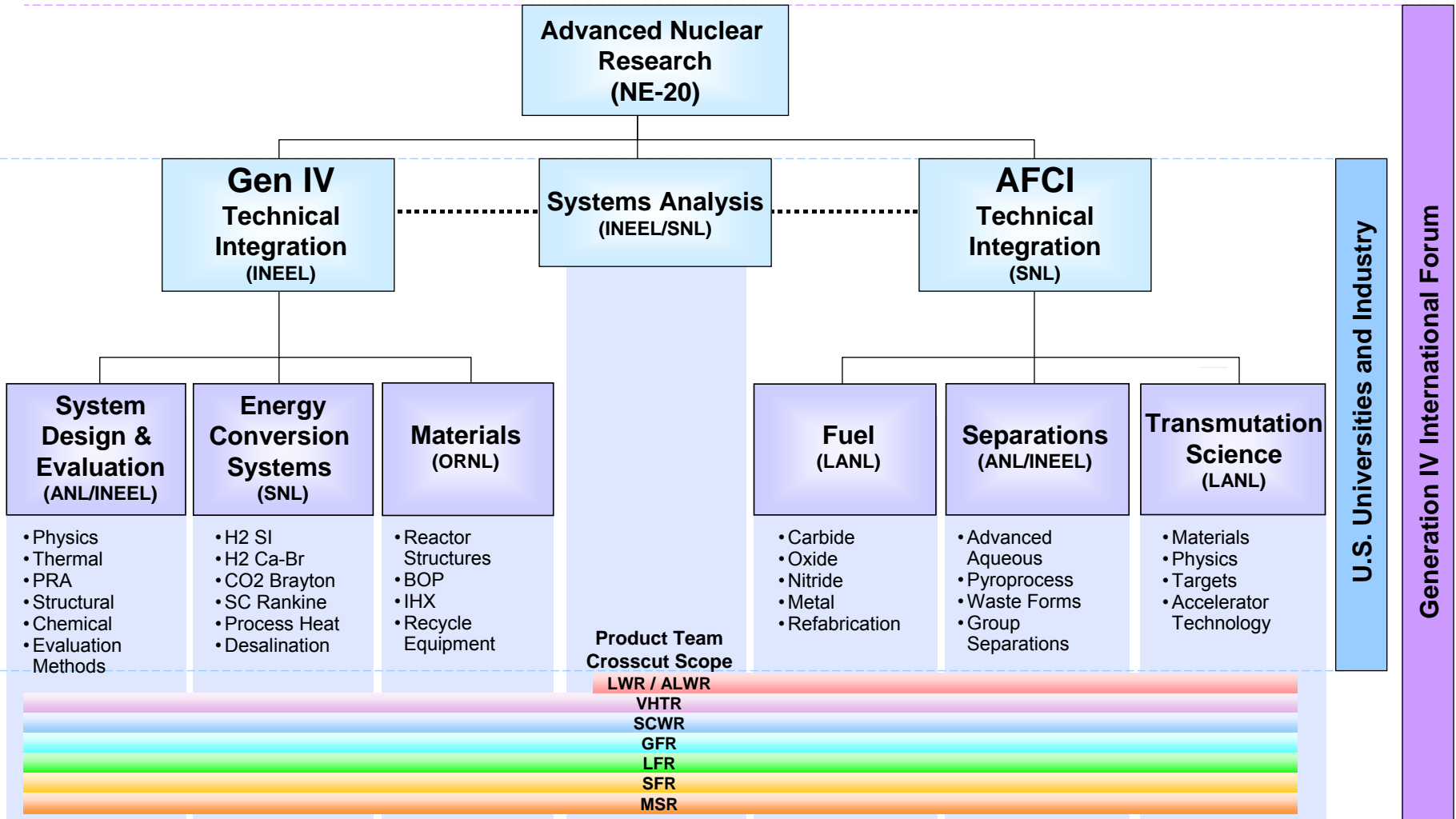


A Long-Term Strategy





An Integrated Program: Generation IV and Advanced Fuel Cycle Initiative





AFCI International Activities

France -- CEA Cooperative R&D Underway

- Fuels Tests in PHENIX Fast Reactor (2006)
- Advanced Materials
- Reactor and Accelerator System Safety Analysis
- Pyroprocessing R&D

Switzerland -- Paul Sherrer Institute

- MEGAPIE Lead-Bismuth Spallation Target Experiment

EU, Japan, ROK -- Strong Potential

- Pyroprocessing R&D
- Advanced Materials
- Advanced Fuel & Fuel Cycle related R&D (e.g. fertile free fuel)
- ADS (TRADE experiment in Italy)