Lab / University Participation in the Global Nuclear Energy Partnership (GNEP)

presented to the workshop on

Nuclear Physics and Related Computational Science R&D for Advanced Fuel Cycles

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What is GNEP?

This morning, I want to speak to you about one part of this initiative: our plans to expand the use of safe and clean nuclear power. Nuclear power generates large amounts of low-cost electricity without emitting air pollution or greenhouse gases.

….my Administration has announced a bold new proposal called the **Global Nuclear Energy Partnership**. Under this partnership, America will work with nations that have advanced civilian nuclear energy programs, such as France, Japan, and Russia. Together, we will develop and deploy innovative, advanced reactors and new methods to recycle spent nuclear fuel. This will allow us to produce more energy, while dramatically reducing the amount of nuclear waste and eliminating the nuclear byproducts that unstable regimes or terrorists could use to make weapons.

President George W. Bush
Radio Address: February 18, 2006

GNEP Has Three Simultaneous Goals

GNEP Goals

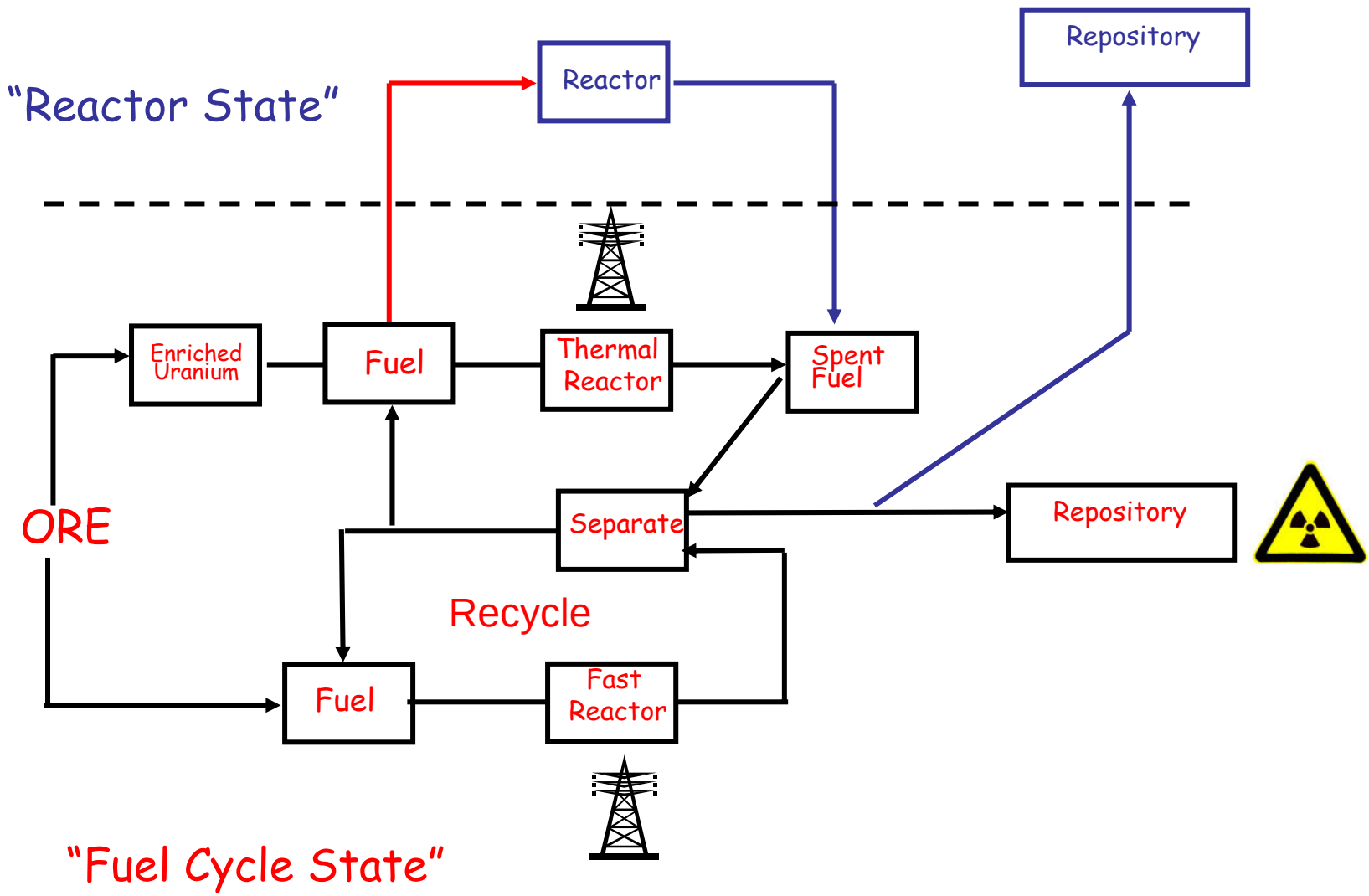
- Lots of Nuclear Power (1000 ~2000 GW yr by 2050)
- Take care of long – term waste problem
- Reduced Proliferation Risk

Policy change to favor recycling by "fuel cycle" states

GNEP Principles:

- Global Issues require global solutions
- Spent Fuel is an **asset** to be managed – not a waste.

Fuel Leasing is the Key Non-proliferation Element



US GNEP Strategy has seven objectives

1. Expand LWR → NP-2010 / Energy Policy Act
2. Export (L)WR → Small Reactors

3. Demonstrate Recycle technology for spent fuel management

3a. UREX + (spent LWR fuels) → U Cs Sr

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3b. Actinide fuel fabrication

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4. Demonstrate Fast Burner Reactors

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3c. Pyroprocessing for ABR fuels

↑ (back to 3b. Actinide fuel fabrication)

Recycle - No separated Plutonium

Little Transuranic Waste

5. Minimize Waste disposition to repository
   - Dispostion = Spent fuel w/o (U Cs Sr + Actinides)
   - 1 x Yucca Mountain sufficient for long term

6. Establish reliable fuel services [to “reactor states”]

7. Enhanced nuclear safeguards technologies [NNSA and IAEA roles]

So, what next?

Government role in solving the “tragedy of the commons” that is nuclear waste:

What is the business model?

- Cost of Separation
- Transuranic Fuel
- Cost of Burner Reactors

Proposed steps:

- International Partnerships
- GNEP technology demonstrations
- R&D including simulations

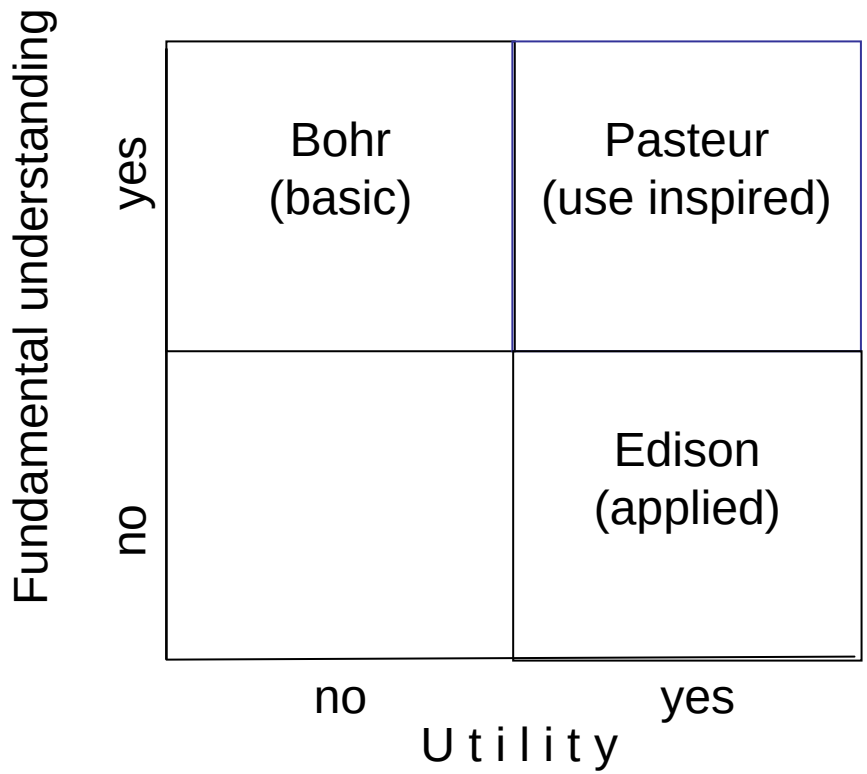
DOE Vision: bring US strength in simulation and systems integration to transform the global nuclear enterprise.

Gehry Technologies

Transformation via:

- Materials
- Multi-scale simulation
- Instrumentation and controls
- Configuration management
- Construction and fabrication
- Performance requirements and risk analyses

Simulation brings fundamental science to complex system problems



*from “Pasteur’s Quadrant” by Donald Stokes, 1997

Lessons from ASCI

- Successful simulation enterprise requires focus and sustainability, i.e. must be owned by an enduring institution
  - DOE / national labs (NE/SC/NNSA – “old AEC”)
  - University ASCI centers have done well. What model could work here?
  - How does industry play?
- Core group must own mission, design role, applications development and platform / environment.
- Key milestones must provide program value.
- Focus on substantial “well-posed” problems.
- Science must be integrated from the start.
- Traditional “validation” does not work well when codes, methods and fundamental understanding undergo rapid evolution.

ASCI lessons cont’d

- Hierarchy from mission need to application requirements to framework support.
- Design, computation and validation is an integrated process.
- Much of the real value of simulation is from the “virtual experiment” - designers / scientists / engineers learning through 1000’s of quick turn-around problems.
- University partnerships important – ideas, algorithms, models, codes, and of course people.
- It’s hard enough with a clear mission and one office controlling resources and providing direction.

What role for universities

Unlike ASCI, our problem is unclassified.

Individual investigators ok for some problems.

Laboratory collaborations / joint centers of various scales (including quite large) for others

Independent university centers of excellence?

- what mechanisms?
- what problems?

Summary: Nuclear Energy is in a Crisis

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Danger

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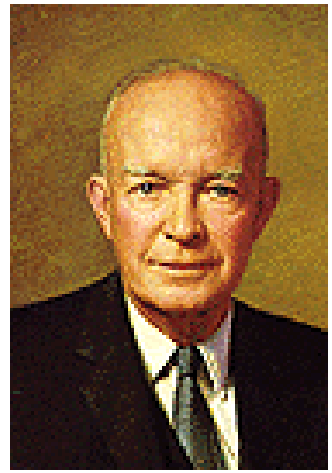
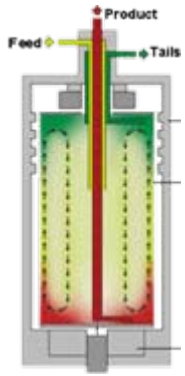
Opportunity





Nuclear Technology will always be in crisis

GNEP represents a unique opportunity for international leadership, shaping the future, an organizing principle for 21st century civilization - “Atoms for Peace! ”