



The Global Nuclear Energy Partnership Program

**Presented to the
Nuclear Energy Advisory Committee**

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Outline

■ **The Global Nuclear Energy Partnership Program**

- GNEP Program overview
- Major Program Accomplishments
- Summary

■ ***Industry Input - Dan Stout - DOE***

■ ***Research and Development Program - Phillip Finck INL***

■ ***International Program - Ed McGinnis - DOE***

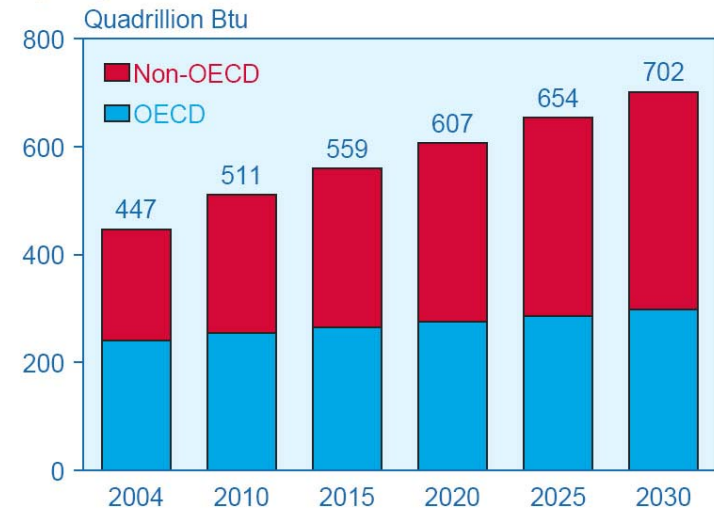




World energy demand is growing substantially, especially in developing nations

- World energy consumption is predicted by the Energy Information Administration to increase by 57 percent through 2030.
- Total energy consumption in non-OECD countries will increase by 95 percent compared to 24% in OECD.
- Supply and price of natural gas and volatility of oil prices add uncertainty to their use.
- Mitigating global climate change requires lowering greenhouse gas emissions.

World Marketed Energy Consumption by Region, 2004-2030

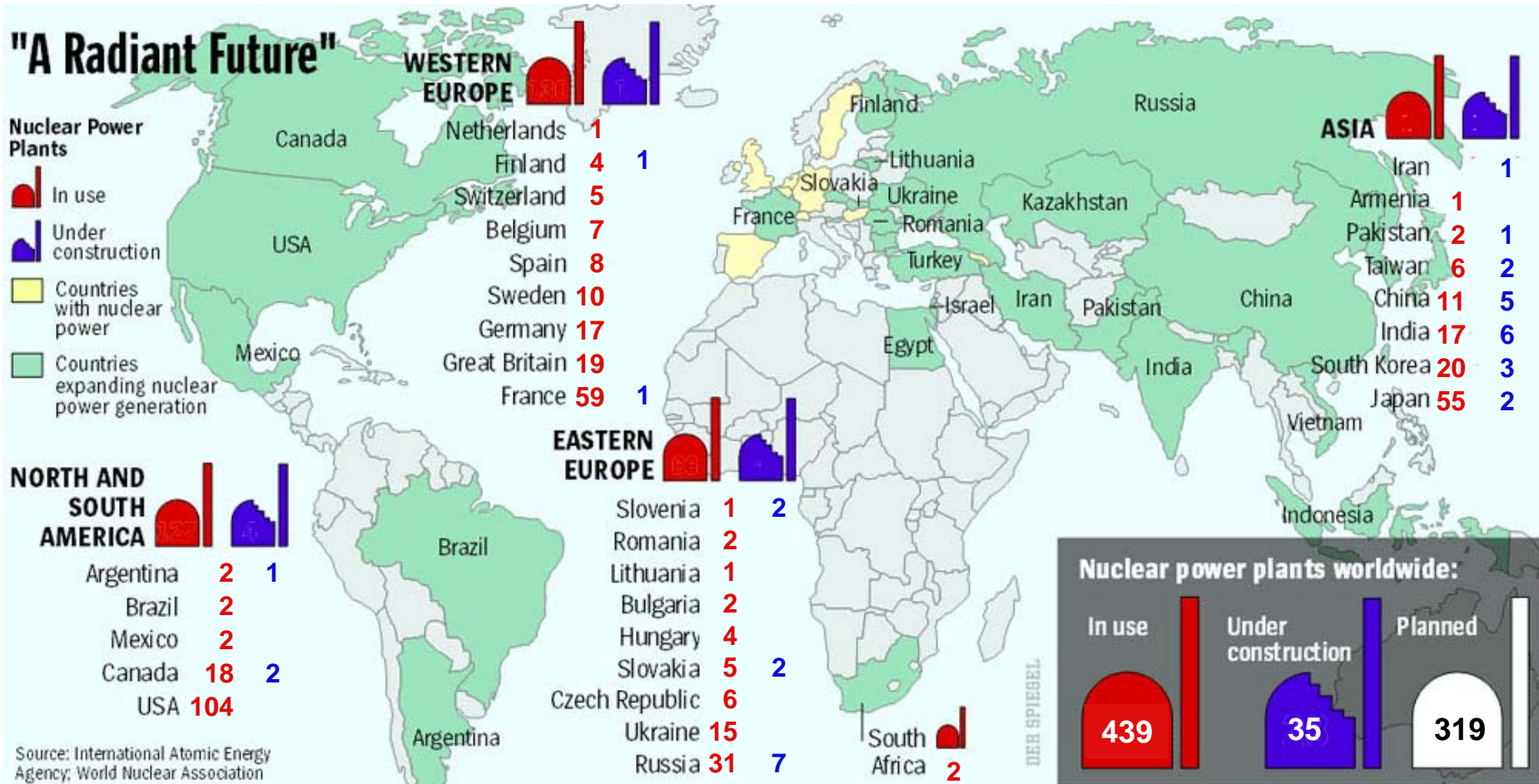


Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *System for the Analysis of Global Energy Markets* (2007).





International expansion of nuclear power to help meet the energy demand is underway



<http://www.spiegel.de/international/spiegel/0,1518,460011,00.html> (updated WNA 4/17/2008)





GNEP promotes safe and secure expansion of nuclear power worldwide by:

Element

- Facilitating global deployment of nuclear power through responsible stewardship
- Establishing reliable international fuel services
- Supporting grid-appropriate exportable reactor development and deployment
- Developing enhanced nuclear safeguards
- Developing and implementing advanced used nuclear fuel recycling technologies
- Developing and implementing advanced reactors to consume transuranic elements separated from spent fuel.
- Improving used fuel and nuclear waste management

Principal Focus

GNEP

GNEP

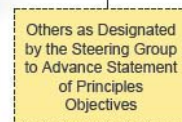
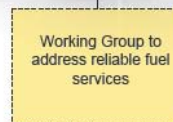
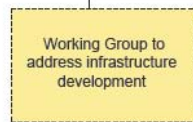
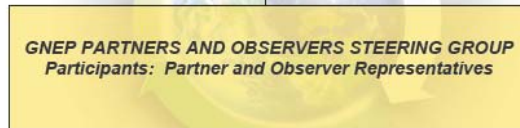




A Global Partnership - 21 Member Nations



GLOBAL NUCLEAR ENERGY PARTNERSHIP Structure



April 21, 2007

NEAC GNEP Overview

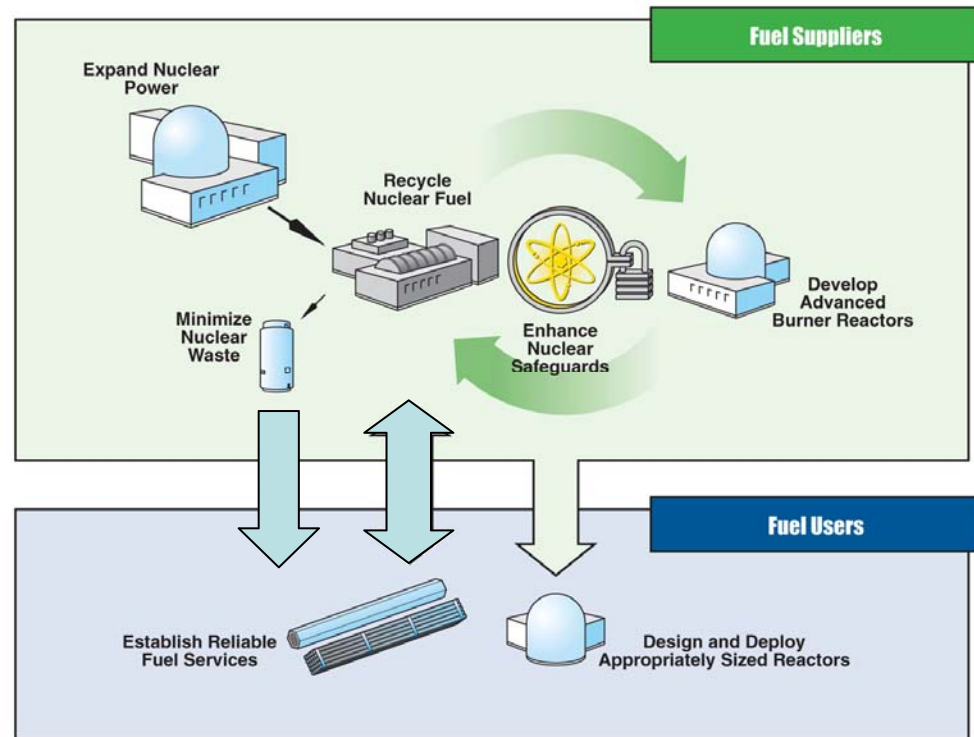
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The key nonproliferation benefit of GNEP will come from providing reliable fuel services

- **Fuel Suppliers:** Operate reactors and fuel cycle facilities, including fast reactors to transmute the actinides from used fuel into less toxic materials
- **Fuel Users:** Operate reactors, lease and return fuel
- **IAEA:** Provide safeguards and fuel assurances, backed up with a reserve of nuclear fuel for states that do not pursue enrichment and reprocessing

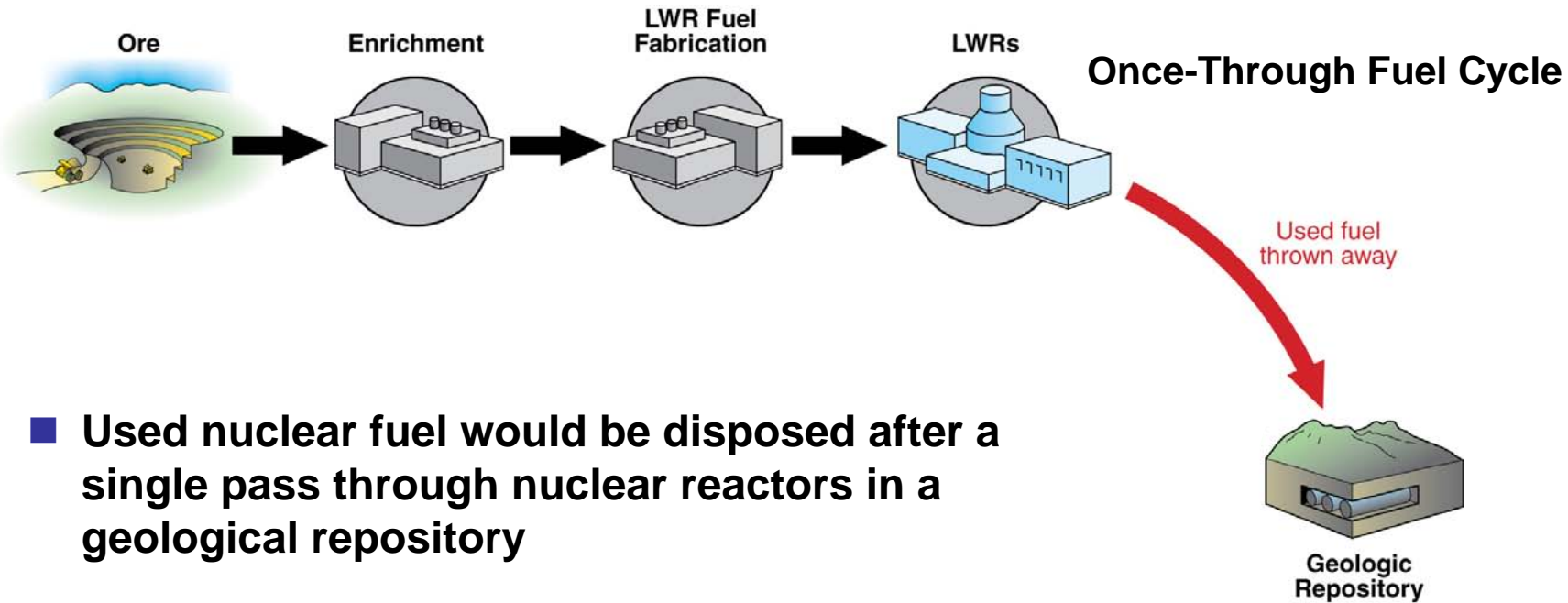


GNEP makes diversion and misuse of fissile materials more difficult, more costly, and acquisition of sensitive fuel cycle technologies more difficult to justify as part of a peaceful nuclear program





At present the U.S. has a once-through fuel cycle



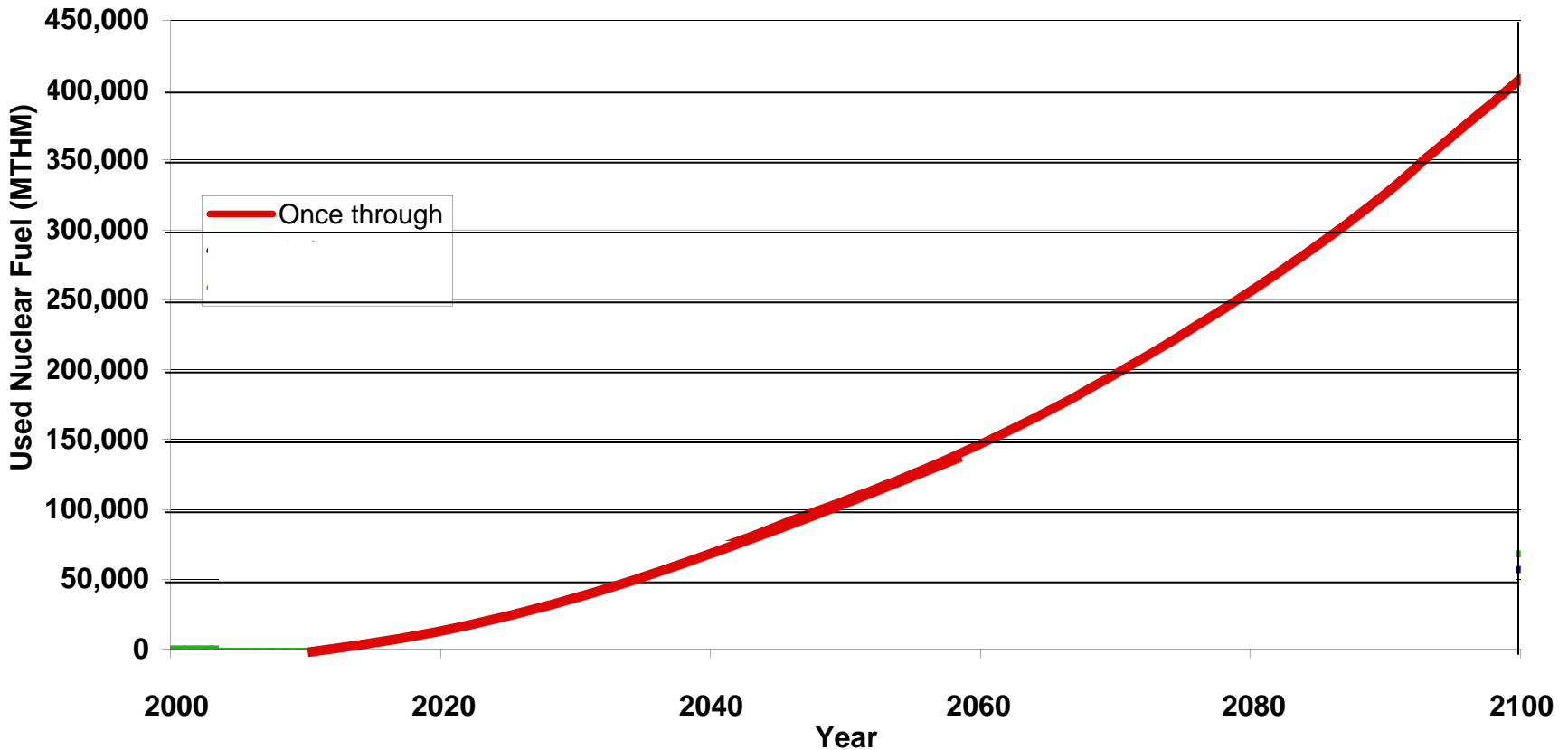
- Used nuclear fuel would be disposed after a single pass through nuclear reactors in a geological repository
- If nuclear power increases as predicted, the U.S. will need multiple repositories by the end of the century with the once-through fuel cycle

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In our open fuel cycle many geologic repositories will be needed to support increased nuclear power



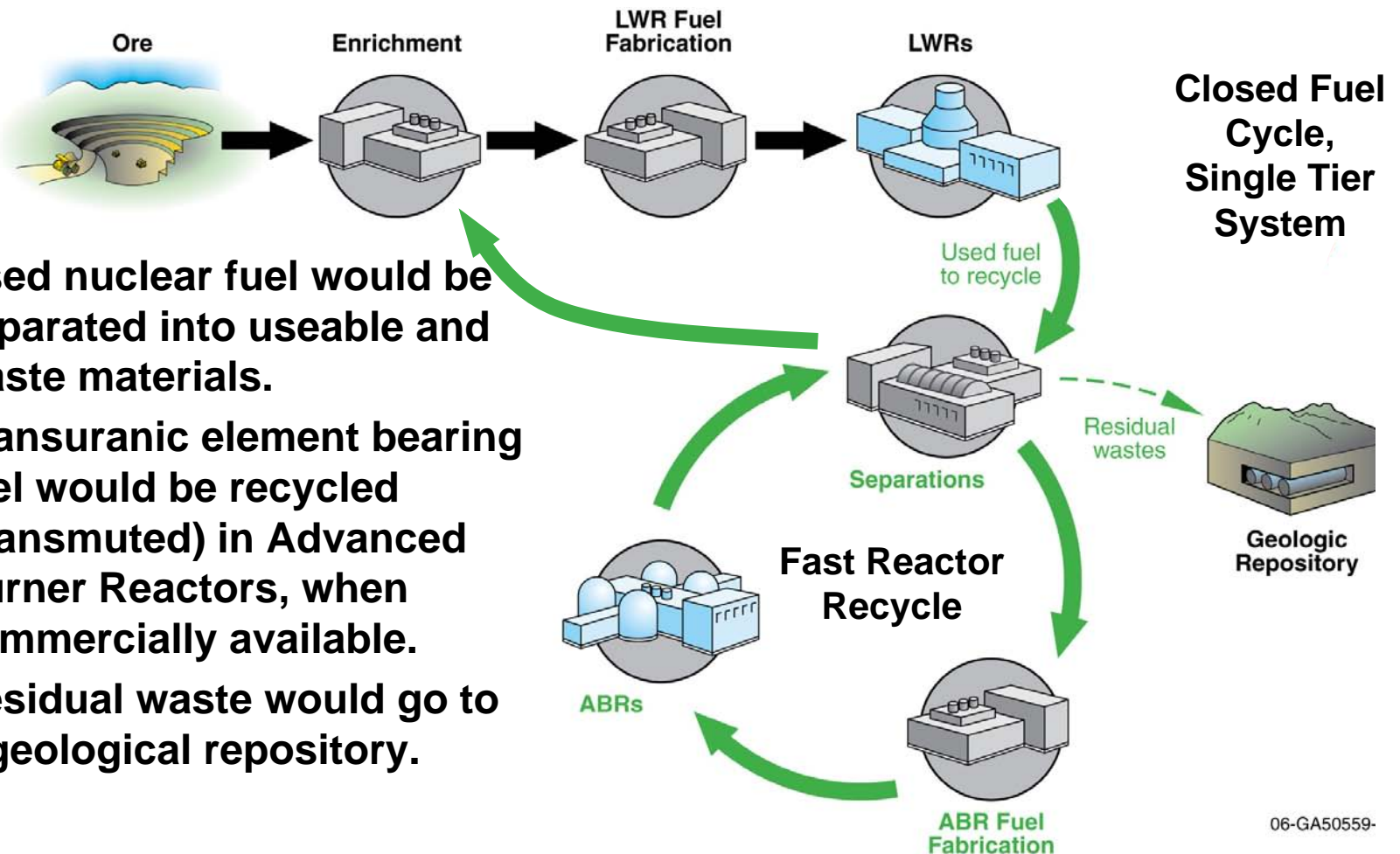
63,000 MT SNF is assumed to go into a geologic repository, and is not shown in this graph. Total electricity is assumed to grow at ~1.2%/year





GNEP Domestic Closed Fuel Cycle Option:

- Fast reactor recycle is the long-term GNEP goal



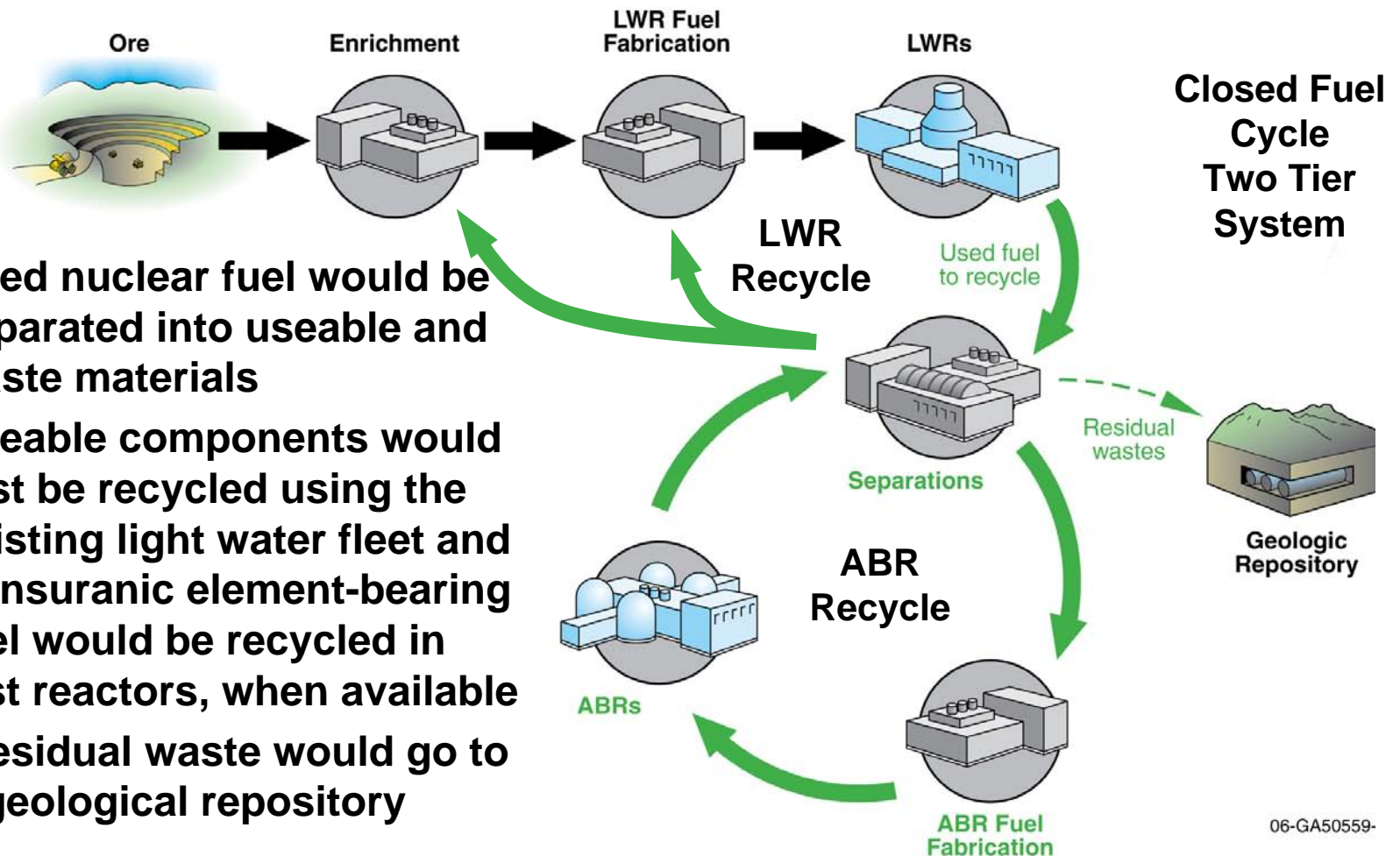
- Used nuclear fuel would be separated into useable and waste materials.
- Transuranic element bearing fuel would be recycled (transmuted) in Advanced Burner Reactors, when commercially available.
- Residual waste would go to a geological repository.





GNEP Domestic Closed Fuel Cycle Option:

- Fast reactor with light water intermediate step to reach the long-term GNEP goal



- Used nuclear fuel would be separated into useable and waste materials
- Useable components would first be recycled using the existing light water fleet and transuranic element-bearing fuel would be recycled in fast reactors, when available
- Residual waste would go to a geological repository

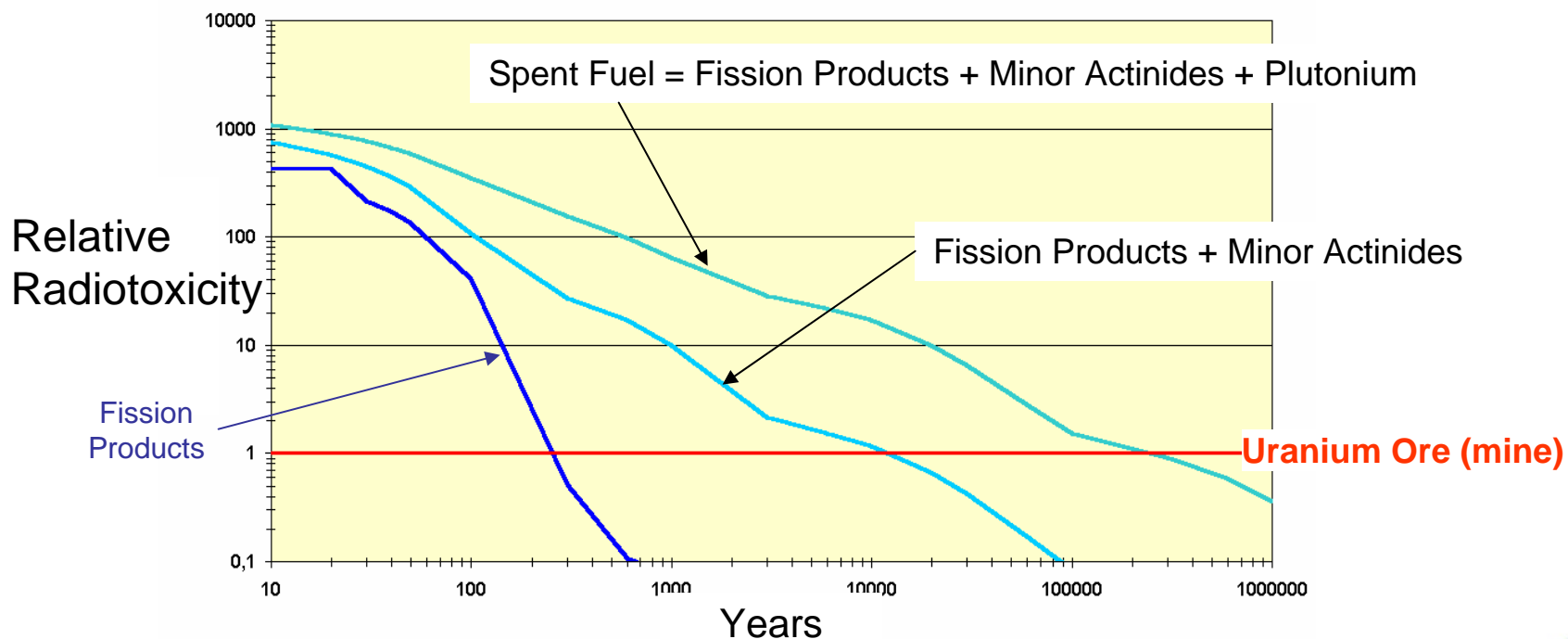




A closed fuel cycle can reduce both high-level waste and long-term radiotoxicity of material going to a geologic repository

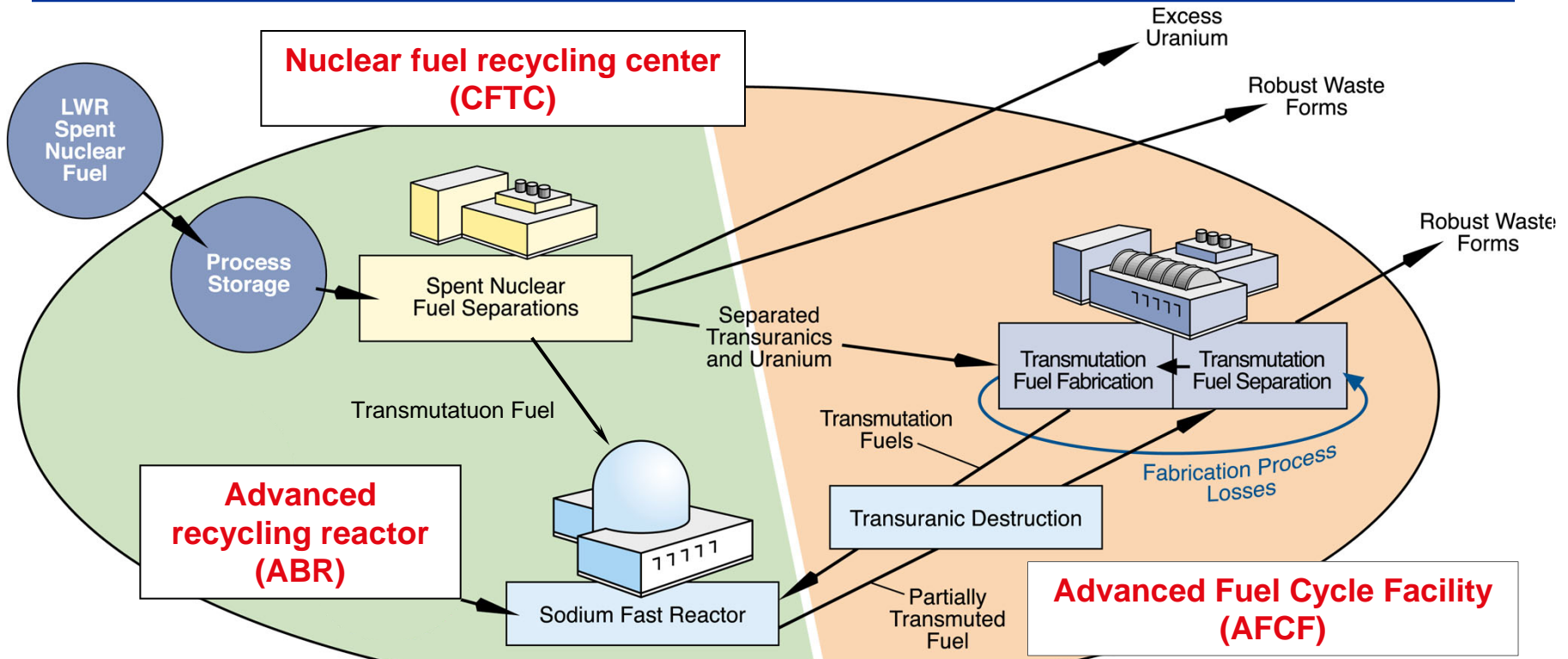
Each GW-Year ~ 20 tons of spent fuel
No greenhouse gas emissions
[~ 19 t Uranium + ~ 0.7 t fission products
+ 0.2 t Pu + 0.02 t Minor Actinides

Coal GW-year ~ 7-8 million Tons CO₂





GNEP envisions three domestic facilities supported by research and development activities



Industry led with national laboratory, university and international participation

National laboratory led with NRC, industry, university and international participation

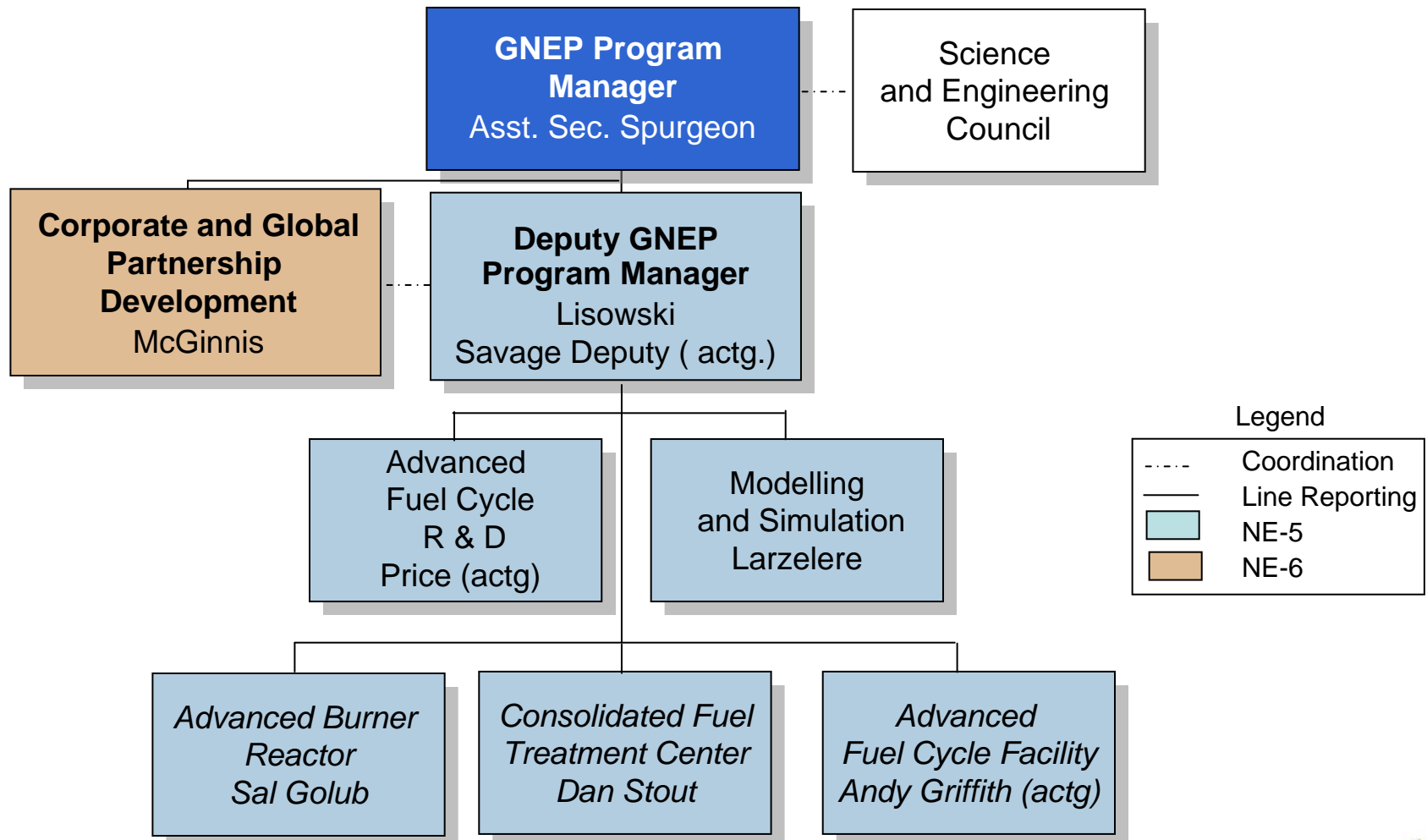
Advanced Fuel Cycle R & D

National laboratory led with NRC, industry, university and international participation



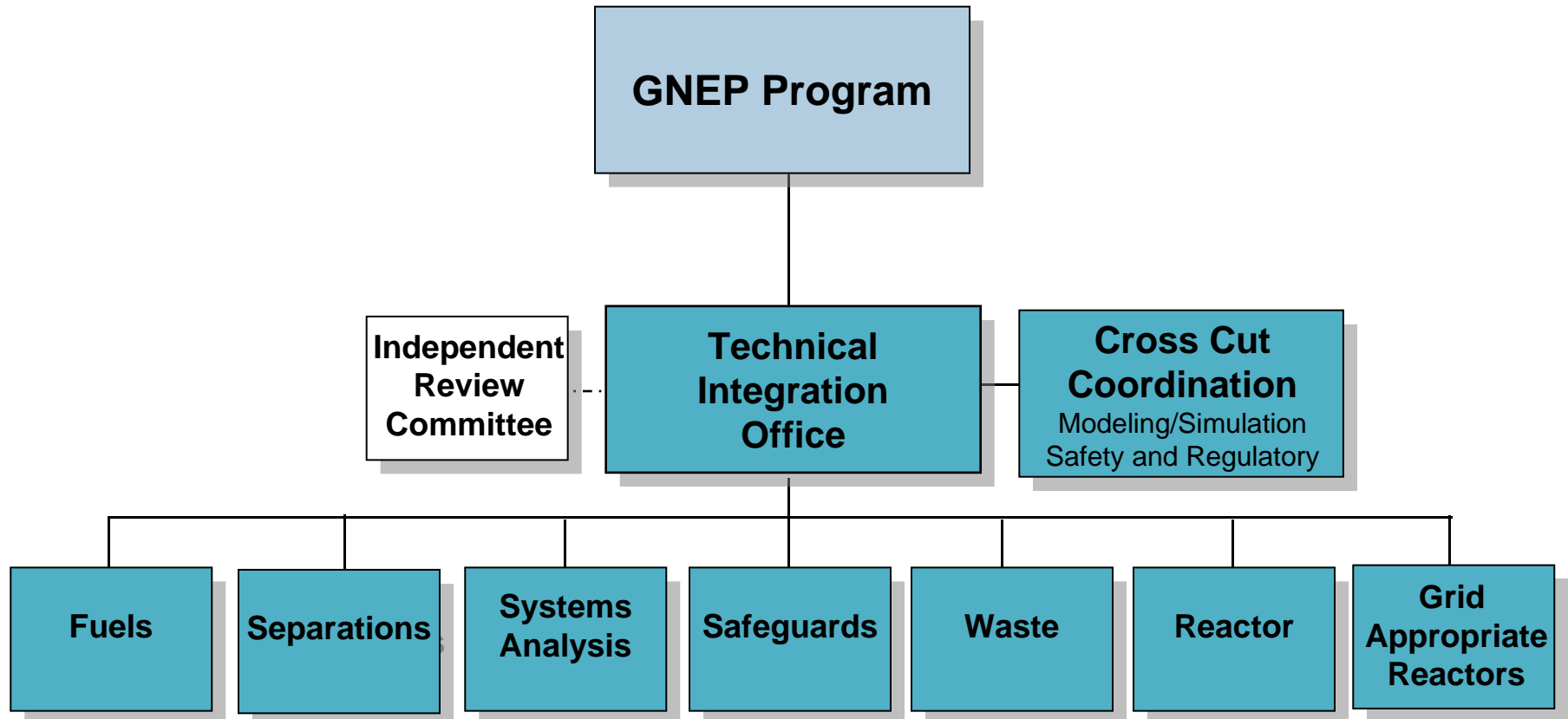


The program structure is arranged to address R&D activities, required facilities, and international activities





The supporting laboratory structure is organized to address the major fuel cycle technology areas





The GNEP Technical Integration Office (TIO) coordinates national laboratory work

- TIO serves as the point of contact between the DOE and the laboratories for coordination, integration, and reporting.

- Three main functions:
 - A technical function to integrate research and development (R&D) and technology development activities necessary for GNEP execution;
 - A project controls function to collect, analyze, and integrate financial and schedule data;
 - An administrative function to will deal with activities such as quality assurance (QA), documentation, and communications.





Major Program Activities Since Last NERAC Meeting

- Preparing draft PEIS to incorporate 14,200 public comments on the NOI
- Technical Integration Office is in place and operational
 - Established FY08 planning process including new project controls system and required program documents (QA plan, Program Management Plan, etc.)
 - Implemented GNEP Document Management System including the transfer of electronic documents from Sandia to the TIO.
 - Established GNEP Independent Review Committee through TIO
 - GNEP Technology Development Plan issued in July 2007, follow-on Technology Roadmap Document in preparation
- GNEP FOA awards made to industry, intermediate input received
 - INRA (AREVA Federal Services, LLC),
 - EnergySolutions, LLC
 - GE-Hitachi Nuclear Americas, LLC, and
 - General Atomics
- All program level 2 and above milestones for FY2007 were met





Major Program Activities Since Last NERAC Meeting

- Science and Engineering Council Established – Mike Lawrence (PNNL) Chair
- Participated in National Academy Review of GNEP
- Supported 18-month Government Accountability Review of GNEP
- Completed Action Plans for technology cooperation with Russia, Japan, China, ...
- Trilateral MOU signed between DOE, JAEA and CEA for SFR cooperation
- MOU with TVA signed to provide utility perspective and licensing insight
- Continues and increased university involvement in GNEP
 - NERI funding for previously selected projects
 - NERI-C awards for research consortia
 - NERI-I awards to develop infrastructure needed to support GNEP R&D
 - Continued Fellowship Program with an announcement of upcoming awards
- Preparing to award \$15M in FY2008 funds in open competition for supporting research and development at universities, industry, and national laboratories





Industry Engagement

■ Accomplishments

- Since May of last year, over less than one year, DOE issued a funding opportunity announcement, put agreements in place and received two sets of deliverables
- Guided the formation of four industry consortia with extensive, relevant experience
- Obtained clear feedback on design, technology development and business cases

■ Findings

- The initial fast reactor will have to be government funded
- Technologies exist that don't separate pure plutonium that can be used in commercial recycling facilities in the near-term, as an interim step towards fast reactor recycling
- A business case exists using the nuclear waste fund to pay for recycling and repositories in an integrated manner that minimizes government funding
- Dan Stout will cover the details in the next presentation





Summary/Preview

- We have organized the program to address GNEP needs and priorities
 - The TIO and Campaign Structure is in place and functioning
 - The international and domestic parts of GNEP are coordinating well

- There is significant effort underway throughout the program
 - A robust R&D program continues with increased international participation (Finck - INL)
 - Programmatic Environmental Impact Statement is in progress.
 - Industry-led deployment studies have been launched (Stout - DOE)
 - International interest and participation in GNEP has been exceptional (McGinnis - DOE)

