



# The Global Nuclear Energy Partnership

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**Office of Nuclear Energy**

**February 20, 2007**



# Outline

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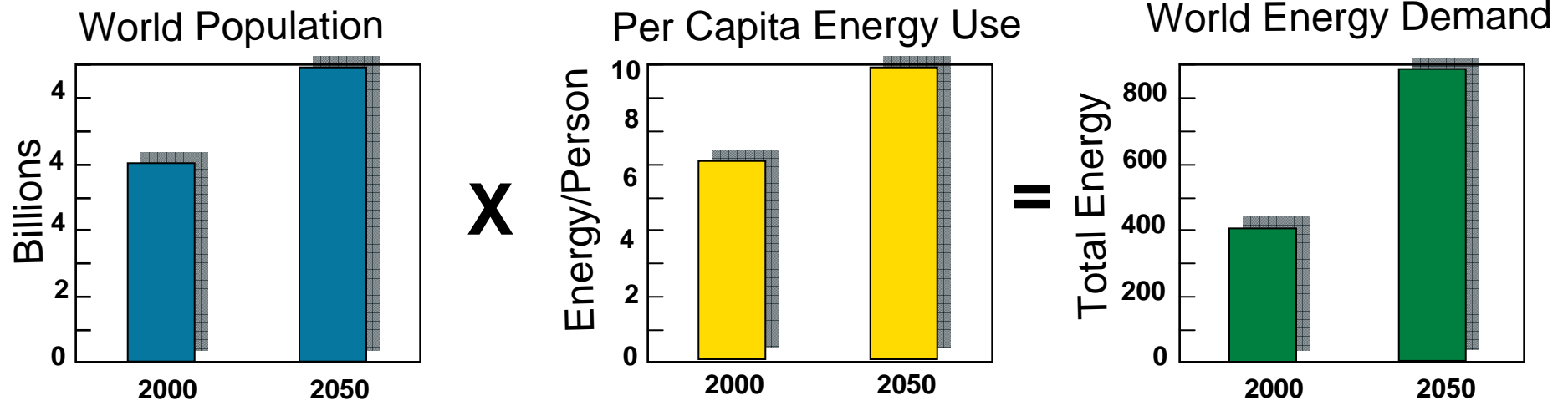
- **Global Energy Demand and GNEP**
- **GNEP** Actions
- **gNEP** Actions
- **GNEP Strategic Plan**
- **Organization and Management Actions**





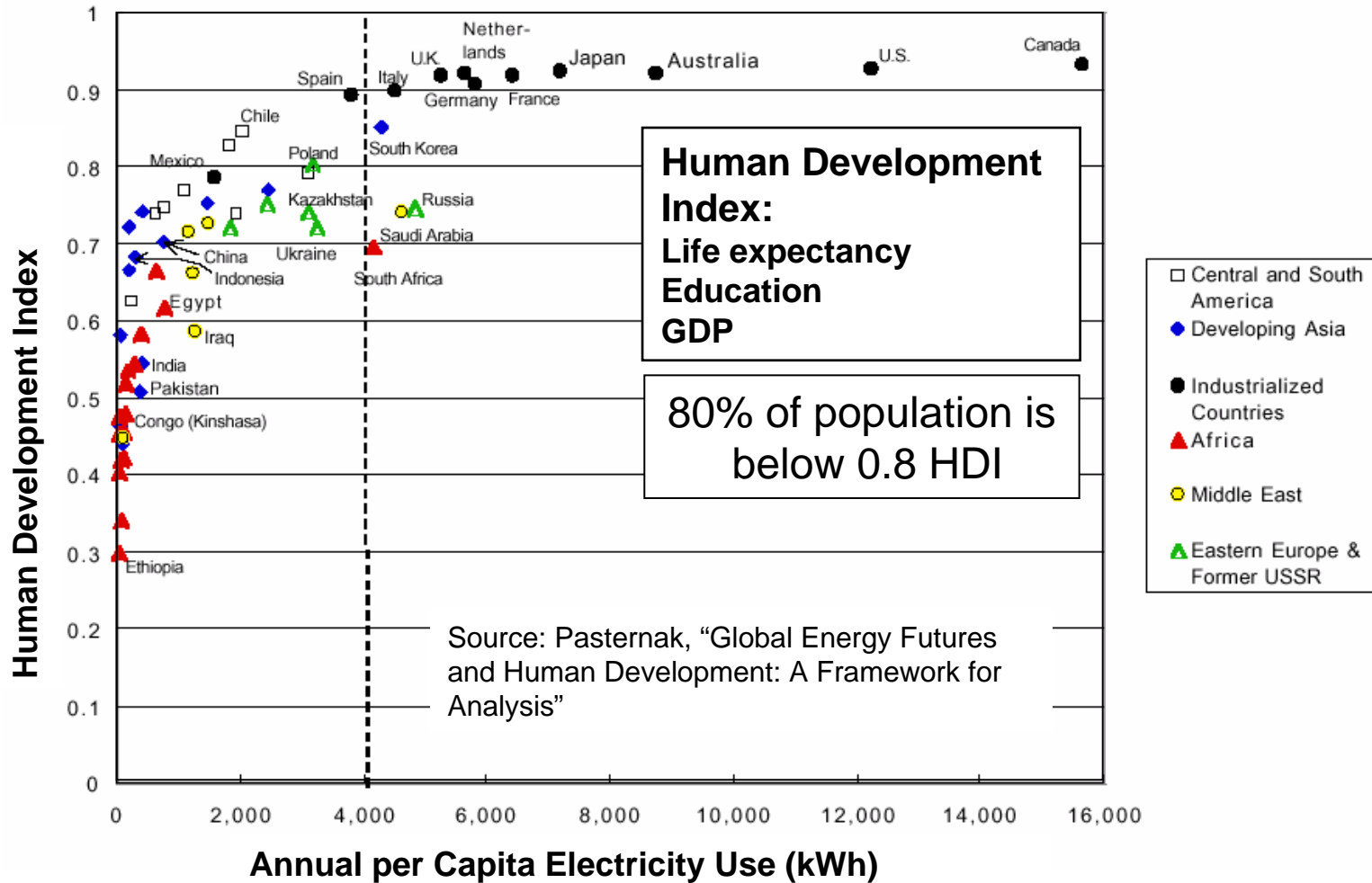
# Global Energy Demand is Expected to More Than Double by 2050

- A reliable energy supply is the cornerstone of sustained economic growth and prosperity
- Expansion of nuclear energy is a key to meeting this demand while reducing greenhouse gases and carbon



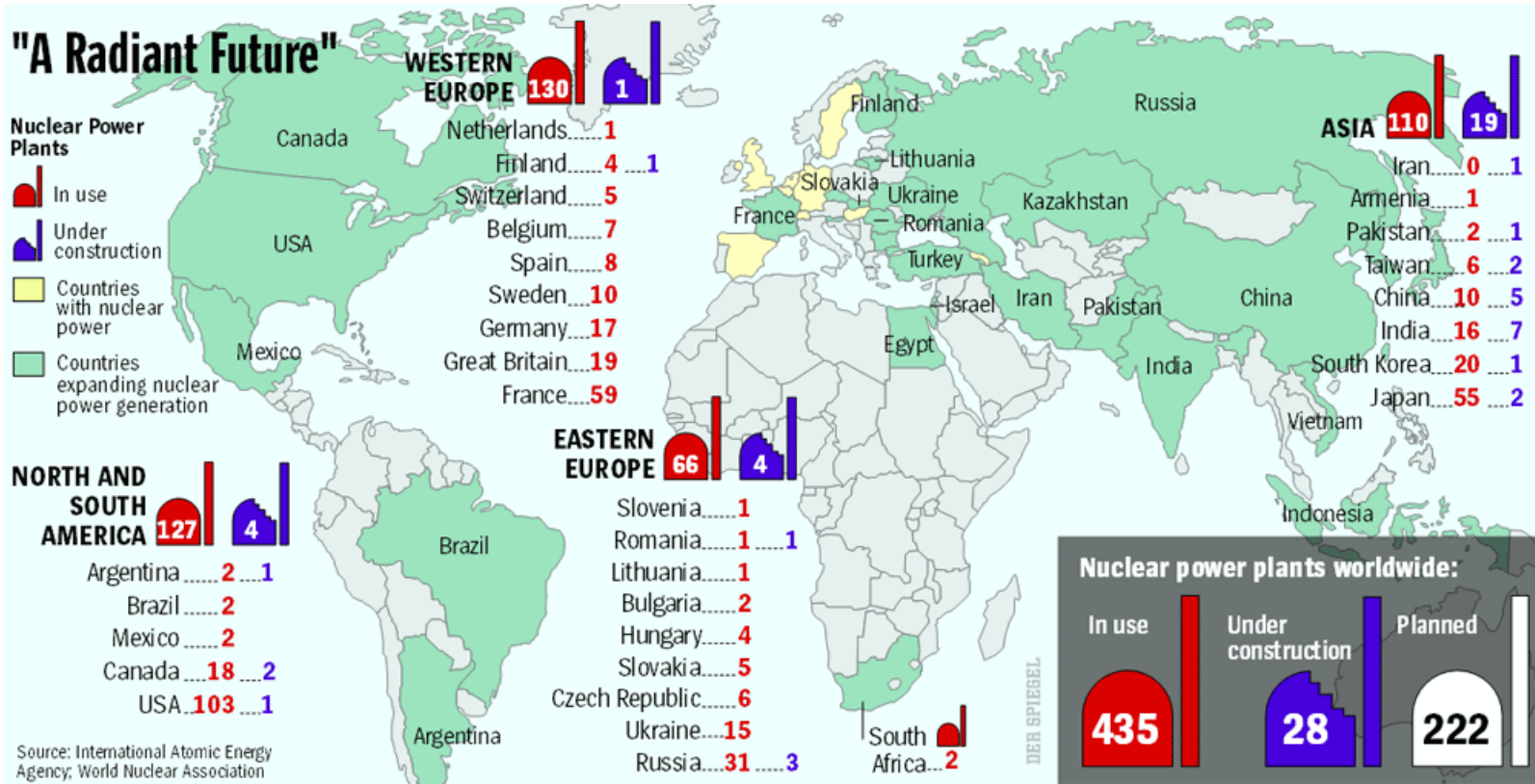


# Electricity and Economic Development go Hand in Hand





# International Expansion of Nuclear Power to Help Meet the Demand is Underway



<http://www.spiegel.de/international/spiegel/0,1518,460011,00.html>





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- Global Energy Demand and GNEP
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## Key International Elements of the U.S. Nuclear Energy Strategy:

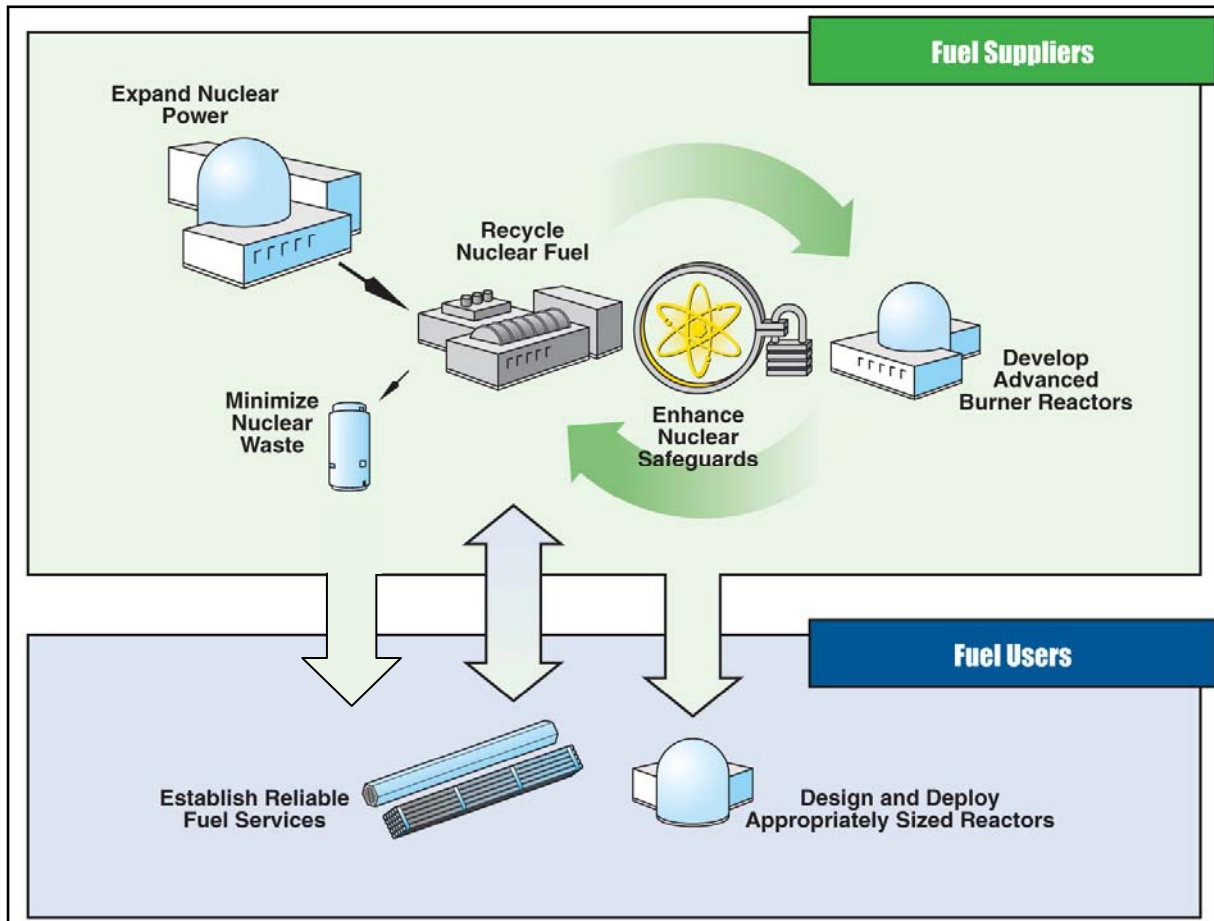
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- Establish supply arrangements among nations to provide reliable fuel services worldwide for generating nuclear energy, by providing nuclear fuel and taking back spent fuel for recycling, without spreading enrichment and reprocessing technologies.
- Develop, demonstrate, and deploy advanced, proliferation resistant nuclear power reactors appropriate for the power grids of developing countries and regions.
- Develop, in cooperation with the IAEA, enhanced nuclear safeguards to effectively and efficiently monitor nuclear materials and facilities, to ensure commercial nuclear energy systems are used only for peaceful purposes.





# Reliable Fuel Service is an Essential Part of National and Global Security



- **Fuel Suppliers:** operate reactors and fuel cycle facilities, including fast reactors to transmute the actinides from spent 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







# Key GNEP International Engagement Pathways

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## ■ Policy Engagement

- Establish bilateral and multilateral GNEP partnerships based on GNEP principles, including fuel supplier, fuel recipient and prospective recipient countries

## ■ Framework Development

- International fuel assurance system that includes:
  - *Reliable fuel leasing mechanisms between fuel suppliers and users;*
  - *Emergency fuel banks/reserves in the event of an interruption in supply.*

## ■ Technical Collaboration

- Advanced fuel cycle cooperation (only with established fuel cycle countries)
- Grid-Appropriate Reactors (small and medium size, 10-350 Mwe);
- Infrastructure development for countries interested in nuclear power





# Draft GNEP Statement of Principles (SOP) Part 1

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- The goal of the Global Nuclear Energy Partnership (GNEP) is the expansion of nuclear energy for peaceful purposes worldwide in a safe and secure manner that supports clean development without air pollution or greenhouse gases, while reducing the risk of nuclear proliferation.
- To ensure that nuclear energy makes a major contribution to global development into the 21st century consistent with non-proliferation and safety objectives, cooperation among GNEP partners will include the following objectives:
  - **Expand nuclear power to help meet growing energy demand in an environmentally sustainable manner and in a way that provides for safe operations and management of wastes.**
  - **Develop and demonstrate advanced technologies for recycling spent nuclear fuel for deployment in facilities that do not separate pure plutonium, with the goal over time of ceasing separation of plutonium and eventually eliminating stocks of plutonium and drawing down existing inventories of civilian spent fuel. Such advanced fuel cycle technologies, when available, would substantially reduce nuclear waste and simplify its disposition. In the interim, GNEP recognizes that countries will take advantage of the best available fuel cycle approaches.**
  - **Develop, demonstrate, and deploy advanced fast reactors that consume transuranic elements from recycled spent fuel.**





## Draft GNEP Statement of Principles (SOP) Part 2

- Establish international supply frameworks to enhance reliable fuel services and supplies to the world market for the purpose of generating nuclear energy, without spreading enrichment and reprocessing technologies.
  - Promote the development of advanced, more proliferation resistant nuclear power reactors appropriate for the power grids of developing countries and regions.
  - In cooperation with the IAEA, continue to develop enhanced nuclear safeguards to effectively and efficiently monitor nuclear materials and facilities, to ensure nuclear energy systems are used only for peaceful purposes.
  - International cooperation among GNEP partners will be carried out under existing and, where appropriate, new bilateral arrangements as well as existing multilateral arrangements such as the Generation IV International Forum and the International Project on Innovative Nuclear Reactors and Fuel Cycles.
  - Commitments and international obligations, including IAEA safeguards and the requirements of UN Security Council Resolution 1540 will be strictly observed. The highest levels of nuclear safety and security will be maintained.
- States that share these goals will be welcome to participate. Through international cooperation, partners aim to accelerate development and deployment of advanced fuel cycle technologies to encourage clean development and prosperity worldwide, improve the environment, and reduce the risk of nuclear proliferation. Participating States would not give up any rights, and voluntarily engage to share the effort and gain the benefits of economical peaceful nuclear energy.





# GNEP – IAEA Activities

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## ■ IAEA – General Conference and Infrastructure Workshop

- Conference, Focus on “Fuel Assurance” and Developing Countries
- Infrastructure Workshop – Focus on Developing Countries Needs





# GNEP International Technical Cooperation

## ■ Russia:

- “Bilateral Action Plan to Enhance Global & Bilateral Nuclear Energy Cooperation” submitted to Presidents Bush and Putin, Dec. 15, 2007.

## ■ Japan:

- “Bilateral Program Plan for Implementing Nuclear Energy Cooperation under GNEP”
  - draft completed, under review by DOE/GC. Target Date for completion – 4/2007.

## ■ France:

- On-going cooperation initiated in 2001 under the Advanced Fuel Cycle Initiative. Value in return evaluated at over \$80 million, in data, test results, and services. Bilateral Program Plan will be established in FY 2007.

## ■ China & U.K.:

- China has expressed strong interest in GNEP cooperation & request an update U.K. has recent expressed interest in GNEP, a meeting is scheduled for Jan 2007.

## ■ Others: Canada, Australia, & Korea:

- All have expressed interest in GNEP cooperation.





# GNEP – International Activities with Russian Federation

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## ■ **Planned Workshops & Deliverables:**

- March 13-14, 2007
- May-August 2007 – U.S. host
- November 2007 – Report on Joint Activities/Accomplishments

## ■ **Sub-Working Group Topics:**

- Transuranic Fuels/Nuclear Data
- Small/Medium Exportable Reactors
- International Fuel Service Center
- Advanced Monitoring, Control and Accounting Technologies
- Fast Reactor Technologies (Design, Safety, etc.)
- Advanced Spent Fuel Processing and Waste Management
- Common Vision





# GNEP – International Activities with Japan

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## ■ Major Meetings and Accomplishments:

- Energy Secretary Bodman, and Minister of Economy, Trade and Industry of Japan, Akira Amari, met in, Washington on January 9, 2007 and reached agreement on completion of bilateral cooperation report by April 2007.
- Agreement on Working Groups:  
*1) Fast Reactor Technology, 2) Separations, 3) Simulation & Modeling, 4) Small Reactors, 5) Safeguards, 6) Waste Forms*

## ■ Activities to Date:

- April 10, 2006, First U.S./Japan meeting – Washington, D.C.
- May 25-26, 2006, Second Meeting, in Tokyo, w/METI, MEXT, MOFA, JAEA
- Jun 29-30, 2006, Working Group Meeting, Argonne National Laboratory
- August 21, 2006, Government-to-Government Meeting, Working Groups Established, Tokyo
- January 29, 2007, DOE/JAEA Meeting to review Bilateral Action Plan, Washington, D.C.





## GNEP – International Activities with France

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### ■ **Activities to Date:**

- Advanced Fuel Cycle Initiative (AFCI) established joint cooperation in 2001, and continues today:
- Semi-Annual Review Meeting – Exchange Technical Information

### ■ **Agreements:**

- DOE/Commissariat A L'Energie Atomique (CEA) Cooperation in Advanced Nuclear Science & Technology, September 18, 2000
- DOE/CEA Implementing Arrangement – Irradiation of Eight (Fuel) Pins in the PHENIX Reactor, August 24, 2004

### ■ **Planned and New Activities:**

- FUTURIX Transuranic Fuel Irradiation to begin in 2007
- Establishment of a new DOE/France Bilateral Cooperative Agreement (focus specifically on GNEP needs)







# GNEP – International Activities with the U.K. and China

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## ■ Activities to Date:

- Initial GNEP Meetings:
  - *U.K. Department of Trade and Industry, London, March 24, 2006*
  - *China - in Beijing, May 22, 2006*

## ■ Recent Activities:

- U.K. Embassy Energy Representative, January 8, 2007- DOE visit
- China – U.S. Embassy Beijing, January 9, 2007 – GNEP Update Requested by China
- Statement of Principles – under discussion with both U.K. & China





## Important Next Steps Internationally

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- **Complete Joint Action Plans with Japan & France**
- **Hold First U.S./Russia Technical Cooperation Workshop  
March 13-14, 2007, Obninsk, Russia**
- **Engagement on Statement of Principles with P-5 + Japan, mid  
2007**





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## Key Domestic Elements of the U.S. Nuclear Energy Strategy:

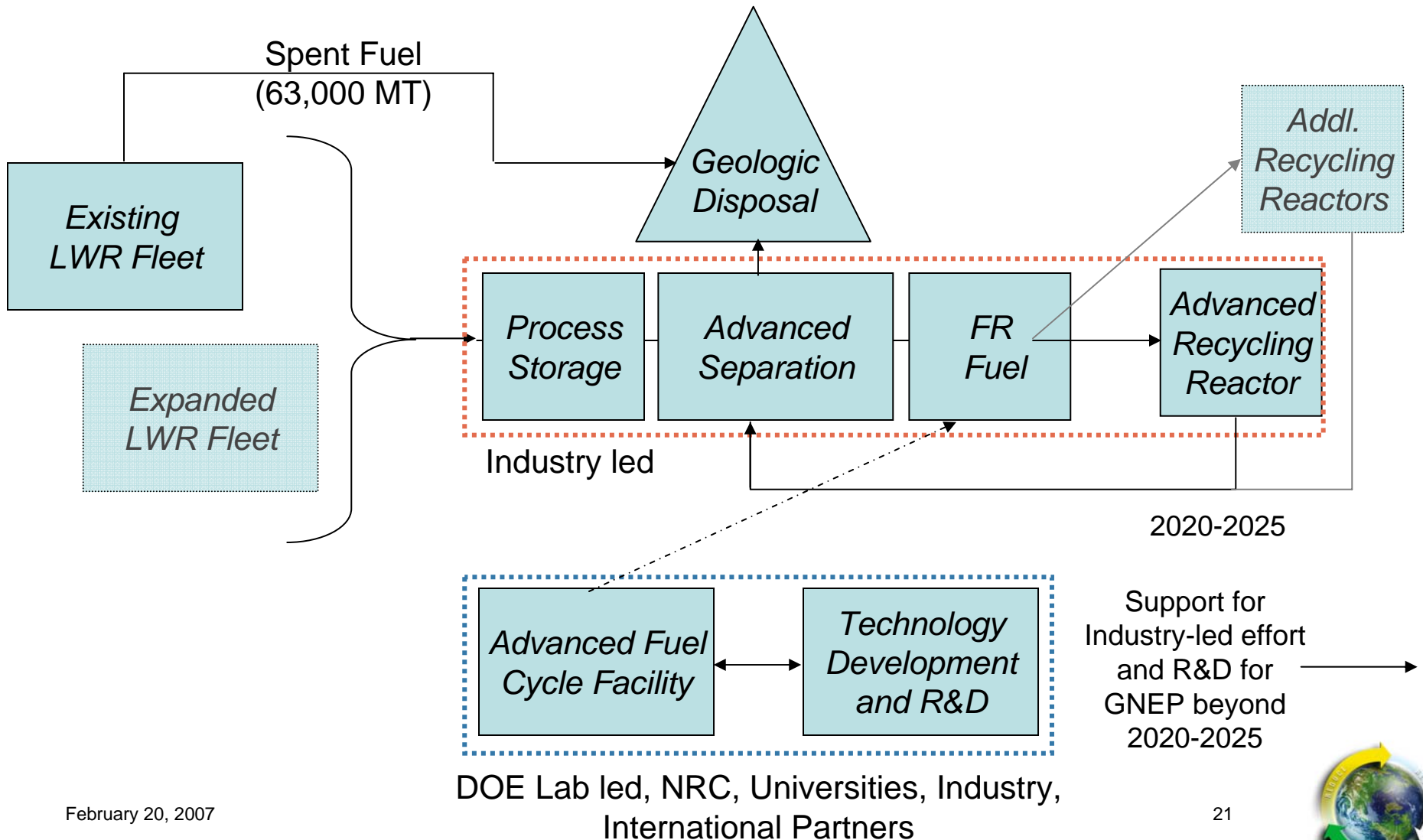
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- Expand nuclear power to help meet growing energy demand in an environmentally sustainable manner.
- Develop, demonstrate, and deploy advanced technologies for recycling spent nuclear fuel that do not separate plutonium, with the goal over time of ceasing separation of plutonium and eventually eliminating excess stocks of civilian plutonium and drawing down existing stocks of civilian spent fuel. Such advanced fuel cycle technologies will substantially reduce nuclear waste, simplify its disposition, and help to ensure the need for only one geologic repository in the United States through the end of this century.
- Develop, demonstrate, and deploy advanced reactors that consume transuranic elements from recycled spent fuel.



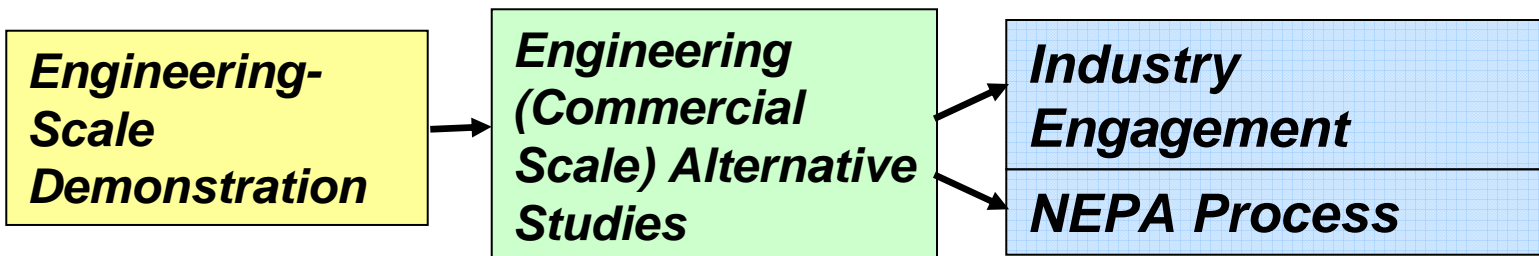
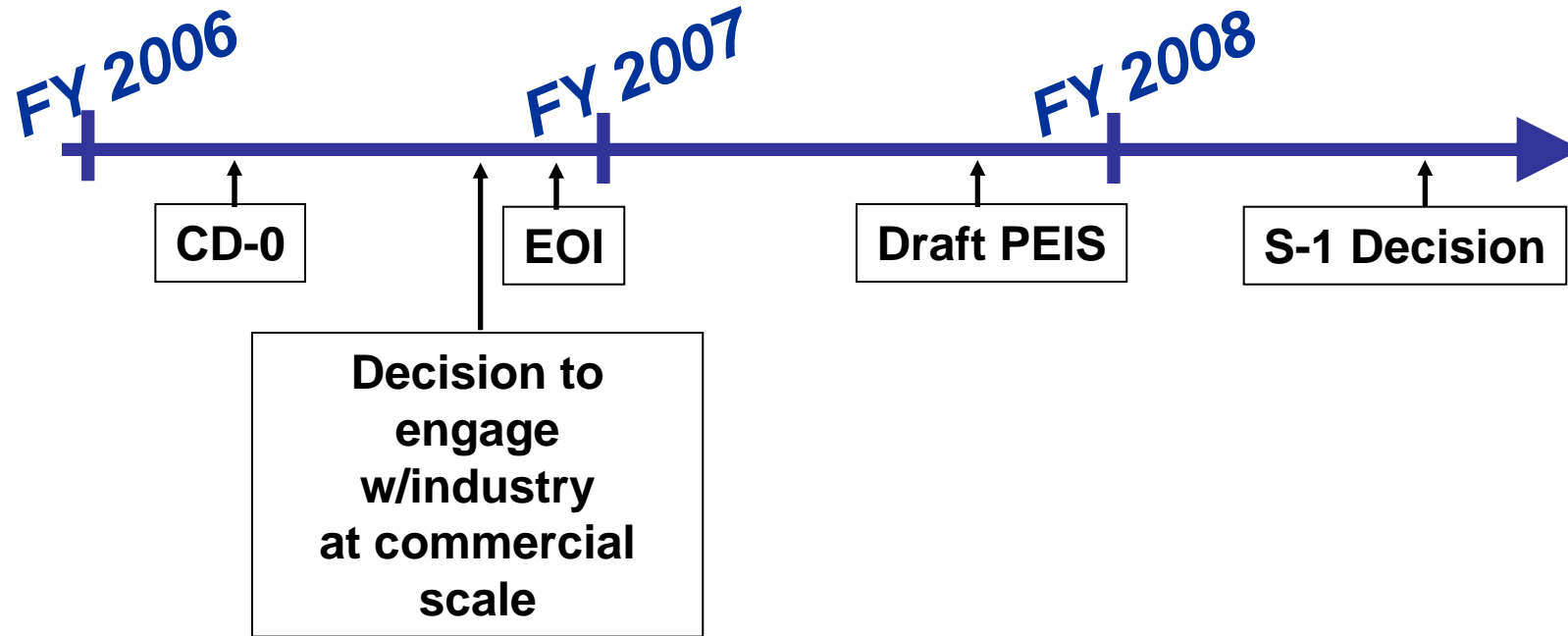


# Supporting the GNEP Strategy Requires New Facilities, Technology Development and R&D



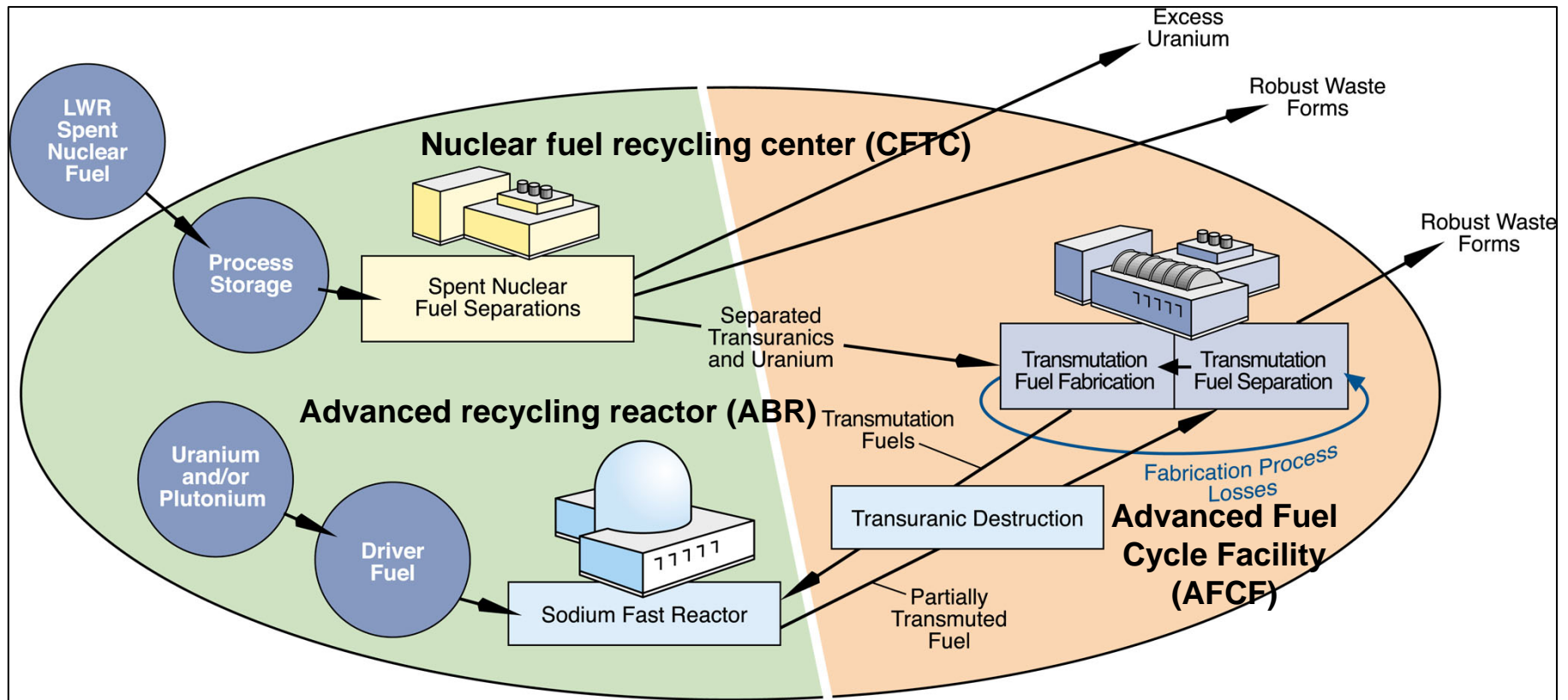


# The Domestic Approach to GNEP has Evolved





# For the Initial GNEP Operation We Envision Three Supporting Facilities





# Consolidated Fuel Treatment Center (CFTC) project is preparing for S-1 Decision and beyond

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## ■ Engineering Alternative Studies

- Evaluation of the most challenging aspects of engineering-scale and commercial-scale deployment of light water reactor spent fuel recycling

## ■ Industry Engagement

- Developing an approach that engages with industry early while refining a long-term acquisition strategy that appropriately shares costs and risks between the government and private sector to more efficiently deploy GNEP facilities

## ■ Project will need to address key areas of risk:

- Advanced separations technology scale-up and implementation
- Schedule risk due to uncertain regulatory framework
- Approval (potentially) to share sensitive spent fuel separations technology between foreign governments, companies and people
  - *Significant global separations experience resides outside the U.S.*
- Waste management product qualification and disposition







## Near-term CFTC activity status and plans

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### ■ CFTC Expressions of Interest from Industry

- EOI was issued in August 2006 with input received in September 2006
- Future industry engagement expected by September 2007

### ■ GNEP Detailed Siting Studies

- FOA issued in August 2006 (the 11 grants awarded in November)
- Awards made in January 2007 (with a 90 day performance)

### ■ GNEP NEPA Documentation

- NOI issued in January 2007 with EIS-ROD expected in Summer 2008

### ■ Engineering Alternative Studies

- Contract awarded in August 2006 through the INL to WSRC
- Initial EAS will be completed by June 2007; possible follow on studies through June 2008

### ■ DOE Decision Process

- Support Secretarial Decision (June 2008)





# Advanced Burner Reactor (ABR)

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- **The ABR is a sodium cooled fast reactor designed to**
  - Demonstrate closure of the fuel cycle
  - Consume transuranic elements from recycled fuel to generate electricity
  - Reduce the burden on the geologic repository
  - Generate electricity for the grid
  
- **The ABR will serve as a prototype for future fast reactors**
  - Incorporate improved safeguards and passive safety features
  - Qualify transmutation fuels and materials
  - Demonstrate fast reactor safety
  - Demonstrate cost reduction design features





## ABR Status

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- **Feedback from the stakeholder community has endorsed**
  - sodium cooled fast reactor technology
  - the 2020-2025 timeframe for initial startup using conventional technologies
    - additional technology development and R&D is required
  - proceeding with a commercial scale prototype
    - A pre-conceptual design has been completed for a 250 MWt test reactor
  
- **There is interest from potential host communities to site the ABR**
  
- **The assessment of environmental impacts is underway as part of the GNEP Programmatic Environmental Impact Statement**





## ABR Path Forward

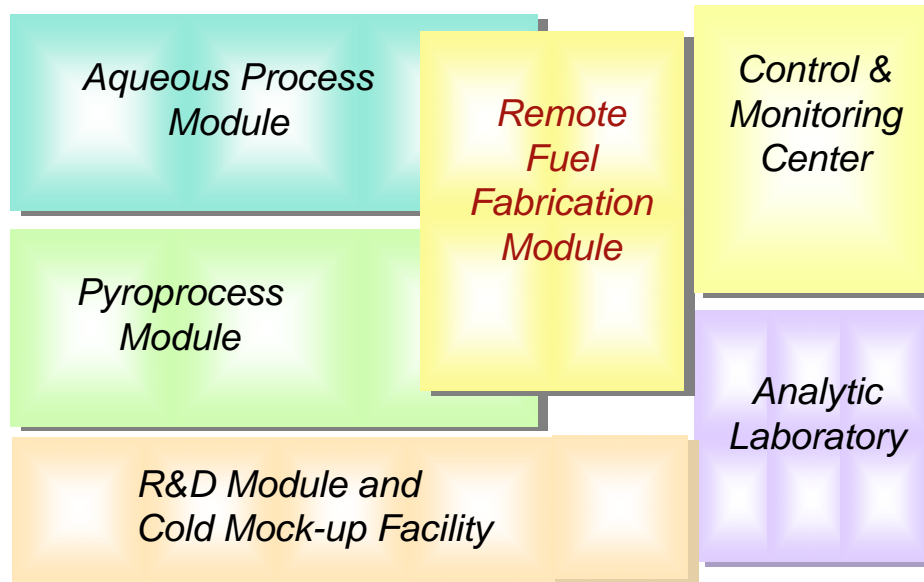
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- **Address potential risk areas**
  - cost competitiveness with advanced LWRs
  - transmutation fuel development
  - deterioration of the domestic infrastructure
  
- **Work with the NRC to establish the appropriate regulatory framework for commercial fast reactors**
  
- **Complete the NEPA process**
  
- **Develop strategy for near term and long term industry engagement and international collaboration**
  - Including potential for international fast reactor collaboration
  
- **Provide input to support Secretary Bodman's decision**





# AFCF is a Research and Technology Development Facility for Advanced Recycling Technologies.



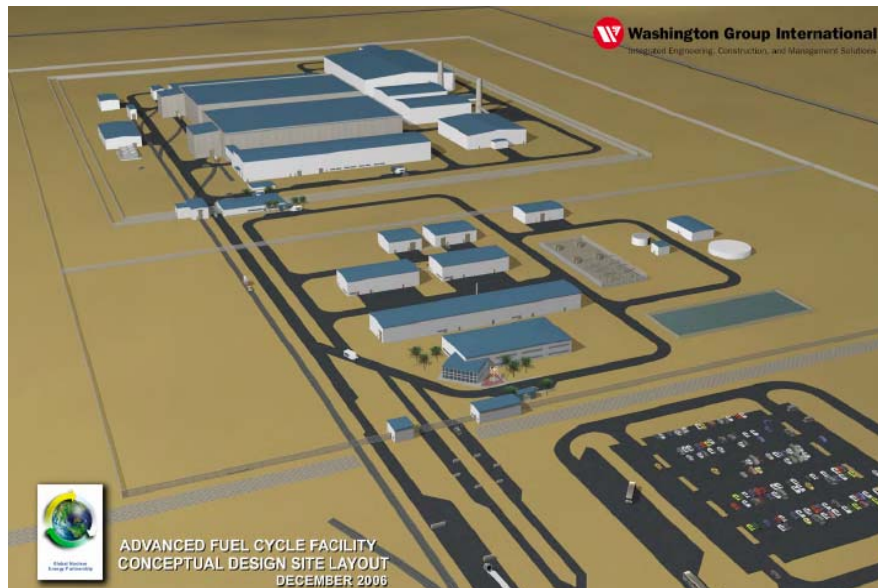
- **100,000 to 150,000 sqft integrated facility for advanced technology development**
  - Aqueous Process
  - Pyroprocess
  - Transmutation Fuel
  - Waste Form
- **Demonstration bed for advanced safeguards, materials controls and accountability (MC&A)**

- **When completed, AFCF will become the World's most advanced facility for developing advanced recycle technologies.**
- **AFCF design will be determined by National Laboratories. The research and technology development using AFCF will be carried out in collaboration with universities, industry and International partners.**





## 30% Conceptual Design Review Has Been Successfully Completed.



- **30% Conceptual Design Review has been completed.**
  - The review team concluded that the project team has done an impressive job.
  - An virtual facility layout was generated and well-received by the reviewers.
- **30% conceptual design will be used as the baseline for subsequent trade studies and improved cost estimate**
- **Technical basis for the flow-sheets associated with the baseline technologies are documented and uncertainty assessments started.**
- **The objective is to provide a reliable cost and schedule estimate for June'08 Secretarial Decision.**

February 20, 2007

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## GNEP has a Strategic Plan in Place That Calls for Specific Actions

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- Obtain input from U.S. and international industries and governments on how best to bring the needed GNEP facilities into being, what technology and policy issues must be resolved, and what business obstacles must be overcome.
- Develop a detailed GNEP technology roadmap for demonstrating solutions to the remaining technical issues in order to support commercial GNEP facilities. Inform and adjust this roadmap with input received from industry, international partners, and the policy community.
- Pursue industry participation in the development of conceptual design and other engineering studies that support both a nuclear fuel recycling center and an advanced recycling reactor.
- Prepare a programmatic GNEP Environmental Impact Statement.
- No later than June of 2008, prepare a decision package for the Secretary of Energy to proceed with a government-industry partnership to build a nuclear fuel recycling center and a prototype advanced recycling reactor







# The GNEP Plan Requires Industry Supported by Technology Development

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- **The plan is to have commercial-scale fuel recycling and demonstrate the closed fuel cycle in the U.S. as early as possible (2020 - 2025)**
  - Building commercial-scale prototypes of recycle and fast reactor facilities will require Technology Development
    - *Industry led design and construction, operation*
    - *Laboratory led work to close technology gaps in fuel cycle knowledge and to develop and transmutation fuel*
- **Supporting this approach requires both Engineering Development and R&D**
  - Engineering Development will support work needed for design and construction of ABR, CFTC, and AFCF
  - R&D focus on longer-term activities supporting fuel-cycle development and implementation
- **Within the GNEP structure INL will provide technical integration of work performed by other participating laboratories**





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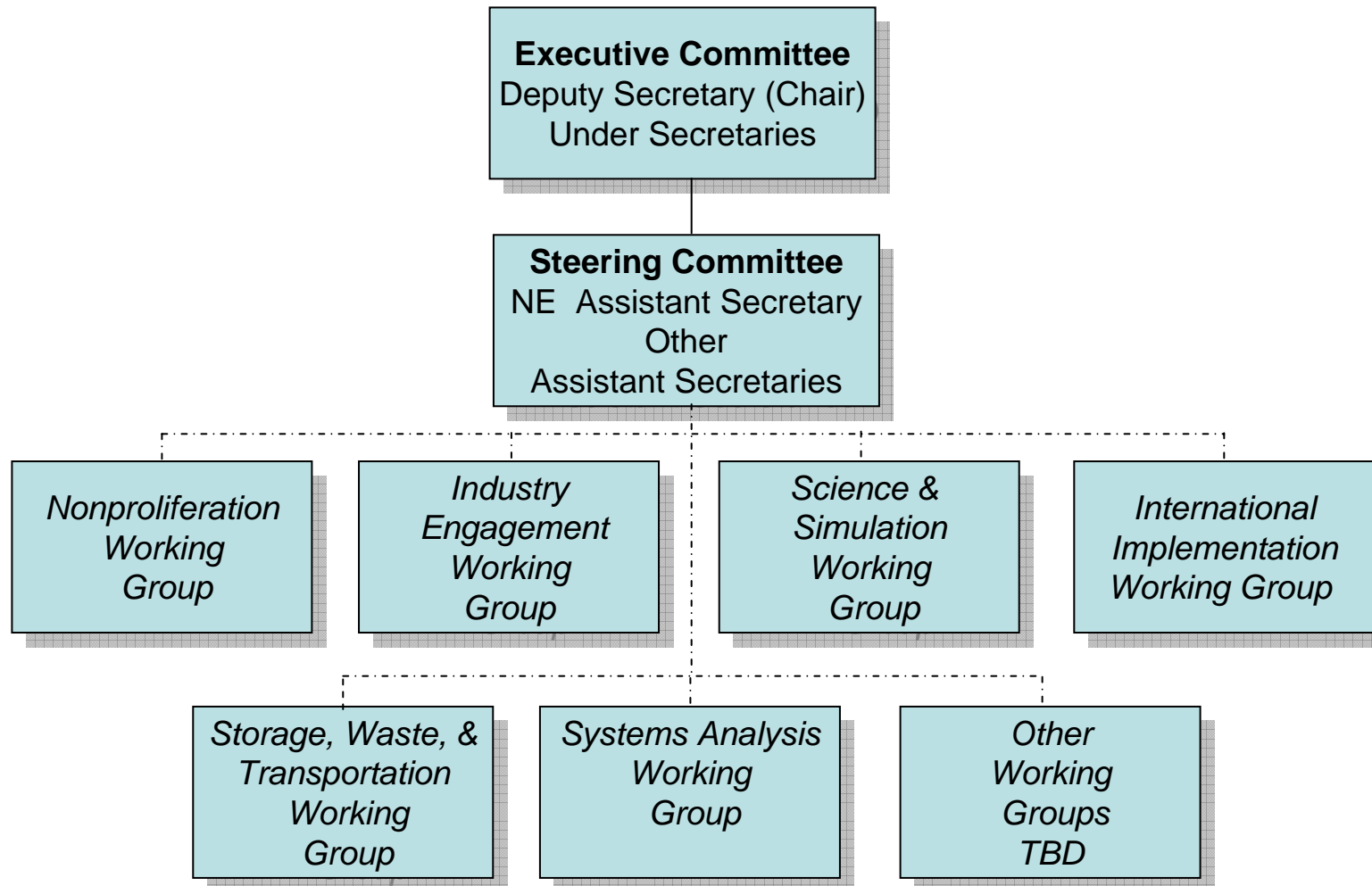
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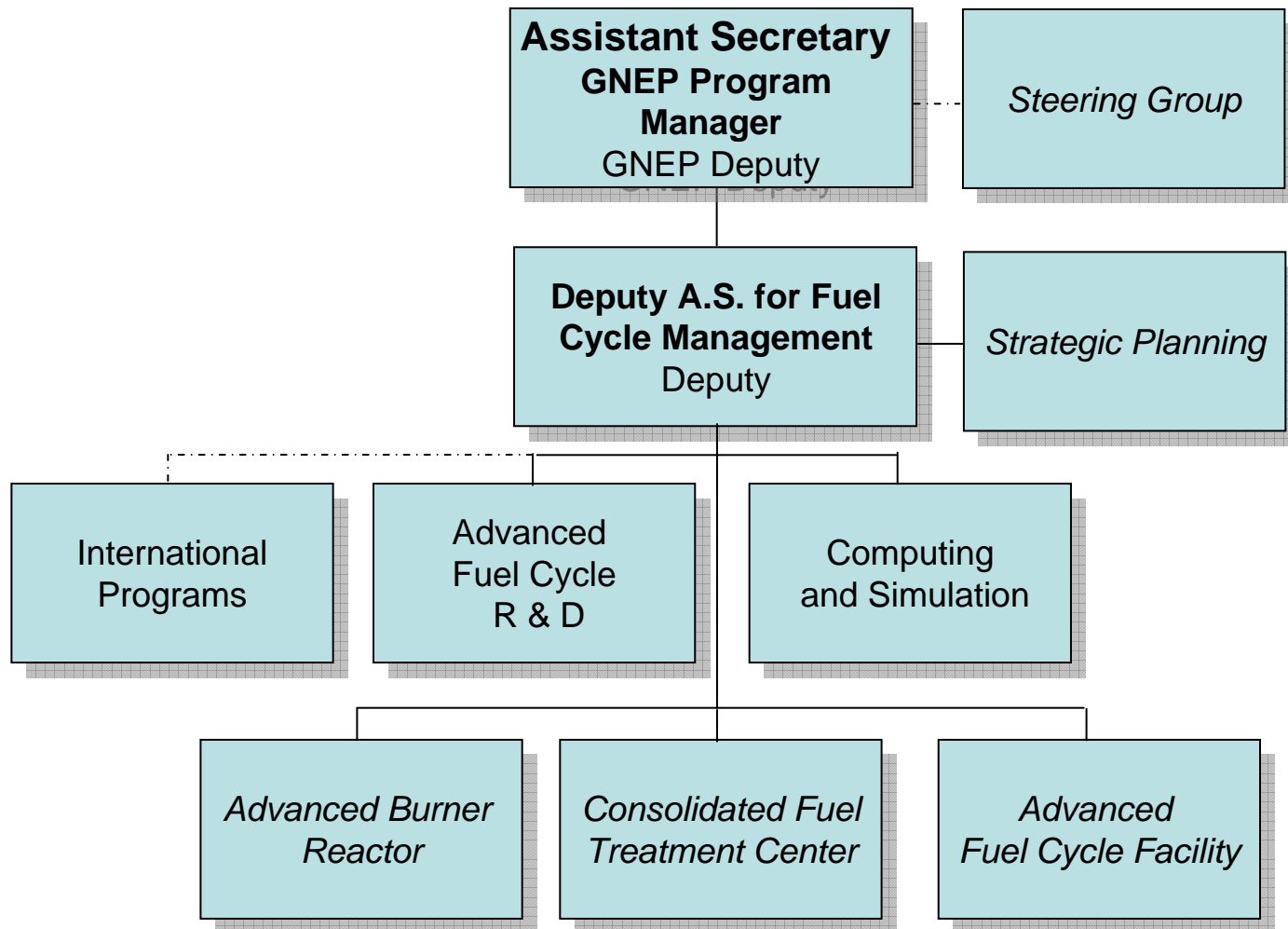


# The DOE has Established a Functional Structure to Manage GNEP Across Organizational Boundaries





# The Office of Nuclear Energy has a GNEP Program Organizational Structure Supporting the Strategic Plan





## Near Term GNEP Actions Have Increased Emphasis on Work to Inform the 2008 Secretarial Decision

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- **Restructure to move from Advanced Fuel Cycle Initiative to GNEP management**
- **Develop and implement GNEP technology using industry and national laboratories**
- **Engage international community in GNEP technology**
- **Engage international community on fuel services**
- **Develop adequate information to inform the Secretarial decision on GNEP in June of 2008**





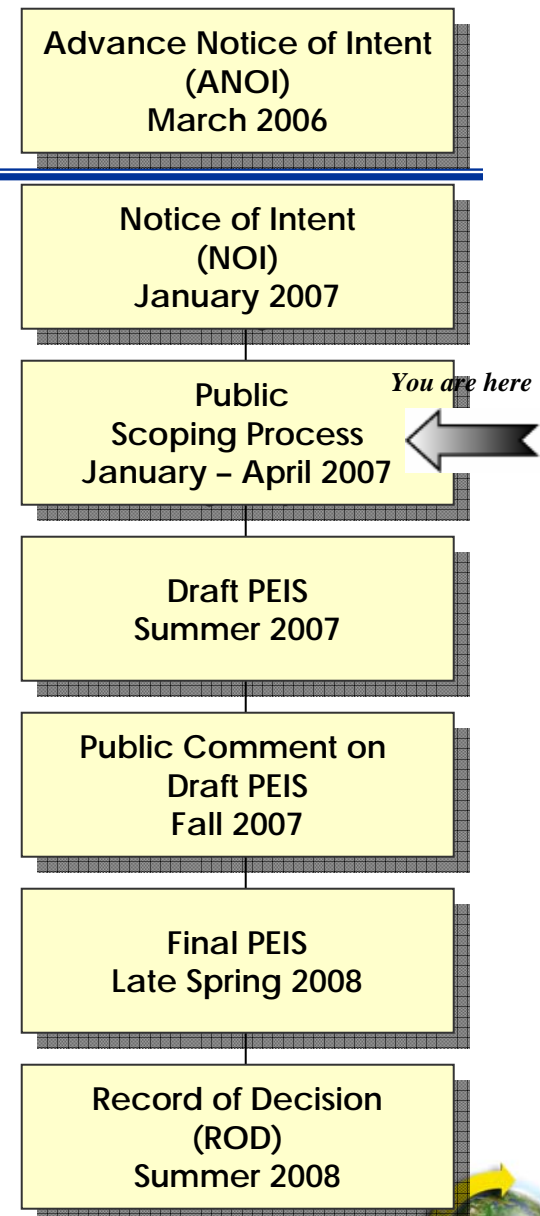
## A NEPA Process is Underway to Provide Siting Information

- NEPA requires consideration of potential environmental impacts of proposed actions and alternatives
- This process utilizes public involvement to produce more informed and better decision-making
- An Environmental Impact Statement (EIS) is required for any major federal action that may significantly affect the quality of the human environment
- A Programmatic Environmental Impact Statement (PEIS) is prepared for a broad program such as GNEP

See

<http://www.gnep.energy.gov/PEIS/gnepPEIS.html#gnepPEISScopingMeetings>

February 20, 2007





# GNEP Site Alternatives

The following sites are under consideration for one or more of the facilities planned under GNEP:

## DOE Sites

- Argonne National Laboratory (IL)<sup>3</sup>
- Hanford (WA)<sup>1,2,3</sup>
- Idaho National Laboratory (ID)<sup>1,2,3</sup>
- Los Alamos National Laboratory (N.M.)<sup>3</sup>
- Oak Ridge Reservation (TN)<sup>1,2,3</sup>
- Paducah (KY)<sup>1,2</sup>
- Portsmouth (OH)<sup>1,2</sup>
- Savannah River Site (S.C.)<sup>1,2,3</sup>

## Non-DOE Sites

- Atomic City, ID<sup>1,2</sup>
- Barnwell, S.C.<sup>1,2</sup>
- Hobbs, N.M.<sup>1,2</sup>
- Morris, IL<sup>1,2</sup>
- Roswell, N.M.<sup>1,2</sup>

\*1: Advanced recycling reactor; 2: Nuclear fuel recycling center; 3: Advanced fuel cycle research facility





## Record of Decision (ROD)

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- **DOE's Record of Decision will determine whether to proceed with the construction and operation of GNEP recycling facilities, and if so may address:**
  - where to locate any such facilities
  - what technologies and capacities to utilize
  
- **DOE's decision will be based on input from the PEIS, as well as cost, technical, and policy information**







## Near Term GNEP Actions

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- **Secure the President's Budget Request**
- **Engage industry**
- **Develop and implement GNEP technology pathway using both industry and national laboratories**
- **Engage international community in GNEP technology and on fuel services**
- **Develop adequate information to inform the Secretarial decision on GNEP in June of 2008**





## GNEP – “Why” and “Why NOW”

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- **There is a rapidly expanding global demand for nuclear power**
  - Without some global regime to manage this expansion many more “Iranian” situations will likely appear
- **A global regime is forming up with Russia, France, Japan and China having both the will and the means to participate.**
  - The United States, through GNEP, is leading the formation of this global regime but we do not have the means to participate in its execution.
- **Unless the United States implements the domestic aspects of the GNEP program we will suffer significant consequences in our energy security, industrial competitiveness and national security.**
- **There are potential repository benefits, but the international need for GNEP is compelling.**
- **The United States must act decisively and quickly to implement GNEP or face the real possibility of having no influence over the certain future global expansion of nuclear energy.**

