The Global Nuclear Energy Partnership: Systems Analysis and Integration

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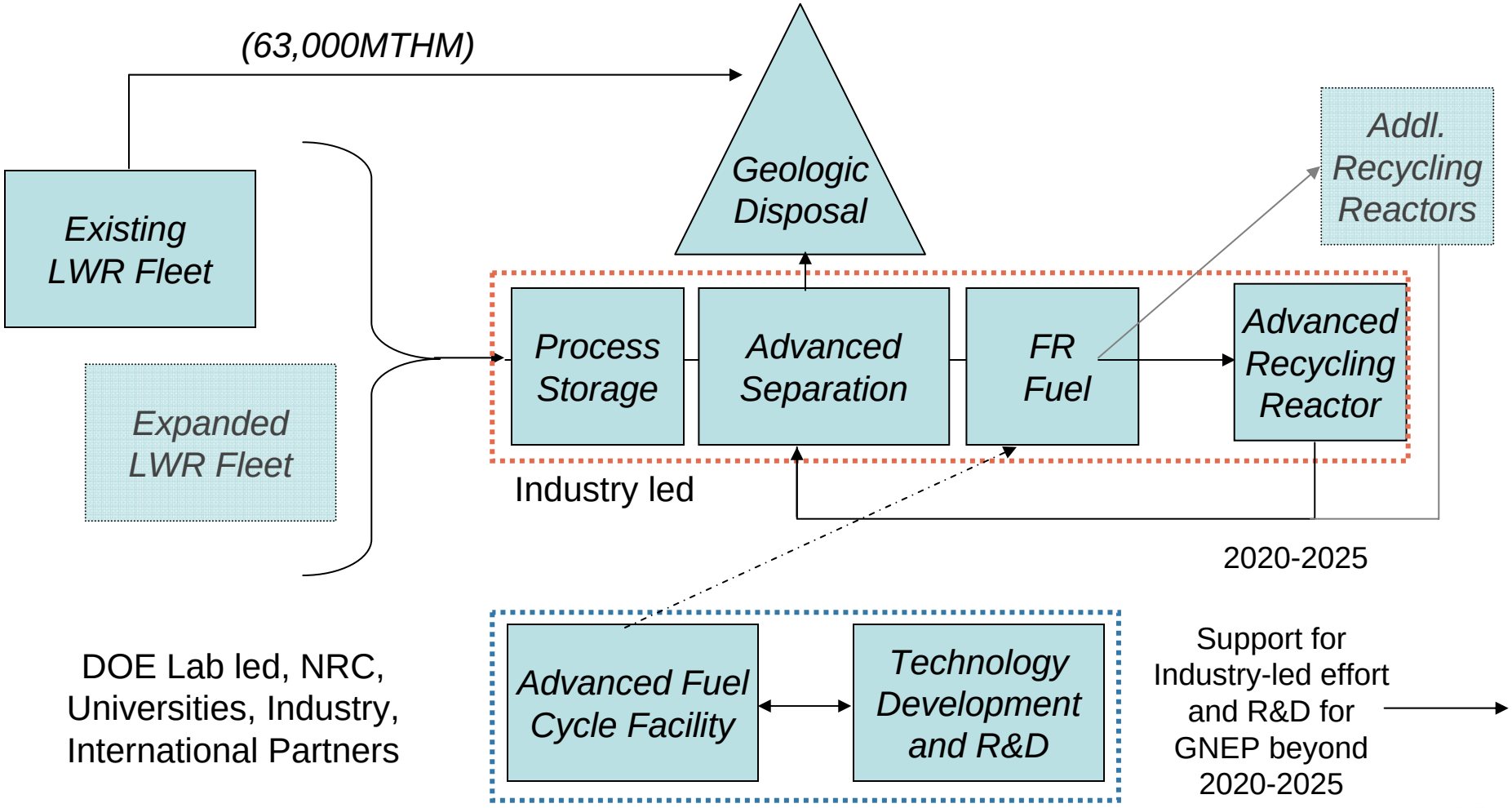
Summary

- The Role and Challenges of Systems Analysis
- System Architectures and their Benefits
- Technical Options and Alternates
- Economics Analyses
- 2008 Focus
- Path Forward on Technical Integration
- Conclusions

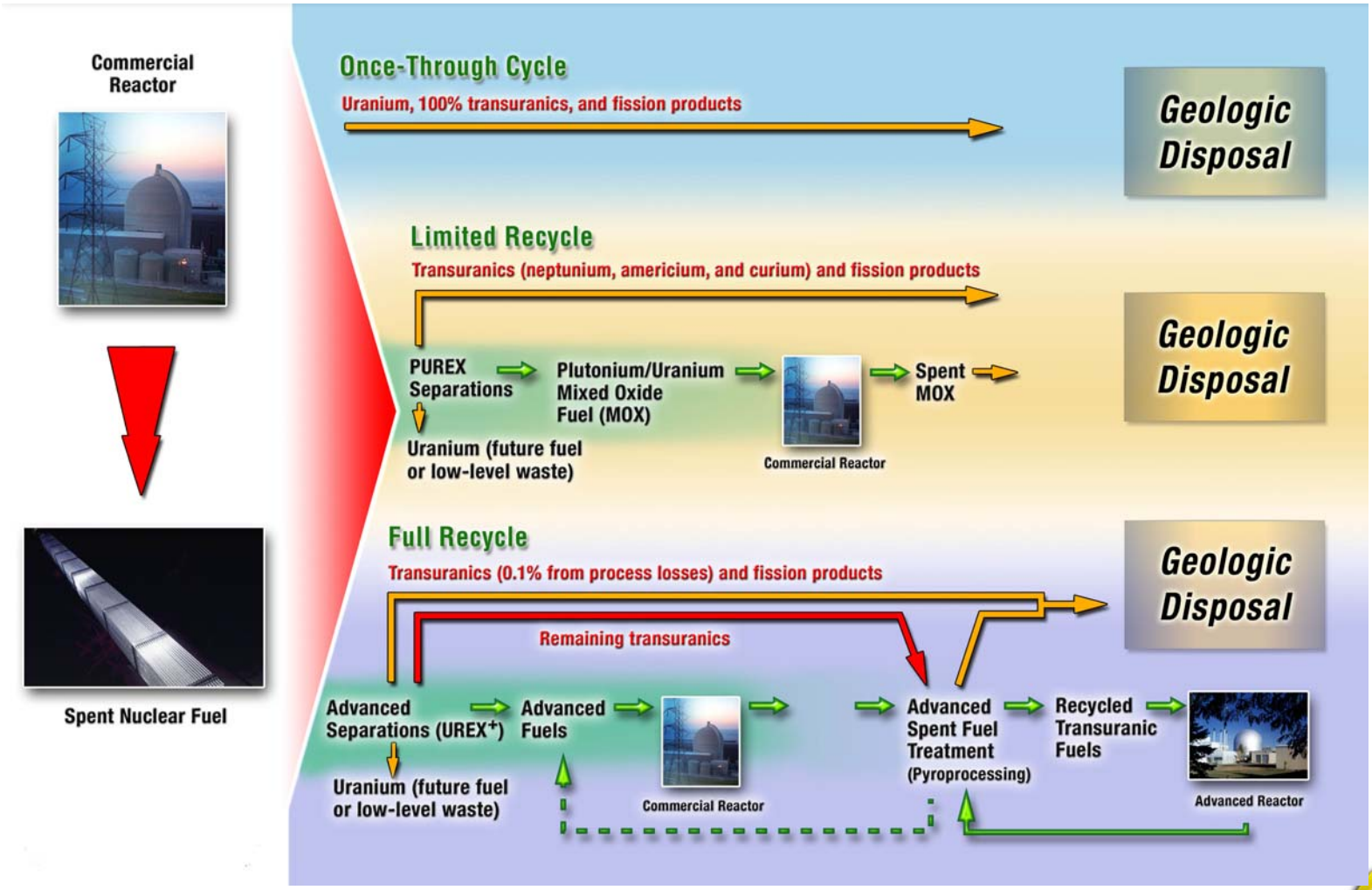
Supporting the GNEP Strategy Requires Facilities and Capabilities that Largely Do Not Exist at Present



Challenges of Systems Analyses

- **GNEP objectives are technically complex**
  - Need a requirement driven process to structure the approach
- **Technologies are highly interdependent**
  - Need to choose a workable system
- **Materials pathways need to be managed**
  - Many forms are envisioned; management will need to last for centuries
- **Economics and deployment strategies are key issues**
  - Need integrated analysis approaches
  - Understand and manage benefits and costs
- **Technology risk needs to be managed**
  - Need to develop a prioritized technical approach

2. Spent Nuclear Fuel Management Options



3. Systems Analyses Accomplishments: Selection of Reference Technical Options

- **Systems Analyses Investigations have demonstrated that:**
  - Achieving repository benefits (capacity, dose) requires the management of uranium, transuranics, and certain short- and long-lived fission products. The UREX+1a process provides a proof of existence of such schemes.
  - Losses of transuranics must be controlled during separations and fuels fabrication stages to achieve these benefits
  - Significant transmutation of transuranics is not practical in current commercial reactors; fast reactors provide a more efficient solution
  - Transuranic elements should be kept together as much as practical to reduce proliferation risk
  - Systems analysis must address the entire fuel cycle
  - Transition to a closed fuel cycle will take several decades to complete
  - To reduce proliferation risk in the international fuel cycle, it is critical to discourage the spread of enrichment and separation capabilities, and to eliminate excess stocks of separated plutonium
- **Issues needing further attention:**
  - Evaluation of alternative options
  - Domestic and international deployment scenarios
  - Economics
  - GNEP waste management strategy

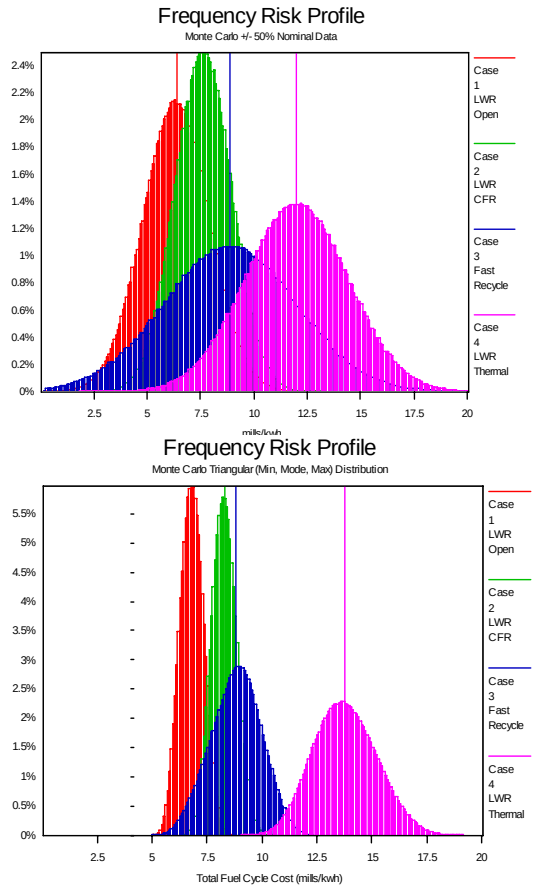
Evaluation of Alternate Options

- **Current choice of reference technologies provides a proof of existence.**
  - Performance might not be optimized
  - Economics might not be optimized
  - Implementation will need to progress incrementally

- **Key alternates that need to be evaluated**
  - Separation schemes that provide a transition from existing technologies to complete waste management
  - Transmutation schemes that are adapted to that transition
  - GNEP waste management strategy that incorporates both technical and regulatory requirements

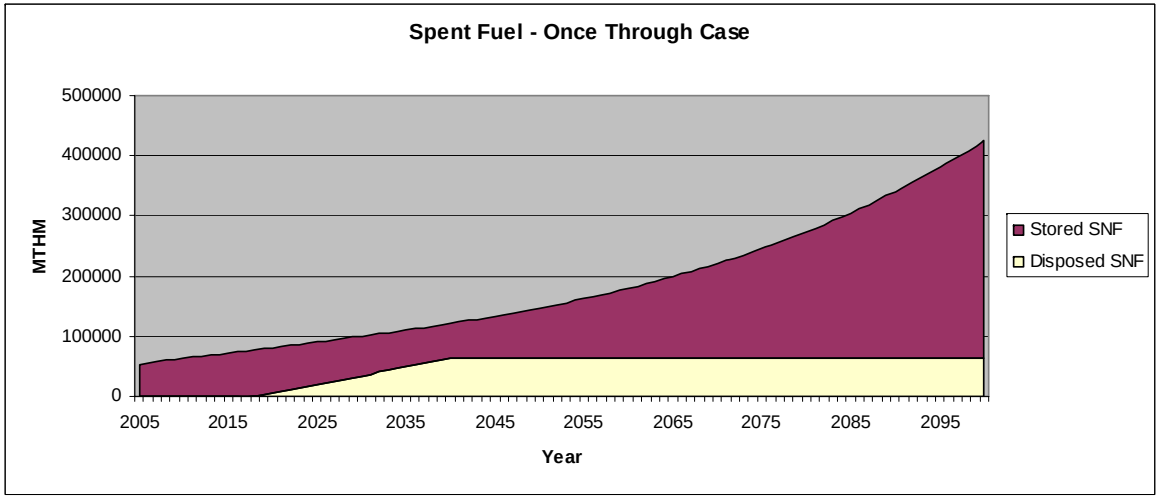
The Economics task is developing an on-going, credible, technical cost analysis basis

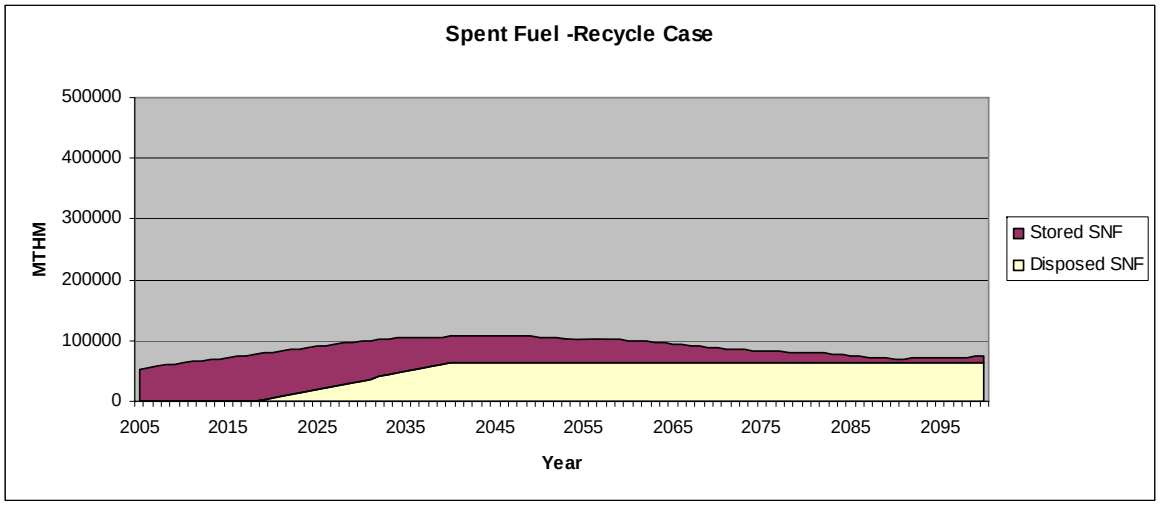
- **We are evaluating the impacts and benefits of a wide range of nuclear energy deployment options to:**
  - understand the issues and opportunities related to keeping nuclear power an economically competitive option (via greater participation with Industry),
  - evaluate the elements that dominate nuclear fuel cycle costs (via modeling and sensitivity analysis),
  - and help to develop creative solutions that can make future nuclear reactors and their fuel cycles internationally viable (via international participation).
- **Our costing database continues to be reviewed by independent industry experts**



The goal is to provide a balanced analysis with consistent cost data, credible design basis, and peer-reviewed methods and accounting practices

Comparison of SNF Storage and Disposal for Once-Through and Recycling scenario

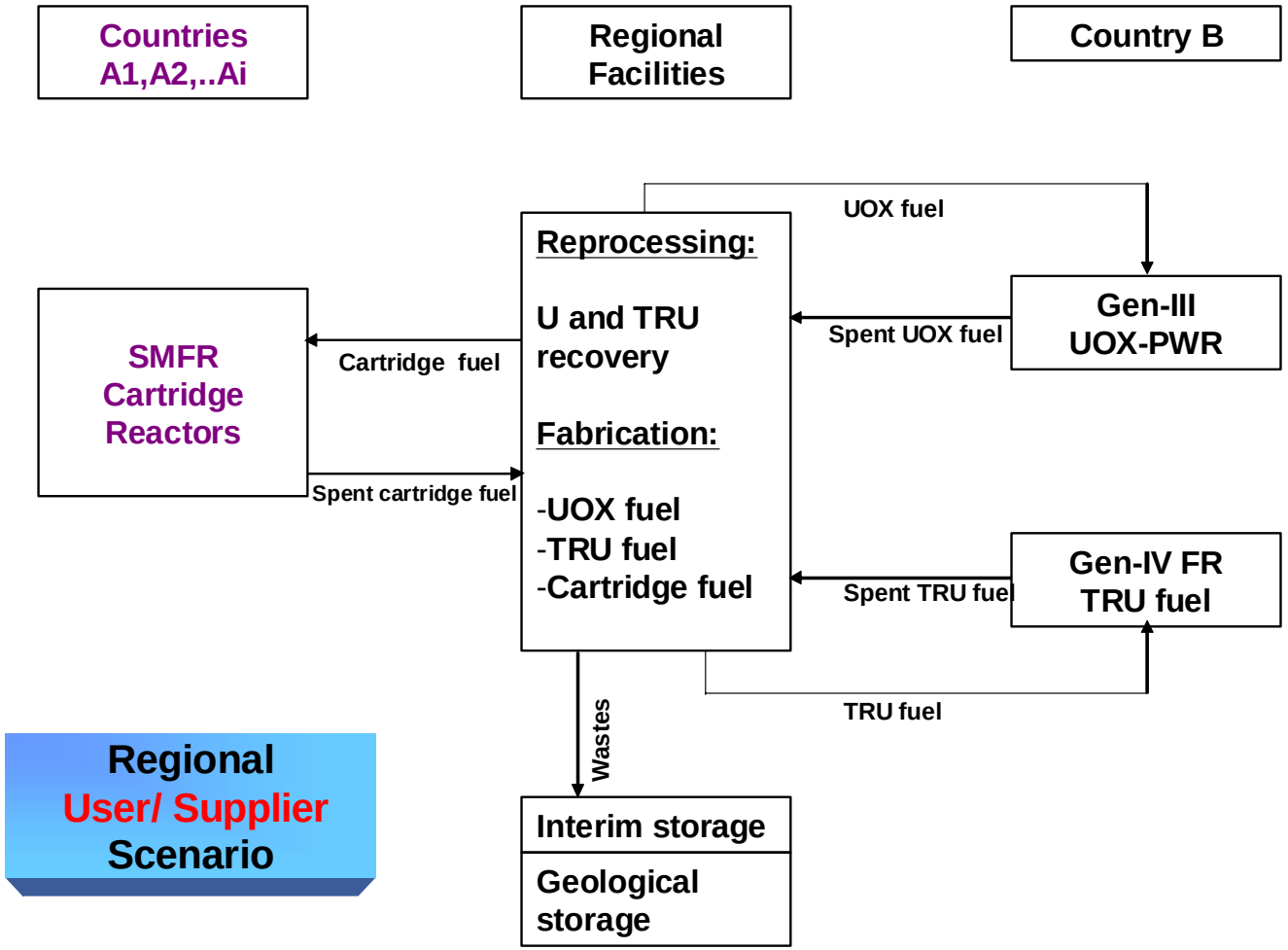




Once developed, scenario analyses such as this one provide important information

- **Provides insights on the interactions between constraints and variables**
- **Provides important information for program decisions and enables system enhancements**
  - Coordination and timing of facilities
  - Requirements for separations efficiencies
  - Technology cost estimates for market penetration
  - Guide technology development needs
  - Repository/waste form acceptance criteria
  - Informs licensing/regulatory process
  - Enables evaluation of options and optimization and system
  - Transportation infrastructure needs
  - Industry infrastructure needs
  - Informs national/international laws and policies
  - Informs program risk
- **Enables effective communication to stakeholders**

NEA/OECD Working Party on Scientific Issues of the Fuel Cycle includes studies of User/Supplier scenarios



Near-term Focus is Input to the Secretarial Decision Package for June 2008

- **Deployment options. Comparison with partner states**
- **Economic and business payoffs**
  - Benefits, costs, and their redistribution
- **Effect of uncertainties in technology development**
- **Input to business plan**
- **Role of nuclear (with GNEP) in global energy picture**
- **Integrated waste management strategy**
- **Provide input to NEPA and PEIS activities**

Path Forward on Technical Integration

- **Organize the Program into Campaigns (4/1/2007):**
  - Focused product driven structure
  - Integrate Technology Development, Engineering Research, Modeling and Simulation, and Scientific Research
  - Drive the transformation of the research process
  - Six Potential Campaigns:
    - *Systems Analyses*
    - *Fuels*
    - *Separations*
    - *Fast Reactors Technologies*
    - *Safeguards*
    - *Waste Forms*

Path Forward on Technical Integration (2)

- **Establish a Technical Integration Office (TIO) with two functions**
  - Technical coordination
    - *Between campaigns*
    - *Between campaigns and projects*
    - *Between campaigns and foreign partners*
    - *TIO drives Systems Analyses*
    - *TIO owns cross cutting activities (Regulations; …)*
  - Program coordination
    - *Integrated schedules*
    - *Controls*
    - *QA*
    - *Information Management*
    - *Communication*

Summary

- **Under the GNEP initiative, the systems analysis effort is now focused on definition and assessment of a closed fuel cycle**
- **Dynamic scenario analyses are used to integrate program information and inform program decisions**
  - Provides insights on the interactions between constraints and variables
  - Provides important information for program decisions and enables system enhancements
  - Enables effective communication to stakeholders
- **The systems analysis effort will assist in informing both domestic and international policy**