

# 2011 Carnegie International Nuclear Policy Conference

## Destination Unknown: Where is the Global Nuclear Fuel Cycle Heading?

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# Current State-of-Play

- Significant Expansion of Spent Fuel Services – particularly in South Asia – represent three NWPA-sized repositories (about 200,000 MT)
- The Republic of Korea, in the short-term, and China and India in the longer-term, will be among the dominant worldwide nuclear reactor suppliers – represent another tripling
- Trend towards bundled services (tied to Reactor Sales)



# Utopian Vision: (Former IAEA Director-General's Three-Stage Process)

- The first step would be to establish a *system for assuring supply of fuel for nuclear power reactors*
- The second step would be to have all *new enrichment and reprocessing activities* in the future put exclusively under multilateral control
- The third step would be to convert all *existing enrichment and reprocessing facilities* from national to multilateral operations



# Current Consensus (reality check)

- Any multilateral mechanism *should not disturb the international market for nuclear fuel cycle services*
- The establishment of multilateral fuel cycle arrangements should be implemented *step by step*
- There would be *no uniform approach that would be* satisfactory for all technologies and all countries, and successful implementation of the multi-lateralization would depend on the flexibility of its application



# “Material” Topics Frequently In Conversation

1. Whether uranium will be scarce or will be expensive?
2. Whether the economic penalty associated with reprocessing and recycling is outweighed by the noneconomic benefits that would accrue?
  - Technology gamechanger required
3. Whether the current infrastructure (capacity that has already had significant investments) for reprocessing is fully utilized; will there be future bottlenecks?
  - Over the next 20 years, 400,000 metric tons of spent fuel is expected to be generated. The shortage of reprocessing capacity is likely not to be a bottleneck.



# “Material” Issues (contd.)

4. Whether the economics is the key discriminator in decisions on the front- and back-end?
  - Adopting a more expensive back-end scheme that includes reprocessing fabricating mixed-oxide fuel would have a very small impact on the LCOE paid by consumers of electricity.
  
5. Whether individual policy decisions to develop indigenous enrichment and reprocessing decisions can be viewed on a case-by-case analysis and do not have long-term implications?
  - The implications for siting new reprocessing and enrichment outside the current holders may send a negative signal, and may encourage several more countries to follow suit.



# Promotion of Dialogue

- Secure a better understanding of previous efforts to achieve nuclear fuel-cycle solutions
- Understand both the shortcomings (for example, attempts to establish international facilities) and the successes (for example, the facilities in Sweden and Finland)
- Identify the advantages and disadvantages of multinational fuel assurance arrangements.



# Multilateral Back-end Services

- “It would also be desirable to pay attention to joint multilateral schemes in relation to the back-end of the fuel cycle, i.e., reprocessing of spent fuel and/or final storage of spent fuel, including from other States. Final storage (disposal) is a difficult proposition considering public opinion in most countries, but it is possible that in large supplier States and in certain regional contexts such cooperative schemes for intermediate and perhaps final storage could be achievable.”\*
- Key consideration: a competitive economic advantage over indigenous development of enrichment and reprocessing

\* “Multilateral Approaches to the Nuclear Fuel Cycle” – Working paper submitted by Sweden, No. 17 (NPT/CONF.2010/WP.7)



# Key Advantages of a Multinational Fuel Assurance Arrangement

- Provide the financial and institutional support to develop, construct, and operate interim centralized and/or regional storage facilities
- Manage the risk of uranium supply interruption due to physical or political reasons. The opportunity for diversification of supply that is inherent in this fuel supply model provides an alternate method for managing these risks.
- By pledging the revenues from electricity sales, facilitate the payment for infrastructure projects in the developing countries; reduce the capital formation requirements of these countries. Even if these countries were able to obtain lower concessional rates from international development entities, the blended rates would be lower, but not substantially lower.



# Key Disadvantages of a Multinational Fuel Assurance

- Require multiple bilateral and multilateral agreements and commitments, likely requiring a new institutional entity to manage the leasing arrangements
- Likely require significant start-up capital
- Lead to protracted discussions – ironing out all the contract and payment terms – that are likely to take so long to implement that consumer countries may have already locked themselves into fuel supply and reprocessing contracts – thereby not offering a near-term option for them



# In-Between Considerations

- Status of existing suppliers' fuel cycle capacities, who can supply fuel cycle services with “economies-of-scale”
- Support for advanced R&D concepts
- The disposition of the waste



# Back-end Issues

- Competition: what are the alternatives?
- Back-end avoided “all-in” costs – not having to site and deploy interim storage and disposal – is this decisive?
- Regulatory issues – including import/export licenses
- Strategies that encourage participation of fuel service providers
- Appropriate linkages to reactor suppliers
- Long-term sustainability: Finite fissile fuel supply, possibly leading to closing the fuel cycle



# List of Issues (contd.)

- Bilateral and Multilateral Approaches – International Spent Fuel Storage – Russia, Kazakhstan and other IUEC partners
- Dedicated funding source and management entity to lease fuel to emerging nuclear utilities
- Flexibility to address:
  - Centralized or regional interim storage
  - Advanced technology disposition pathways (i.e., actinide burning)
- Business principles: economic viability in the market place ...
  - HEU Agreement



# Questions

