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Nuclear Symbiosis - A Means to Achieve Sustainable Nuclear Growth While Limiting the Spread of Sensitive Nuclear Technology

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Global growth of nuclear energy in the 21st century is creating new challenges to limit the spread of nuclear technology without hindering adoption in countries now considering nuclear power. Independent nuclear states desire autonomy over energy choices and seek energy independence. However, this independence comes with high costs for development of new indigenous fuel cycle capabilities. Nuclear supplier states and expert groups have proposed fuel supply assurance mechanisms such as fuel take-back services, international enrichment services and fuel banks in exchange for recipient state concessions on the development of sensitive technologies. Recipient states are slow to accept any concessions to their rights under the Non Proliferation Treaty. To date, decisions to not develop indigenous fuel enrichment capabilities have been driven by economics. However, additional incentives may be required in the future to offset the user state's perceived loss of energy independence.

In order for a country to forgo development of sensitive nuclear capabilities, the basis for an equitable economic trade-off must be established. This paper proposes that the nuclear trade-off can be made through a combination of fuel supply assurances, leveraging work by the United Nations and International Atomic Energy Agency on sustainable nuclear development, and use of "nuclear symbiosis". The primary focus of this paper is on how nuclear symbiosis could be used to achieve a user-state's desired economic, energy, and infrastructure development end states. The desired result from this "symbiosis" is a nuclear-centered industrial complex that creates new economic opportunities through infrastructure improvements, human resource skills development and the development of new sustainable industries.

This paper also describes the Nuclear Materials Exchange (NME) as a practical tool for performing nuclear symbiosis. The NME can be used to define existing and new international nuclear resources and their linkages and relationships with current and future users within the international nuclear system. The NME was developed as a prototype relational database and populated with data sets of the capacities and operational data for existing reactors and fuel cycle facilities located throughout the world. Country, regional, and supplier-specific data is required for full implementation.

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