Study of Feasible and Sustainable Multilateral Nuclear Approach on Nuclear Fuel Cycle

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Benefit and Incentive on MNA

1. Formulation of no discriminatory framework can be primary incentive to make states join MNA. Recent criteria-based approach of export of sensitive technologies in NSG would help create a framework taking into account NPT Article IV.

2. Nevertheless, the number of enrichment and reprocessing facilities can be limited from the viewpoints of their needs (capacities) and nuclear nonproliferation.

3. Services on spent nuclear fuels, take-back, take-away, storage, reprocessing etc, should systematically be assured. Recipient countries can enjoy such services in NMA framework.

4. It is also expected that the host country in MNA would be discouraged to divert nuclear materials and misuse of the related technologies because of the multilateral control of the fuel cycle facilities.

5. To minimize proliferation risk on SFs: Accumulation of spent fuels, e.g., in power reactor user countries, comes to be a serious issue in the world. Leaving such spent fuel in individual countries, there is also a certain level of risk to make such countries change the policy, i.e., to have incentive to try reprocessing.

6. It may be expected for the proposed NMA framework that infrastructure support such as nuclear safety and security (2Ss) be involved. It involves application of international standards/guidelines on nuclear safety/security.

7. Host countries may be able to expand their nuclear fuel cycle business capabilities further more although facilities are expected to be controlled under/by MNA.
Regional Cooperation

Asian Nuclear Developed & Emerging States

Needs on Frontend Services
Backend Services

Equality

Feasible/Sustainable Framework

Compatibility Peaceful Use and Non-proliferation

Non-Proliferation
Nuclear Security
Nuclear Safety

3 S

Target: Regional MNA

Multilateral Nuclear Fuel Cycle Approach (MNA) in Asia

Treaty
Agreements (Management & Operation)
Justification of the Region (Asia) for MNA
Our Study: Targeted to central – south/east Asian

• Nuclear Power Growth in Asian Region.
• The Region possesses high level of nuclear technologies and capability of nuclear fuel cycle and abundance of nuclear materials.
• The region needs stable fuel supply system, spent fuel services and cooperation on 3S between developed and emerging countries is needed.
• Seriousness of spent fuel (SF) accumulation (need of solution), possibility of regional cooperation on SF.
• Desire to have new type non-proliferation framework.
Basic Concept on Our MNA Study

- Proposed MNA-Framework on Nuclear Fuel Cycle should be designed based upon 1) Nuclear- Nonproliferation, 2) Sustainability, and 3) Feasibility.

- Compatibility of “inalienable right (equality)” and “nuclear non-proliferation” in peaceful use of nuclear energy should be pursued. (pursuant to Article 4, NPT)

- MNA to hold equal level of nuclear non-proliferation (NNP) function to the existing NNP measures (e.g. substitute for bilateral nuclear agreement, AEA article 123) The specific requirement to participate in the multilateral framework is to satisfy conditions equivalent to the “objective criteria” described in INFCIRC 254 part 1, 6-7 (NSG Guidelines revised in 2011).

- MNA-Framework to include the services on not only nuclear fuel supply (front-end) but also spent fuel - SF treatment (back-end); Not only assurance but provision of both services.

- MNA to comply with the international guideline/standard on safety, safeguards and security (3S) (Regional System also should cover Safety/ Security).

- At the same time, MNA contributes to “improving transparency” and “trust-building” as a measure for nuclear non-proliferation.
Cooperative Scheme

Host Facilities At Host States

Recipient States

Services (Activities)

Type B

Regional Safeguards
Regional Security
Security, Safety
Audit by AMMAO

Type A

MNA Facilities At Site States

Type C

Services: Fuel Supply, SF Storage, Reprocessing, MOX Storage by Multinational Consortium
Management: Asian Multilateral Fuel Cycle MAmanagement Organization (AMMAO)
A MNA Model and Potential New Capabilities in Asia Region

- Natural Uranium (Type A) → U Refine, conversion
- U Enrichment in Asia (Type B/C) → U Fuel Fabrication in Asia (Type A)
- MNA MOX Fuel Fabrication (Type C)
- MOX Storage (Type C)
- NPP
  - Japan, China, S.Korea
  - Indonesia, Thailand
  - Malaysia, Vietnam etc
- SF Long Term Storage Country of Origin (X) in Asia
- MNA Reprocessing (Advanced) (Type A)
- Other Low Enriched U outside Asia
  - LWR MOX (Type A)
  - (Type A)
  - (Type C)

Country X in Asia having abundant U resource

All countries with NPP

U Enrichment in Asia (Type A)
Features for formulation of MNA

Label A: Nonproliferation (restriction of NPT Article IV, safeguards, nuclear security and export control)
Label B: Assurance of supply (services)
Label C: Siting – choice of host country
Label D: Access to technology
Label E: Multilateral involvement
Label F: Economics
Label G: Transportation
Label H: Safety
Label I: Nuclear liability
Label J: Political and public acceptance
Label K: Geopolitics
Label L: Legal aspects (relations with international agreement, bilateral agreements, nuclear free zone, etc.)
Asian Multilateral Nuclear Fuel Cycle Framework: Structure

Member States

Type B
Host States

Type A, B, C
Partner States

Type C
Site States

Asian Multilateral Treaty for Nuclear Fuel Cycle Supply and Service (MNA Specific Treaty)

• Agreement on export control
• Agreement on nuclear safety, security and nuclear liability
• Agreement on transfer of MNA facilities
• Agreement on management & operation of Host States’ facilities
• Agreement on nuclear fuel supplies
• Agreement on nuclear fuel cycle services

Regional Safeguards Agreement

IAEA

Asian Multilateral Nuclear Fuel Cycle Management Organization (AMMAO)

AMMAO Observation Center

Regional Safeguards, Nuclear Security, Safety

Agreement on Supply Assurance and Additional Assurance

International Organization

Support for MNA Foundation

IAEA

Agreement on Sensitive Technology Control

Technology Holders (States)
### Evaluation element (label) and its contents

<table>
<thead>
<tr>
<th>A</th>
<th>Nuclear non-proliferation</th>
<th>Related treaties, agreements, etc.</th>
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| **A-1:** Limitation of sensitive nuclear technologies/peaceful use of nuclear power | • Treaty on the Non-Proliferation of Nuclear Weapons (NPT)  
• **Bilateral nuclear cooperation agreements** |
| **A-2:** Safeguards | • Full-Scope Safeguards Agreement (INFCIRC/153)  
• Additional Protocol (INFCIRC/540)  
• Regional safeguards agreements (e.g.: EURATOM, ABACC) |
| **A-3:** Physical protection of nuclear material and nuclear security | • IAEA recommendation regarding physical protection of nuclear material (INFCIRC/225/Rev.5 corrected)  
• Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1)  
• Nuclear Terrorism Protection Agreement |
| **A-4:** Export regulation | • **NSG Guideline regarding Export of Nuclear-Related Materials and Equipment (INFCIRC/254/Rev.10/Part 1)**  
• United Nations Security Council Resolution 1540 |
| B | Guarantee of (nuclear fuel) supply | NA |
| C | Selection of host states (In case where Asian states are the member states) | • Southeast Asian Nuclear Weapon Free Zone Treaty  
• Treaty on a Nuclear Weapon Free Zone in Central Asia  
• Mongolia’s Declaration of Non-Nuclear Weapon Position  
• Korean Peninsula Non-Nuclear Weapon Declaration |
| D | Access to technologies | Related to above-described label A |
| E | Degree of involvement in multinational initiative | NA |
| F | Economics | NA |
| G | Transport | • IAEA recommendation regarding physical protection of nuclear material (INFCIRC/225/Rev.5 corrected)  
• Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1)  
• Execution Standards of Transboundary Movement of Radioactive Wastes (INFCIRC/386) |
| H | Safety | • Convention on Nuclear Safety, Convention on Early Notice of Nuclear Accidents  
• Treaty on Nuclear Accident Assistance  
• Treaty on Safety of Radioactive Wastes, etc. |
| I | Compensation | International Treaty on Compensation for Nuclear Damage |
| J | Political/social acceptability | NA |
| K | Geopolitics | NA |
| L | Legal regulations | NA |
Challenges:

✓ Satisfying non-proliferation requirements by bilateral nuclear cooperation agreements between MNA member states and nuclear supplier states, especially the US

✓ Need prior consents by supplier states
  - re-transfer of nuclear materials
  - alternation in form and content by irradiation
  - SNF reprocessing

✓ Without such consents, MNA will not function effectively and efficiently

✓ In order to gain such consents, the MNA itself needs to be equipped with robust nonproliferation characteristics
A possible conclusion would be the establishment of comprehensive bilateral agreements between AMMAO and nuclear supplier states which could replace the existing bilateral nuclear cooperation agreements between each state and nuclear supplier states.
MNA Participants and Nuclear Fuel Transportation Route

- Transshipment center
- Customs tariff union between KAZ and RF
- Enrichment, reprocessing, SF storage, etc
- Siberian Land Bridge (Main route)
- Uranium Mine, SF storage, etc
- Eurasia Land Bridge (Supplemental route)
- Resource Export Promotion Policy between Mon and RF
- Fuel fabrication, SF storage, etc
- Uranium Mine, SF storage, etc
- Fuel fabrication, Enrichment and Reprocessing, etc
- Territorial dispute Area
- Fuel fabrication, Reprocessing, SF storage, etc
- Chokepoint
- Fuel fabrication, Enrichment and Reprocessing, etc
- Land Transportation route
- Sea Transportation route
- Nuclear Facility
- Corroborative defensive action area
- NED/UNDER CONSTRUCTION LINK
Thank you for your attention

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