

Energy and Nuclear Cooperation in Comprehensive Agreement for
Security in Northeast Asia

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Introduction

One of the elements of the Comprehensive Agreement for Security in Northeast Asia (from now “the Comprehensive Agreement”) proposed by Dr. Morton Halperin¹ is “assistance for nuclear and other energy”. The proposal states that “the right of all parties to the treaty have access to necessary sources of energy including nuclear power need to be affirmed.” But he also states that “beyond a general commitment this will probably need to be negotiated as a separate agreement.” It is true that energy assistance has always been one important element for negotiation with DPRK (Democratic People’s Republic of Korea). At the same time, there are complex technical, economic and political issues associated with nuclear energy cooperation, especially involving nuclear fuel cycle activities. Therefore, it is worthwhile to explore what are potential issues and possible common agenda for energy cooperation under the Comprehensive Agreement. This paper is intended to identify key issues and potential areas of cooperation to meet the criteria of the Comprehensive Agreement, especially on the one involving DPRK and civilian nuclear fuel cycle issues.

Energy assistance as a “win-win” tool for DPRK and the security of the region

Energy assistance was always a part of the agreements between DPRK and the US and six party talks, which was assured to DPRK in return for DPRK’s acceptance to give up and dismantle all its nuclear weapons programs. Under the 1994 Agreed Framework between the US and DPRK, the US guaranteed the following in return for DPRK giving up its nuclear weapon programs².

- two LWRs with a total generating capacity of approximately 2,000 MW(e), financed and supplied by an international consortium, by 2003;
- 150,000 tons of heavy fuel oil by October 1995 for heating and electricity production foregone due to the freeze of its graphite-moderated reactors, and

¹ Morton Halperin, “A Comprehensive Agreement for Security in Northeast Asia,” September 2014.

² US-DPRK Agreed Framework, October 21, 1994.

<http://www.nti.org/treaties-and-regimes/us-dprk-agreed-framework/>

- 500,000 tons annually thereafter until the completion of the first LWR; and
- formal assurances from the United States against the threat or use of nuclear weapons.

In order to implement this agreed framework, Korea Energy Development Organization (KEDO) was established in 1994 for providing finance, technical assistance and eventually providing two LWRs to DPRK. Unfortunately, when this Agreed Framework was found to be no longer effective, KEDO suspended its activities in 2003.

And in 2005 Joint Declaration of Six Party talks also included one item for energy cooperation as follows³;

“#3 The Six Parties undertook to promote economic cooperation in the fields of energy, trade and investment, bilaterally and/or multilaterally. China, Japan, R.O.K.(Republic of Korea), Russia and the U.S. stated their willingness to provide energy assistance to the D.P.R.K. The ROK reaffirmed its proposal of July 12th 2005 concerning the provision of 2 million kilowatts of electric power to the D.P.R.K.”

Subsequently, in 2007, as a part of the initial phase of the implementation of the above joint statement, the DPRK was guaranteed to receive economic, energy and humanitarian assistance up to the equivalent of 1 million tons of heavy fuel oil (HFO), including the initial shipment equivalent to 50,000 tons of HFO, in return for complete declaration of all nuclear programs and disablement of all existing nuclear facilities, including graphite-moderated reactors and reprocessing plant⁴.

Although such assistance was not enough for DPRK to abide by the agreement under the Six Party Talks, it is clear that energy and economic assistance, especially meeting humanitarian needs, can and should be a part of the items to be included for possible energy cooperation scheme in the Comprehensive Agreement.

In fact, most recent report by the Nautilus Institute on energy situation in DPRK assures the need for such energy cooperation⁵. The report, co-authored by David von Hippel and Peter Hayes, emphasizes the importance of energy assistance to DPRK as follows;

“One underlying aspect of the DPRK international situation, its ‘energy insecurity’ or lack of reliable supplies of fuels to maintain and build its economy,

³ Joint Statement of the Fourth Round of the Six-Party Talks, Beijing 19 September 2005, <http://www.state.gov/p/eap/regional/c15455.htm>

⁴ Initial Actions for the Implementation of the Joint Statement, 13 February 2007, http://www.ncnk.org/resources/publications/June_2008_6PT_Statement_of_the_Chair.doc

⁵ David von Hippel and Peter Hayes, “Energy Needs in the DPRK, and Opportunities for Collaboration on Energy Sector Engagement and Redevelopment”, August 12, 2014. <http://us4.campaign-archive2.com/?u=0de7e0e84dc3aff619f936a70&id=49739881bf&e=8e42275c49>

has changed little in the past few years, and remains both an underlying driver of the DPRK's behavior in discussions with other nations and a possible lever, if used correctly, for other nations to use to begin and sustain the process of engagement with the DPRK."

And they conclude;

"Overall, international projects involving the DPRK will be even more difficult to manage than cooperative projects involving other Northeast Asian countries, which pose significant challenges of their own. Involving the DPRK in such projects, however, can offer significant benefits in terms of engagement of the DPRK with the international community, even apart from their energy and economic benefits."

This conclusion is both assuring and alarming. If we successfully develop a cooperative scheme with DPRK, it could bring significant benefits to DPRK and the stability of the region. But if not, instability of DPRK could be accelerated by its "energy insecurity." It is essential for the countries in the region to understand the real needs of DPRK and provide effective assistance. The above report suggests that such assistance should be carefully crafted as the effective assistance would require not only fuel and technologies, but require human and social infrastructure to support healthy energy development in DPRK. Adequate power transmission system, for example, is one of such urgently needed infrastructure in DPRK.

In order to achieve such "win-win" energy assistance, a special expert working group on assistance to DPRK needs to be established under the Comprehensive Agreement to craft careful and comprehensive strategy.

Possible regional energy cooperation scheme: "Asian Super Grid" and "Energy Charter Treaty"

But energy assistance to DPRK should be coordinated in a way that would bring benefits to the entire Northeast Asia region. In fact, the Northeast Asia is one of the regions with highest energy demand growth in the world and dependence on outside region, especially on Middle East, is rapidly increasing. So energy security is a common policy goal for the countries, especially for countries without energy resources such as ROK, DPRK and Japan.

Most importantly, China is the largest consumer and now the importer of oil in the world. On the other hand, Russian Far East is potentially the largest supplier of fossil fuel and electricity in the region. Therefore, naturally, there have been series of proposals for regional energy cooperation scheme since early 1990s. Unfortunately,

history suggests competition rather than cooperation over energy resource has become a source of concern in the region, and even such competition could lead to regional tension over territorial issues where natural resources are at stake.

While energy market and private energy companies can work effectively based on market needs and mechanisms, it is argued that the governments in the region must cooperate together to ensure stable and secure investment environment and ensure reliable market mechanisms. In fact, energy cooperation among states in Europe has enhanced regional confidence building and the Northeast Asian region can learn lessons from them. This notion was recently confirmed by Vice Foreign Minister of ROK, who recently told at Pacific Energy Summit in Seoul that "I believe that energy cooperation among countries in Northeast Asia could also contribute to creating an environment conducive to regional peace and security as it could help to build trust in the region,"⁶

While it is not the purpose of this paper to discuss specific proposal in detail, one interesting proposal should be worth considering as it could involve all key countries in the region, especially DPRK. The proposal is "Asia Super Grid Network" and possible "Energy Charter Treaty" in the region⁷. The proposal, "Asia Super Grid", has been discussed by many experts in the region, to follow the idea of similar regional power grid system in Europe. While economic and technical barriers may still exist for "Asia Super Grid", it is worth considering the proposal to establish a legal framework like "Energy Charter Treaty" which is intended to ensure transparent and fair trade in energy goods/services in the region. Under the proposed project, five partners (Energy Charter Secretariat as a lead partner, with Energy Economic Institute of ROK, Ministry of Energy of Mongolia, Renewable Energy Foundation of Japan, Energy Systems Institute of Russian Federation) are working together for a feasibility study⁸. One of the important findings is that DRPK is the key for success of this ambitious project. According to Urban Rusnák, Secretary General of the Energy Charter organization, integration of North Korea to the super-grid plan as "highly desirable" but, he said that integration would have to start from the very beginning of the grid planning process⁹.

In short, establishing a regional framework for energy cooperation, such as "Energy

⁶ "S. Korean Vice FM urges energy cooperation in Northeast Asia", Yonhap News Agency June 30, 2014, <http://www.globalpost.com/dispatch/news/yonhap-news-agency/140630/s-korean-vice-fm-urges-energy-cooperation-northeast-asia>

⁷ Zafar Samadov, Senior Expert, Energy Charter Secretariat, "Intergovernmental Framework: Key considerations," at Expert Group Meeting on Conceptualising the Asian Energy Highway (AEH), 4 September 2013, http://www.unescap.org/sites/default/files/4.1Zafar_Samadov_ECS.pdf

⁸ "Gobitec and Asian Super Grid For Renewable Energies in Northeast Asia," 2014, http://www.encharter.org/fileadmin/user_upload/Publications/Gobitec_and_the_Asian_Supergrid_2014_ENG.pdf

⁹ "North Korea holds key to East Asian "super-grid", Posted on 15 October 2013, World Energy Council web-site, <http://www.worldenergy.org/news-and-media/news/north-korea-holds-key-to-east-asian-super-grid/>

Charter Treaty for Grid Network”, can be a “win-win” proposal for all countries involved, including DPRK and can contribute to confidence building in the region and to regional stability.

Nuclear cooperation in Northeast Asia: Emerging impacts of the Fukushima accident

Now, let’s turn to the nuclear energy cooperation. First of all, it is important to recognize the fact that Asia is the region where highest growth in nuclear power capacity is expected in the coming decades, especially due to rapid growth in China.

As of August 31, 2014, 437 reactors are currently in operation worldwide, and 70 reactors are under construction. Out of 70 reactors under construction, 28 reactors are in China¹⁰. In this region, in the past, Japan and ROK were the leaders in expanding nuclear power capacity, but after the Fukushima nuclear accident in 2011, future of nuclear power in Japan has become totally unclear. Due to lack of public trust, majority of public opinion (~80%) is now in favor of phase out of nuclear power (either gradually or immediately)¹¹. As a result, while the government confirms to keep nuclear power as a “base load” energy source under the new Strategic Energy Plan¹², the future of nuclear power is still uncertain.

ROK, still committed to maintain the policy of expanding nuclear power capacity, also lowered its target share from 50% to 29%¹³. Even in China, although still very ambitious, target for nuclear expansion has been lowered. This trend is becoming global, while still many countries committed to expand nuclear power, its pace is likely to be slower. The recently published “The World Nuclear Industry Status Report 2014”¹⁴ says that share of nuclear power has been in 30 decline from its peak in 1995 (~17%) to only 10% or so in 2013 and this trend may continue. When Chernobyl and Three Mile Accident happened, average age of global nuclear power plants was still relatively young. But now the average age is 28.9 years and unless new construction of nuclear plants could catch up with the pace of “decommissioning” of older plants, share of nuclear power generation in global power production is likely to decline further.

Still, it is likely that many nuclear power plants will be operating in the Northeast Asia in the coming decades. And needs for international cooperation in the field of nuclear

¹⁰ International Atomic Energy Agency (IAEA), PRIS database. <http://www.iaea.org/pris/home.aspx>

¹¹ Hirota Hirose, “Changes of Public Opinion about Nuclear Power,” Presented at Japan Atomic Energy Commission, July 17, 2013, (in Japanese) <http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryu2013/siryu27/siryu2.pdf>

¹² “Strategic Energy Plan,” April 11, 2014.

http://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/4th_strategic_energy_plan.pdf

¹³ Simon Mundy, “South Korea cuts target for nuclear power”, Financial Times, January 14, 2014, <http://www.ft.com/cms/s/0/4e8c1872-7cf7-11e3-81dd-00144feabdc0.html#axzz3C3e90UvF>

¹⁴ Mycle Schneider and Antony Froggatt, “The World Nuclear Industry Status Report 2014”, <http://www.worldnuclearreport.org/IMG/pdf/201408msc-worldnuclearreport2014-hr-v4.pdf>

safety, nuclear security and non-proliferation will become stronger. Japan, ROK and China has already agreed to enhance such cooperation and international framework can be established under the Comprehensive Agreement. Most recently, President Park of ROK proposed to establish regional nuclear safety organization in Northeast Asia with Japan and China¹⁵. Although the detail of such proposal is still not clear, such initiatives should be welcome and all parties should work together for possible regional scheme on nuclear safety, security and non-proliferation.

Inequality issue in nuclear fuel cycle activities and plutonium stockpile management

Article IV of the Non-Proliferation Treaty (NPT) says that “Nothing in this Treaty shall be interpreted as affecting the “inalienable right” of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.” Therefore, it is also important to keep this principle for regional cooperation of peaceful use of nuclear energy under the Comprehensive Agreement.

One sensitive issue is what to do with nuclear fuel cycle capability, especially uranium enrichment and reprocessing which can be used to produce “weapons-usable material (WUM)” i.e. Highly Enriched Uranium (HEU) and plutonium. At present, as a non-nuclear weapon state, Japan is the only country with both enrichment and reprocessing capabilities as Japan maintains closed fuel cycle policy. China and Russia also adopts closed fuel cycle policy and have both enrichment and reprocessing capabilities. ROK and DPRK once had an agreement not to have enrichment and reprocessing facilities under the Joint Declaration on the Denuclearization of Korean Peninsula in 1992. But DPRK operated small reprocessing plant and is believed to develop enrichment capability. ROK maintains open fuel cycle policy and thus has neither enrichment nor reprocessing facility. But ROK plans to develop nuclear fuel cycle capability and has built a small pilot reprocessing plant as a long term R&D plan to develop Fast Breeder Reactor and its fuel cycle.

This leads to a question of “inequality” in fuel cycle capability especially between ROK and Japan.

Under the 1973 US-ROK bilateral agreement on cooperation of peaceful use of nuclear energy, ROK has not been allowed to have both enrichment and reprocessing capability. Recently, ROK government negotiated with the US to renew such agreement to remove such constraints. In April 2013, with little progress being made by the

¹⁵ “Park proposes Northeast Asian nuclear safety group”, World Nuclear News, August 15, 2014.
<http://www.world-nuclear-news.org/NP-Park-proposes-Northeast-Asian-nuclear-safety-group-1508145.html>

negotiatoin, a two-year extension of the existing arrangements was agreed, to March 2016, and this was confirmed by US Congress in January 2014¹⁶.

Meanwhile, under the 30-year programmatic approval of the 1988 US-Japan bilateral agreement on peaceful use of nuclear energy, Japan has continued reprocessing activities (commercial contracts with France and the UK) and constructed a large commercial-size reprocessing facility (800 tons/y) in Rokkasho village in Aomori. The Rokkasho plant is now under safety licensing and its operation date is not clear. Japanese government stresses that all plutonium activities are under international safeguards and has volunteered to disclose all stockpile data every year for better transparency. Japan also has a “no-plutonium surplus policy (i.e. not to have plutonium without any specific purpose to use)” which was introduced in 1992 and has been enhanced since 2003 when Japan Atomic Energy Commission issued a new policy that electric utilities publish “plutonium usage plan” every year before separating plutonium. Still, past reprocessing activities resulted in about 44 tons of plutonium stockpile (35 tons in Europe and 9 tons in Japan)¹⁷. Given the uncertainty in reactor operation schedules in Japan, if Rokkasho reprocessing plant starts up, more plutonium is likely to be accumulated in Japan. This has caused significant international concern in the region.

Because of acute concern over increasing plutonium stockpile worldwide, Joint Communique at Hague Nuclear Security Summit in March 2014 says that “We encourage States to minimise their stocks of HEU and to keep their stockpile of separated plutonium to the minimum level, both as consistent with national requirements.”¹⁸ This is an important commitment made by participating countries, including Japan, and thus Japan should develop a new policy to minimize its plutonium stockpile.

In order to respond to international concern over stockpile of plutonium as well as addressing to inequality issues in nuclear fuel cycle activities, it would be desirable to develop a scheme to assure “equality” and better “transparency” in nuclear fuel cycle activities to minimize such international concern as well as nuclear proliferation/security risk associated with nuclear fuel cycle activities.

¹⁶ “Nuclear Power in South Korea”, World Nuclear Association, updated August 2014. <http://www.world-nuclear.org/info/Country-Profiles/Countries-O-S/South-Korea/>

¹⁷ Cabinet office, Secretariat of the Japan Atomic Energy Commission, September 2013. <http://www.aec.go.jp/jicst/NC/sitemap/pdf/130911e.pdf>. But in June 2014, it was reported that 640kg was mistakenly reported under the category of “plutonium included in spent fuel” and thus was removed from the category of “separated plutonium”. It was once loaded into Genkai nuclear power plant but the plant never operated since, and thus it should be included in the category of “separated plutonium.” So far, the government has not made any changes of the above data.

¹⁸ The Hague Nuclear Security Summit Communique. March 25, 2014. https://www.nss2014.com/sites/default/files/documents/the_hague_nuclear_security_summit_communique_final.pdf

I would like to propose three options below for nuclear fuel cycle arrangements in the Comprehensive Agreement for possible considerations.

Possible cooperative scheme for nuclear fuel cycle in the Comprehensive Agreement

(1) Multilateral Approaches to Nuclear Fuel Cycle

Proliferation of nuclear fuel cycle capability has been a source of international concern and multilateral control over sensitive facilities have been proposed since the beginning of the nuclear development in 1950s. In 2003, then IAEA Director General ElBaradei proposed to revisit the idea of “multilateral approaches” to nuclear fuel cycle activities. Since then, various proposals have been made and now two of them have been implemented so far. One is International Uranium Enrichment Center with LEU (Low Enriched Uranium) Reserve proposed by Russia, and the other is IAEA LEU Fuel Bank originally proposed by Nuclear Threat Initiative (NTI) of the US.¹⁹ Although no specific arrangements have not been realized, International Framework for Nuclear Energy Cooperation (IFNEC), originally proposed by the US government, has been discussing similar ideas at the Reliable Nuclear Fuel Services Working Group (RNFSWG).²⁰

Similar arrangements can be made in the Northeast Asia. There are three basic conditions for such arrangements to be successful. One is “universality.” Any right or limitation applied to any country must be equally applied to other states. Without such principle, any arrangement can be considered “discriminatory” and will not be successful. Second is “transparency.” All arrangements must come with maximum transparency so that confidence in such arrangements will not be lost. Third one is “accountability.” Any arrangements should be based on sound economic and social rationale and thus accountable to the public. Public and social acceptance to such scheme is essential for its success.

One possible arrangement is to establish LEU fuel bank in Northeast Asia and all parties under the Comprehensive Agreement should be eligible to access to the Bank. But priority of such accessibility should belong to the country without nuclear fuel cycle capabilities. Another possible proposal is to establish joint Enrichment Facility managed by multilateral corporation, like URENCO. URENCO operation is supervised by

¹⁹ There are good references on multilateral approaches to nuclear fuel cycle on the web-site of United Nations Institute for Disarmament Research. <http://www.unidir.org/programmes/weapons-of-mass-destruction/multilateral-approaches-to-the-nuclear-fuel-cycle>

²⁰ IFNEC Reliable Nuclear Fuel Services Working Group, <http://www.ifnec.org/Meetings/RNFSWGMeetings.aspx>. IFNEC now has 32 member countries, including US, Russia, China, ROK, Japan, plus 4 observer organizations and 41 country observers. See more detail here; <http://www.ifnec.org/Home.aspx>

tri-lateral government committee under the Treaty of Almelo²¹ to ensure such operation will not lead to increase in proliferation risk.

It is more difficult to develop a scheme for back-end of fuel cycle. One possibility is to develop multilateral R&D scheme on nuclear fuel cycle, so that all research facilities on fuel cycle in the region can be under multilateral control. It would be wise not to encourage reprocessing, but R&D activities could be allowed only under the multilateral approaches.

For reprocessing and plutonium activities, the principle of “no-plutonium surplus policy” by Japan should be strictly followed by all party countries. For example, a shift from “supply driven” fuel cycle to “demand driven” fuel cycle activities should be adopted. In other words, reprocessing must not take place unless clear plan to use recovered plutonium is demonstrated and existing stockpile should be used before further reprocessing. Transparency measures taken by Japan to disclose all existing stockpile should also be followed by all parties involved.

(2) Mutual Inspection and Trust Building Scheme

The second option is to establish a mutual inspection and trust building scheme for nuclear fuel cycle activities in the region. EURATOM is certainly a good model and many proposals have been made in 1990s to establish similar scheme (such as ASIATOM) in the region, but none has been realized.²² One of the primary reasons for not being able to establish such scheme is the difference in priority in objectives of the scheme (“non-proliferation” vs “expansion of fuel cycle activities). In addition, “inequality” issue was also a major hurdle to overcome.

Another possible model is ABACC (Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials).²³ The Agency was established by the two governments for mutual inspection and trust building purposes. Similar organization can be established in Northeast Asia (initially between ROK and Japan and can be extended further later). The Agency does not restrict peaceful activities but mutual inspection would enhance trust and confidence in the region.

(3) International Plutonium Disposition Program

²¹ Treaty of Almelo was originally signed in 1970 by the government of UK, Netherland and West Germany when URENCO was stablished. Similar treaty was signed between the US and three governments when URENCO established the enrichment company in the US. 2005 version of the Treaty can be seen here.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228662/7046.pdf

²² Richard Speiere and Brian Chow, “Asiatom: Proposals, Alternatives and Next Steps,” Rand Corporation, July 1996, DRU-1367-DOE. <http://www.rand.org/content/dam/rand/pubs/drafts/2008/DRU1367.pdf>

²³ http://www.abacc.org.br/?page_id=5&lang=en

The third option is to establish an international program to reduce plutonium stockpile. This program can involve countries in other regions, such as UK and France, as partner countries to deal with growing stockpile of separated plutonium.

There are various technical options to dispose plutonium stockpile, but there are two fundamentally different philosophy in dealing with plutonium. One idea is to consider plutonium as a “resource,” while the other is to consider plutonium as a waste. France, Russia and Japan, belonging to the first group, plan to use plutonium as MOX in either a conventional reactor or a fast reactor (so-called “MOX option”). UK, while it currently plans to dispose plutonium as MOX fuel, along with the US explore other options such as disposing plutonium as a waste (so-called “immobilization” option). But all countries now share a common goal that stockpile of separated plutonium should be safely managed and should be reduced further. Therefore, it would be worthwhile to develop technical programs jointly under the common goal of minimizing the plutonium stockpile. In fact, the UK government suggested an option that UK will take ownership of foreign-owned plutonium in the UK²⁴. This is an interesting proposal to pursue as it can be a “win-win” arrangement for both Japan and the UK. Similarly, international management of plutonium can be a “win-win” for all related parties to share facilities and minimize cost and transportation of plutonium. While the amount is relatively small, separated plutonium in DPRK needs to be disposed of under the Comprehensive Agreement.

Like energy cooperation, it is advisable to establish a working group to explore various options for nuclear cooperation, in particular on nuclear fuel cycle.

Conclusion

Under the Comprehensive Agreement for Security in Northeast Asia, energy and nuclear energy cooperation can play an essential role for its success. Energy cooperation with DPRK can and should be carefully crafted in order to meet the basic needs of DPRK that could contribute to enhanced stability in the region. Larger energy cooperation scheme, such as “Asia Super Grid” and “Energy Charter Treaty” are worth considering under the Comprehensive Agreement.

For nuclear cooperation, it is important to maintain the basic principles of “universality”, “transparency” and “accountability” for establishing any international scheme. In particular, multilateral approaches to nuclear fuel cycle is a worth pursuing idea under the Comprehensive Agreement.

²⁴ Written statement to the Parliament by Energy Minister Michael Fallon, “Management of overseas owned plutonium in the UK,” 3 July 2014.

Figure 1 Asia Super Grid For Renewable Energies in Northeast Asia

Figure 1-3: Possible course of the ASG



Source: “Gobite and Asian Super Grid For Renewable Energies in Northeast Asia,” 2014, http://www.encharter.org/fileadmin/user_upload/Publications/Gobitec_and_the_Asian_Supergrid_2014_ENG.pdf

Table 1 Overview of Nuclear Fuel Cycle Activities in Asia Pacific Region

	Uranium Ore	Conversion	Enrichment	Fuel Fabrication	Reactor Design and Construction	Reprocessing
China	Domestic; Kazakhstan, Namibia, Niger, Uzbekistan	Domestic	Domestic; Russia, URENCO ¹⁰	Domestic	Domestic; France, Russia, USA	Domestic (French cooperation)
India	Domestic; France, Kazakhstan, Russia (Namibia, Mongolia, South Africa)	Domestic	Domestic; Russia	Domestic	Domestic; Russia	Domestic
Japan	Australia, Canada, Kazakhstan, Namibia, Uzbekistan	Down-stream	Domestic; France, Russia, USA	Domestic	Domestic	Domestic; France, UK
Pakistan	Down-stream	Down-stream	Down-stream	China	China	N/A
South Korea	Australia, Canada, Kazakhstan, Niger	Down-stream	France, Russia, URENCO, USA	Domestic	Domestic	N/A
Taiwan	Down-stream	Down-stream	Down-stream	France, USA	USA	N/A

Source: James E. Platte, “Multilateral Cooperation in Asia's Nuclear Sector: Prospects for Growth and Safety”, Working paper submitted to Pacific Energy Summit, July 2014. http://www.nbr.org/downloads/pdfs/ETA/PES_2014_workingpaper_platte.pdf