Response to “Light Water Reactors at the Six Party Talks: The Barrier that Makes the Water Flow”

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By Chaim Braun

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I. Introduction

The following are comments on the essay "Light Water Reactors at the Six Party Talks" by Chaim Braun, Science Fellow at the Center for International Security and Cooperation (CISAC) at Stanford University, which appeared as Policy Forum Online 05-78: September 21st, 2005.

II. Comments by Chaim Braun on Light Water Reactors at the Six Party Talks

I quite agree with Hayes et al point that it is unlikely the U.S. will approve sending any nuclear-sensitive technology to the DPRK before a complete and verifiable de-nuclearization process takes place and produces results in the field. By the time the DPRK de-nuclearization process will be implemented, a new Administration - most likely Democratic - will be in place in Washington. The Republican opposition, depending on its then strength, might be in position to obstruct any provision of such deal with the DPRK involving the construction of a light water reactor (LWR) that a Democratic Administration might propose, if not for relevant reasons then just to spite the Democrats. In general, whichever Administration holds power in Washington by 2009, I think it is unlikely that support for a U.S. nuclear power plant in the DPRK will materialize, given the unhappy experience with the KEDO reactors program. This is even assuming a full disclosure by the DPRK of all its nuclear facilities including the Uranium enrichment program - a not yet foregone conclusion - as Hayes et al have pointed out.

What about other international reactor vendors that could provide a LWR to the DPRK - the point raised by Hayes et al? Let's survey the prospective reactor supplier field. The U.S. provides some components of South Korean and British reactors, and it may have prior consent rights on the exports of Japanese nuclear plants. It is thus not likely that vendors in these countries could export nuclear plants to the DPRK without prior U.S. agreement, which may not be forthcoming. This leaves Canadian, French, Russian and Chinese nuclear vendors. Canadian nuclear authorities are even more sensitive to weapons proliferation concerns than U.S. authorities (if that is possible), so it is unlikely they would want to get involved in DPRK nuclear issues for some time. There are also specific technical and proliferation concerns related to CANDU reactors, having to do with the amounts and fissile grade of the Plutonium produce during normal reactor operation, which may preclude offering them to the DPRK. The Canadian experience with India is a case in point. France could be in position to offer reactors to the DPRK, however the size of a currently licensable reactor in France - the EPR - being of 1,600 MWe is much too large for the DPRK grid and will represent the doubling the entire operating capacity of that grid. France could offer the DPRK older and smaller-sized 1,000 MWe pressurized water reactors (PWRs), similar to those installed in the Daya Bay and Ling-Ao stations in China. However, why should the DPRK consent to have the French build them a reactor that could not be built in France itself as it does not meet current French nuclear safety regulatory standards?

We now have to review the prospects of the Russian and Chinese nuclear vendors. Hayes et al have done a very good analysis of the possibility of building a Russian reactor in the DPRK. While I agree with many of their points, I would disagree with their conclusion on three main grounds. Firstly, The Russians could not pay for constructing a reactor by themselves, which implies that other participants in the Six Parties Talks would have to pay for such a project. Secondly, South Korea -

being one of the most involved parties in these matters - might not easily agree to build a Russian reactor in what they consider to be their own backyard, as discussed below; and thirdly, the safety standards and operational records of current vintage Russian reactors are not top of the line. Let's review the last point first. The Russian VVER-1000 - similar to the reactors now being built in Tianwan in China and Kudankulam in India - represent what the U.S. Department of Energy (DOE) refers to as Generation III reactor. Nineteen reactors representing three older models of this design operate in Russia and the Ukraine, some completed only recently, and the accumulated reactor-years of operational experience are yet limited. The U.S. Nuclear Regulatory Council (NRC) is now licensing the more advanced 'Passive Safety' reactor designs - the Westinghouse AP-1000 and the General Electric ESBWR which might become commercially available by 2006 and 2008, respectively. Both of these are referred to as Generation III+ reactors, and are designed to higher safety standards than do the older Generation III reactors. A generation III reactor like a VVER-1000 would not currently be licensable in the U.S. The French EPR and the South Korean KSNP+ reactor, as well as the more advanced A-1400 Korean design, all represent equivalent Generation III+ reactors. This being the case, why would the DPRK - assuming it has got some leeway in choosing which reactor type to accept - opt for a second class rather than first class reactor design? Would we want the DPRK nuclear plant operators, given their limited operational experience, to operate a less than fully modern and automated reactor?

This gets us to the South Koreans. One might discern elements of a putative Korean long-term multi-step strategy to gain control of the DPRK electric grid and integrate it into the Korean grid as one element of an eventual re-unification process. Firstly the Koreans have offered to upgrade the DPRK Grid and transmit 2,000 MWe through the improved grid to the DPRK load centers. Next the Koreans might offer to build Korean-designed standard nuclear plants at DPRK sites, based on institutional arrangements similar to those used in the Kaesong industrial center, and transmit most of the generated power south. This might benefit the Koreans who have run out of nuclear plant sites in the south, and it might benefit the DPRK through salary payments to plant construction workers and through the collection of levies on the electricity transmitted to the south. Eventually Korea and the DPRK might jointly build and operate standard-design multi-unit Korean nuclear stations at DPRK sites, sending some of the generated power into the relatively small but now modernized DPRK grid and transmitting the bulk of the generated electricity into the South Korean grid. Such slow integration process might eventually combine the Korean and DPRK grids into one network, operating high-quality Korean nuclear power plants. Such a process might ultimately be the best way of providing the benefits of nuclear energy to the DPRK and allowing direct DPRK participation in the construction and operation of a modern commercial nuclear power plants complex. While this might be a good vision, it suffers two main disadvantages: Firstly this process by its very nature might require long implementation period whereas the DPRK would like to demonstrate nuclear-related benefits on a shorter time scale. Secondly, in such a vision - assuming this to be the ultimate South Korean intention - there is no place for a large Russian nuclear power station.

The South Korean already have experience in constructing several foreign reactor designs in their country including the Westinghouse PWR reactors in the Kori and Yeonggwang stations, the French PWR reactors in the Ulchin station and the Canadian CANDU reactors in the Wolsung station. This experience with multiple reactor designs and different international vendor teams has thought the Koreans the benefits of designing their own reactors based on the best foreign practices they could emulate and then building series of standardized Korean nuclear plants. In fact, the Korean experience in nuclear plants standardization rivals the Japanese, Russian and Canadian experience and is second only to the French experience in this matter. Given this attitude which imbues the Korean electric power industry, why would they want to bring into their relatively small peninsula yet another reactor design, inferior to the ones they are already now constructing or are about to construct, and pay for that unwanted reactor into the bargain? Why would they be willing to stretch the not unlimited resources of their nuclear regulatory agency with learning the fine points of the safety systems and the accident prevention features of another large reactor design? Reactors built in the DPRK will be subject to DPRK regulators scrutiny however the Koreans might have to maintain backup safety expertise in the South, in case the yet inexperienced DPRK regulators fail to exercise proper supervision.

The Korean power industry and Government are not happy about having paid for manufacturing the current KEDO reactors equipment - an expenditure of about one Billion Dollars - with no returns. The KEDO reactors represent an interim step between the older Korean Standard Nuclear Plant (KSNP) reactors previously built in Korea and the current series of KSNP+ more modernized designs. Most of the manufactured equipment for the KEDO reactors can not be recycled into the newer and more modern KSNP+ stations now being constructed in the south and can only bring a return if the original KEDO Reactors are built as designed. In fact, the cynics might claim that some Korean nuclear industry persons might have, under the table, egged-on the DPRK in its demand for an immediate reactor construction, in the hope of resurrecting in a new guise the now defunct KEDO station as designed by the Korean nuclear industry. Given all these attitudes it is difficult to see easy acceptance of Russian reactors by South Korea, let alone a Korean commitment to finance a Russian nuclear station in the DPRK.

Hayes et al have emphasized the benefits of integrating the South Korean electric grid with the Russian Maritime grid with its surplus generating capacity using the upgraded DPRK grid as a tie-in. This approach will require, as a part of upgrading the DPRK grid, the construction a long high-voltage transmission line in a Northeast direction which includes only a limited number of small-sized load centers - an expensive proposition. A more useful route to regional East Asia transmission grid integration might involve a shorter northern direction extension of the South Korean electric grid, passing through the main DPRK load centers and connecting to the North-East China grid. This gets us to the possibility of building Chinese reactors in the DPRK which I view as a better option than relying on Russian nuclear plant designs.

China as a reactor vendor has several benefits as compared with a Russian nuclear plant offer. Firstly, China, unlike Russia could provide the bulk financing required for such a nuclear plant project. Secondly China, as the rising economic power in Asia, with extensive financial and commercial ties at both ends of the Korean Peninsula, is more politically acceptable to BOTH the DPRK and to South Korea. Thirdly, China, even more than Russia is eager to break into the global nuclear export market, thus it might offer better terms for constructing its nuclear plant technology in the DPRK. And fourthly, the Chinese nuclear reactor export models are smaller than the Russian reactor offer, being of 300 MWe or potentially 600 MWe capacities as discussed next, and thus representing more suitable additions to the smaller-sized DPRK grid. The smaller sized Chinese nuclear power plant will also present a lesser hindrance to the South Korean designs for integration with the DPRK electric grid, eventually deploying large nuclear power stations with multiple reactors of 1,000 MWe plus capacity, as built in the South. Concerns related to safety features and limited operational experience which were mentioned in regards the Russian reactors, equally apply to a prospective Chinese nuclear plant offer. However the Chinese reactor export models, being of smaller size and representing the first commercial nuclear power plants built in China, were most likely designed with higher safety margins and are thus more 'forgiving' in nature.

As regards Chinese nuclear exports experience, China has now exported its 300 MWe reactor, referred to as Qinshan Phase I plant, to Pakistan, where it operates as the Chasma no.1 plant. China and Pakistan have signed a contract in 2005 to export a second identical unit to be built at the Chasma site. A similar two-reactor offer to Iran was cancelled due to U.S. pressure in 1996. Since then China must have offered such reactors to Myanmar, Vietnam and possibly other prospective clients, though no takers have materialized yet. This represents an altogether not very distinguished list of clients. China is now completing the construction of its two-unit indigenously designed (though with French engineering support and Japanese components manufacture) 600 MWe two-unit station, referred to as Qinshan phase II station, and is contemplating duplicating this two-units station in Qinshan Phase IV. The Chinese might be interested in further developing this design as well as the smaller reactor as their export models to industrializing third world countries with yet small-sized electric grids, particularly those with oil and gas exporting potential. To do that it will burnish their exporting country credentials if they could demonstrate successfully constructing and completing either of these two reactors under the more prestigious auspices of an international KEDPO project.

This finally allows a review the potential future role of KEDO. I would suggest that it might prove useful to resurrect the KEDO organization in New York City and have all the participants to the Six Parties Talks join-in as permanent members. KEDO should be headed by a U.S. representative as a host country privilege, or by a joint U.S. Chinese leadership. KEDO would then act as a permanent Six Parties support organization dealing with political, economic, financial and nuclear related aspect of the DPRK de-nuclearization agreement. Among Other issues, KEDO should oversee in the near-term two (or three) electric power projects: The tie in of the DPRK electric grid to the Korean grid and provision of Korean electricity to the North; The supply of heavy fuel oil to the DPRK (if this activity will be included in the de-nuclearization agreement); and the planning towards the construction of a Chinese-designed reactor in the DPRK. These should proceed in parallel with various stages of the DPRK return to the Nonproliferation Treaty (NPT), disclosure of all its nuclear activities and the start of the de-nuclearization and verification processes, to be supervised by the International Atomic Energy Agency (IAEA). A detailed schedule for de-nuclearization and parallel provision of economic benefits will have to be worked out, with more scheduler flexibility built in to account for unavoidable delays and to prevent later complaints of unfulfilled time-related commitments. Assuming the process successfully works its way further as agreed to, in the intermediate-term KEDO could undertake, all Six Parties agreeing, to supervise the construction completion of the two Korean reactors now held in abeyance. Once de-nuclearization is achieved -a very tall order by any standards - and the plants mentioned here are built, KEDO could step away from its electricity supply mission and let Korea and the DPRK deal directly with this issue, depending on the way their mutual relations evolve.

III. Nautilus Invites Your Responses

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