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Briefing To Korea Conference

“The Six-Party Talks and Korea’s Energy Security”

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Part 1: DPRK Energy Insecurity

Short and sour

Electric Power Update: Empirical Observations (by a contractor) of Operational and Technical Conditions of Electrical Substations in the DPRK

- Lack of engineering and management skills on the part of DPRK counterparts
- Very old, ill-maintained, inoperable, and sometimes missing transmission and distribution infrastructure (on the order of $\frac{3}{4}$ of transformers in some key substations missing or inoperable)
- Lack of information, lack of facilities for control of transmission and distribution equipment, poor frequency and voltage control, and a host of related problems
- A particularly cold winter day may trigger a cascade of system failures severe enough to seriously damage remaining equipment

Continuing degradation of DPRK Electrical Infrastructure

- When degradation of electricity infrastructure becomes even more severe the military will effectively have to run own power stations and diesel generators are unlikely to be an adequate source of power
- As a result, ongoing degradation implies that power sector problems must be cutting deeply into the DPRK military-industrial complex economy (separate from the line-agency economy) and the military must be very concerned
- For 6PT/US Policy, reinforces the need to act on the local level, rather than trying to fix large systems that depend on other failing infrastructure. Suggests that 5 Parties/US should make a contingency plan to deal with more-rapid-than anticipated infrastructure collapse and its impacts

Part 2: DPRK Preferences and Negotiating Phase 3 Energy Assistance

Longer and sour

ANTICIPATING DPRK ENERGY NEGOTIATIONS

1. **Domestic:** has to reflect well on KJI leadership, not cross anti-US, pro-military first lines
2. **External logic:** choose items that:
 - Stand up to China, reduce dependence on China
 - Hold US at arms length but build a cooperative relationship
 - Use ROK against US, China and Japan
 - Engage Russia for marginal leverage, buffer against RO
 - Keep pressure on Japan via everyone
3. **Diplomats in lead at talks:** Interest: how achieves agreement, uses AF precedent
4. **Economic planners play minor support role at talks,** interest:
 - Financing and IFIs; Japan reparations; short-term access to ROK support
 - Capacity-building of a technocratic elite
 - Build relationship with US—training and study in US
 - Free trade zones, big cities, big industry, FX earning (Mines), supporting the military-industrial complex
5. **Energy planners and line agencies;** likely not at the talks, but might be consulted: interest: Coal, generation, grid, refineries, refined product import-distribution

In short, humanitarian and social-economic needs will have no DPRK voice at the talks.

DPRK Likely Preferences

1. **Symbolic project: LWR + Regional Grid**
2. **HFO**
3. **Rehab Coal, Coal is King**
4. **Mining Energy Infrastructure for FX**
5. **“Modern Energy” (coastal LPG, renewables)**
6. **Training**

DPRK Likely Preferences

1. Symbolic project: LWR + Regional Grid:

- LWR is key to KJI
- Long-term, grid rehab and RF-Korea tieline or at least ROK heavy involvement key to LWR as the SK offer is not technically attractive
- LWR + tieline is the only way to make the LWR work anyway

DPRK Likely Preferences

2. HFO (phase 2, perhaps phase 3)

- Refined product or refinery upgrade has no symbolic value for DPRK, nor utility for diplomats in striking agreement; Chinese wouldn't want DPRK to become more independent; military aren't at the table
- Which leaves only HFO: diplomats may use it to benchmark equivalent deals and to cite it as precedent or to sell it at home.
- In reality, not very useful, some coal displacement for coal mining ministry, some use in heavy industry, but hard for them to use it; could reduce HFO imports from China that they have to pay for...
- For economic ministries, HFO is a dead end because no tech transfer, no linkages, no development.
- So NK will be amenable to “equivalent HFO” services

DPRK Likely Preferences

3. Rehab Coal, Coal is King

- Capacity building, basic equipment, transport, cleaning, safety, end-use equipment
- Planning ministry will have interest in waste reduction, e.g. light bulbs (reportedly already in progress), energy efficiency center of some kind, district heating pipes, end users

DPRK Likely Preferences

4. Mining Energy Infrastructure for FX

- Mine-level rehab and related energy infrastructure
- DPRK interest: economic agencies; also, diplomats may find it useful to link back to US-DPRK bilateral (they can argue if they don't export e.g. cigarettes then we have to help them rehab their FX-earning mines).
- Yangdok mine opportunity to combine with humanitarian county-level project
- Power needs for 8 mines specified at <http://www.nautilus.org/DPRKBriefingBook/economy/DPRKonDPRKMines.pdf>

DPRK Likely Preferences

5. “Modern Energy” is Attractive but a Trap

- Will always seek capital equipment, latest high tech, seek to reverse engineer, will fail
- DPRK interest: old-style line agencies, to be avoided along with bigger hi-tech projects such as gas-fired power plants (linked to long-term huge projects such as trans-Peninsula pipedreams)
- Possible useful, negotiable projects

Small coastal urban LPG terminal for bottling, distribution to households, small industry

Reunification renewables, for example, KJI mandate exists for 0.5 GWe of windpower

DPRK Likely Preferences

6. Training

Interest: Economic ministries primarily

- Enterprise-level, hands-on overseas and local short term training is best
- Europe, China, Indonesia, Vietnam, India, SQ is best
- Short-term study tours (NREL, NRECA) in US and allies such as Australia, CA, etc are best
- Technical assistance as preparation to join IBRD, ADB is attractive
- Participation in APEC EWG is attractive
- Entre into sectoral and real planning work (e.g. forestry, agricultural etc)

Part 3: Negotiable Energy Assistance for Phase 3

Energy efficiency—especially
buildings

Refurbishment (David covered)

Networked energy supply or energy
using networks

LWRs or ~

Networked Options

- Regional power grid (RFE-DPRK-ROK)
- LPG pipeline
- LNG imports and distribution system
- Connected networks (roads, rail, telecom)

Networked Grid: <ROK-DPRK-RF interconnection Scenario>

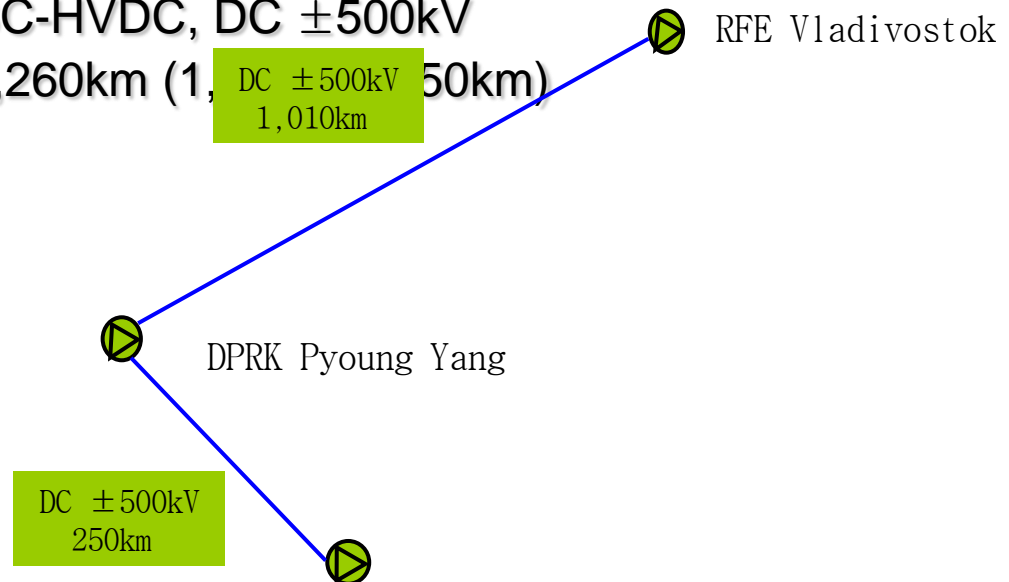
◆ (scenario-1)

“ROK-DPRK-RF” 3-Terminal HVDC interconnection

- Converter stations will be located in Vladivostok, some point near Seoul and Pyoung Yang

HVDC system configuration

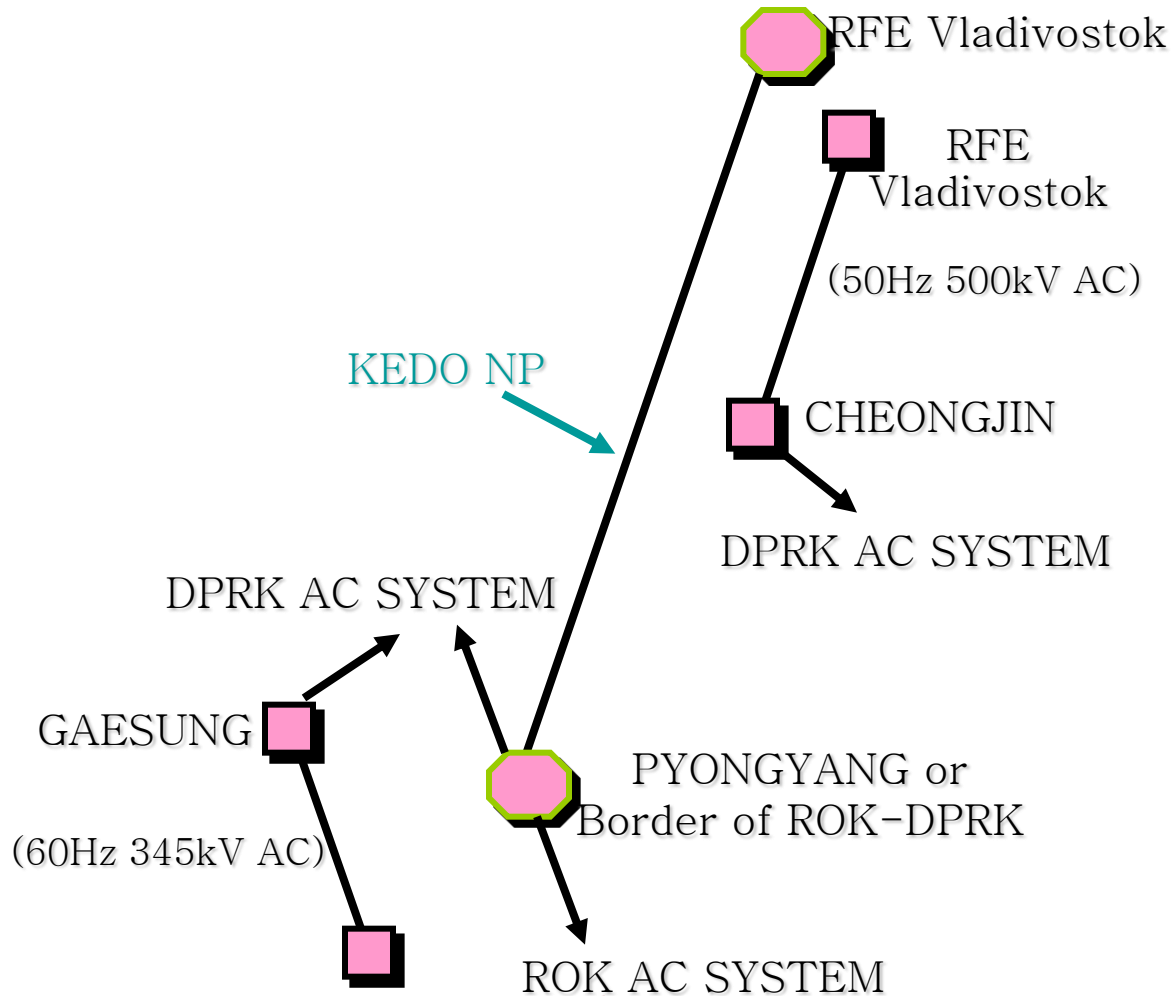
- VSC-HVDC, DC $\pm 500\text{kV}$
- T/L : 1,260km (1,010km, 250km)



<Conclusions for feasible power exchange>

- Proposal for “ROK-DPRK-RF” interconnection
 - Overview of interconnection
 - 3 Terminal PTP-HVDC system is suitable for interconnection
 - Converter stations are located at Vladivostok, Pyung Yang and Seoul
 - BTB–HVDC is not available due to weak power system of DPRK
 - System configuration
 - DC ± 500 kV, Multi-Terminal HVDC system
 - VSC type HVDC system is more appropriate for interconnection
 - Two-Bipole DC transmission
 - Feasible exchange power
 - Feasible exchange power taking account of technical and economic constraints is 3GW to 4GW
 - 3GW to 4GW is allowable from the viewpoint of energy security (About 5% of power demand in 2017)

<Future Prospects : Interconnection Scenario>



Up-to-date Profile of the Regional Tie-line Project

- AC transmission line 500 kV *Vladivostok – Kraskino (Russia) – Chonjing (DPRK)*
- Electricity export from Southern part of the Russian Far East to Northeast of DPRK into *loading islands* due to various frequency of AC in Russia and DPRK (50 vs. 60 Hz)
- Distance – 390 km, of that – 240 km on the Russian territory
- Load – up to 500 MW (2,5-3 bln kWh annually)
- Investments estimates – \$250 mln
- ☀ **The major problem is the source of payment for the electricity supplies**
 - ☀ Korean party offered joint development of Sanson deposit of complex ore and payment for electricity imported from profit of Korean party
 - ☀ as preliminary assessment of Sanson project showed it can be efficient but under certain circumstances
 - ☀ to attract investors INTER RAO UES held preliminary talks with Russian metallurgical companies (RUSAL, Mechel, NLMK). For the reasons of high investment risks due to political situation in DPRK the positive decision has not been received
 - ☀ INTER RAO UES suggested to expand the list of mineral deposits and to include that of coal but DPRK delegation refused and offered as alternative option to implement modernization of CHP plant in Chonjin town

Realization of the investment project of Interstate Transmission Line by INTER RAO UES singly, without involvement of other Russian energy and metallurgical companies is likely to be **not profitable and highly risky**

DPRK Energy Experts Working Group (EEWG) Meeting

- Day 2 Sessions: Status of DPRK Building Energy Sector
 - “Introduction of the Building Sector in DPR Korea”, DPRK Delegation
 - Examples of construction and reconstruction of dwellings in urban and rural areas, construction of public establishments
 - Plans for introduction of new construction methods, materials, and designs for interiors
 - Institutional structure of construction industry in the DPRK



거리전개도 (개작)



거리전개도 (현황)

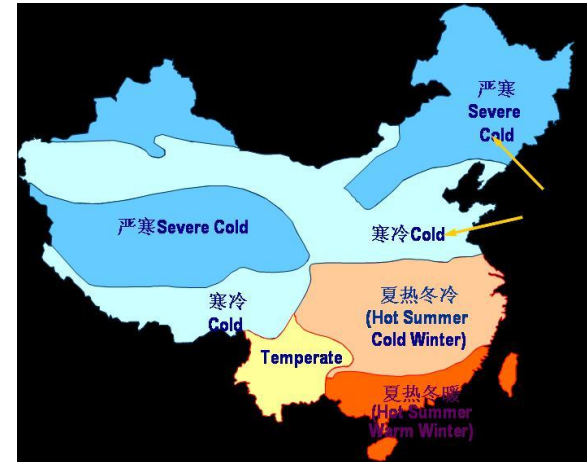
DPRK presentations on building energy

- Presentations show an awareness of building energy efficiency issues, and the existence of an active architecture community
- Delegation was relatively forthcoming with information on building practices, energy end-uses
- Delegation stressed needs for building energy efficiency, capacity-building in the DPRK
- For 6PT/US Policy, confirms that building energy efficiency is a major opportunity at both political—engagement at ground level on an issue of keen interest—and practical—fastest/cheapest way to improve provision of energy services to DPRK population. Again, capacity/institution building is the key place to start

- Day 2 Sessions: International Building Energy Efficiency Initiatives, Opportunities for Assistance to DPRK Buildings Sector
 - Status of Building Energy Consumption in China
 - Building Energy Efficiency and Renewable Energy Experience in South Korea
 - Energy Efficiency & Sustainability in Buildings: Concepts and Implementation in Asia-Pacific, Australia/RMIT, green building certification

DPRK Energy Experts Working Group (EEWG) Meeting

- Day 2 Sessions: International Building Energy Efficiency Initiatives, Opportunities for Assistance to DPRK Buildings Sector
 - Building Energy Policies in China, Joe Huang (LBNL, Retired)
 - Importance of building energy efficiency to China
 - Overview of the Ministry of Construction
 - Characteristics of China's building energy policies, standards for buildings in different climate zones, standards for windows
 - Relevance of the Chinese experience to the DPRK
 - "Agenda 21" building project in Beijing as a model for green building development



– “International Cooperation Opportunities in Building Energy Efficiency for the DPRK”, Ron Jarnagin, PNNL

- Energy management as tool for international engagement
- Benefits of establishing regional centers for excellence in energy
- Examples of international cooperative programs in China and in Eastern Europe, importance of role of national/local government involvement



- Space heating is a primary area for energy savings, including central heating systems/district heating, distributed systems

- Combined Heat and Power Individual control of heating capacity a key in producing savings

Major Lessons Learned/Reinforced 1

—DPRK Energy

- Physical infrastructure in critical areas close to fully depleted
- Radical change quite possible, and discontinuity is on the agenda
- Small/cheap/fast continues to be the preferred mode of assistance, both in providing visible (if modest) services quickly, providing information feedback to international community
- Barriers of entry to external groups delivering projects are going up, not down, over time
- Training and more training is needed, including at enterprise level
- Connecting regional electricity networks without proper preparation of NK grid may have devastating effects on NK T&D
- Corollary on capacity building—absorptive capacity, ability to do things, appears to be shrinking

Major Lessons Learned/Reinforced 2

Buildings EE

- No country has complete answer yet for building EE
- Many opportunities for DPRK to avoid mistakes made elsewhere
- “Clean Development Mechanisms” may provide useful ways for other nations to invest in building energy efficiency in the DPRK
- **Need for DPRK to adopt and adapt customized building energy efficiency standards as soon as possible**
- Need and desire for training and other capacity-building, joining networks in building EE area in DPRK
- The situation in the DPRK is unique; many models used elsewhere for building EE improvement therefore will not work
- **No “shortcuts” in addressing DPRK building EE needs, no room for error—must lead to improved energy/humanitarian situation**

Major Lessons Learned/Reinforced—

General 3

- A major “**phase shift**” in DPRK in next 2-3 years becoming increasingly inevitable due to approach to physical limits of DPRK physical, social infrastructure
 - **Radical uncertainty** needs to be more and more a driving factor in considering what to do
- Need to
 - **Listen** to DPRK speakers, as what they say matters
 - Maintain **compassion** for DPRK citizens in general