

A Plausible Concept of Power Pool for Korea based on NAPSI



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Four countries in North East Asia (China, Russia, Japan, Korea) represent 25% of World GDP and 40% of World CO2 emission.

Growing social awareness with dissent from hot and hard issues:

- ① Expansion of nuclear power construction not forgetting radioactive waste disposal
- ② Coal power generation with CO2 emission
- ③ Fine dust pollution due to industrial activities

These countries are electrically isolated area in the globe.



In the past, lot of studies such as Asian Super Grid & GEI etc.

Now NAPSI has been active:

- ① Any type of power pool between NEA 4 countries is a forward looking technical issue.
- ② Need to develop renewable electric generation at Gobi desert in Mongolia on a grand scale as much as up to 100GW during the next 20 years.

Many-sided 3 advantages:

- ① Reduction of power reserve ratio
- ② Stabilization of power grid
- ③ Economically optimal operation of power facilities

What is NAPSI?: History of Foundation

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Just after Fukushima disaster, in 2012, Asian Super Grid of Japan (Soft Bank) proposed international cooperation between 5 countries.

Other studies were followed by:

- ① GOBITEC by Mongolia together with ECS (Energy Charter Secretariat) supported by European Union
- ② GEI by China in 2016
- ③ Asian Super Grid by Korea in 2016

GOBITEC report was published in January 2014 for which working bodies were MOE of Mongolia, ECS of EU, KIEE of Korea, JREF of Japan, ESI of Russia and Fraunhofer (ISI & ISE) of Germany.

As the first trail, Wind generation of 50MW was constructed and commissioned in 2014 for importing electricity from Russia to Mongolia.



ADB gave the name “NAPSI” to EDF study and allocated the fund of \$1.75 Million in which \$500 thousand aid from Korea.

Mongolian government launched NAPSI project with EDF on May 1st 2017.

EDF has fulfilled deep and intensive investigation with a view to regional power pool considering the geographical condition together with economy elements.

The contract supports Mongolia State (EA) to enter into the NAPSI discussions and then to deduce consensual project considering his huge Renewable Energy Potential.

EDF is selected and works with:

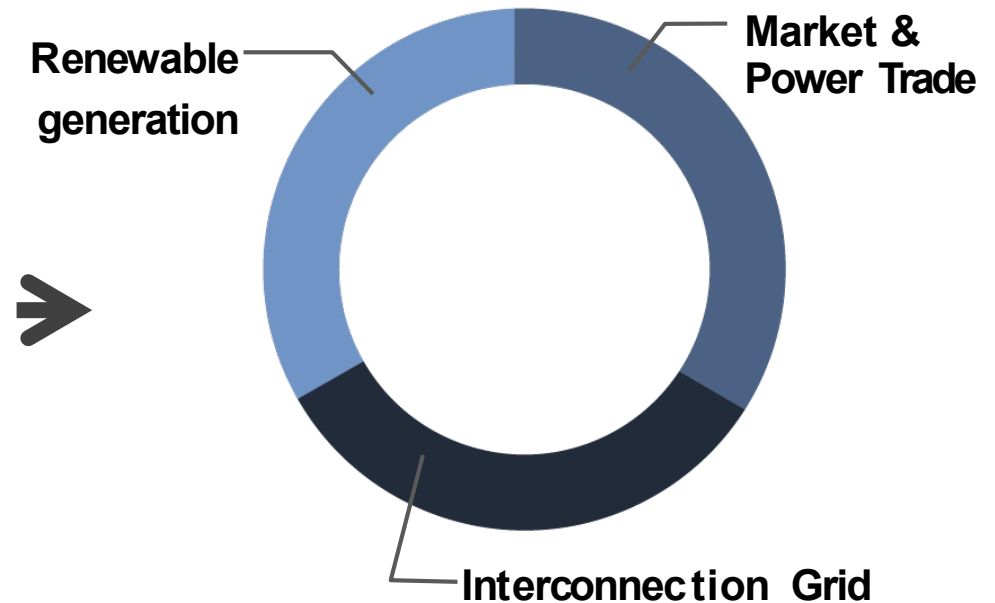
- Nova Terra in Mongolia
- China EPRI
- EDF R&D

Cooperation: **KEPCO, Soft Bank, PJSC ROSSETI**

EDF has already wide experiences in:

- . Low carbon technologies
- . Interconnections for exportation in Europe
- . Adaptation to Europe electricity Market and to Europe Climate Change Energy Policies

3 MASTER PLANS over 20 years



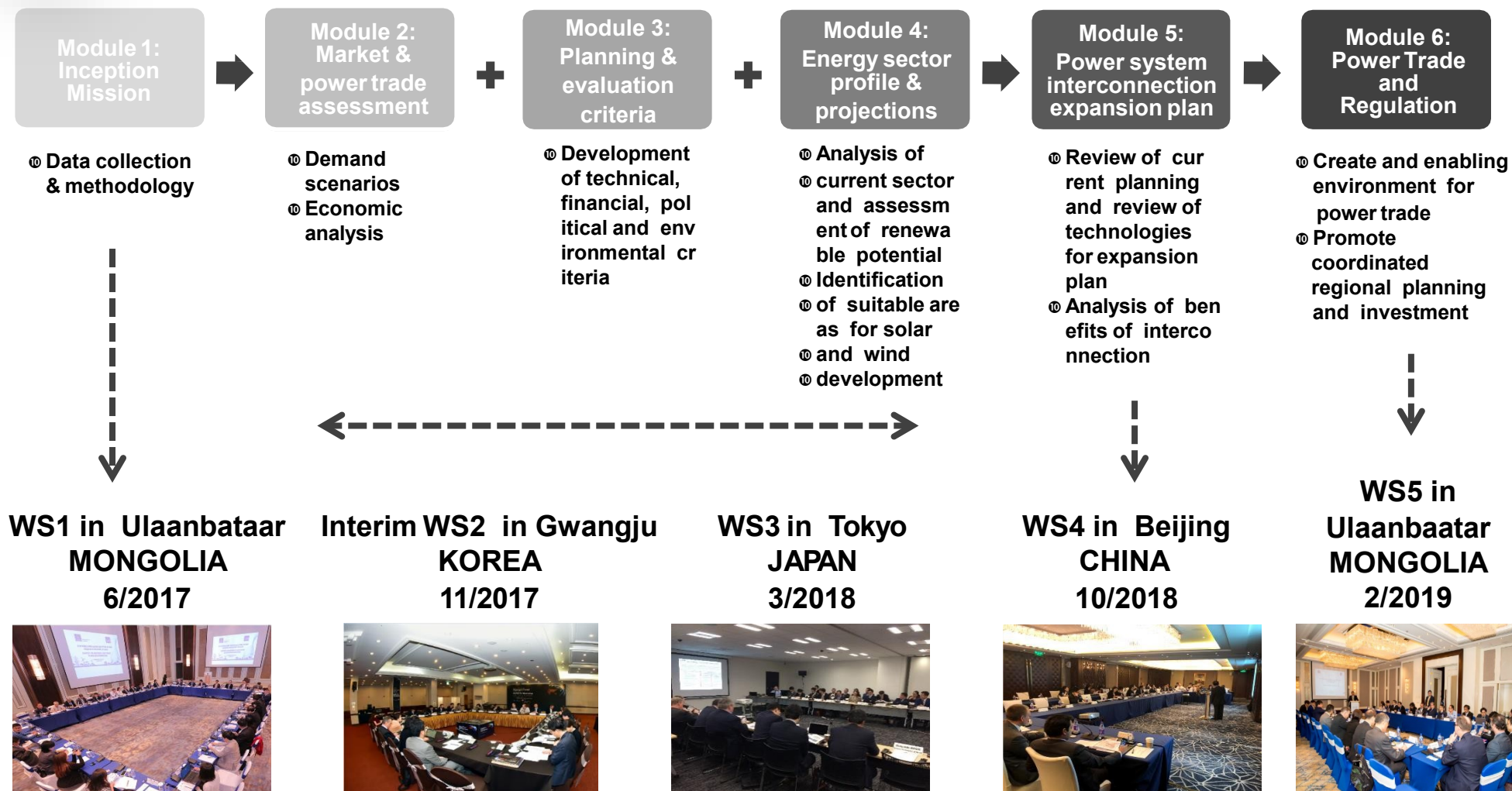
NOVA TERRA



国家电网
STATE GRID

中国电力科学研究院
CHINA ELECTRIC POWER RESEARCH INSTITUTE





Achievements

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Since 2014, the grid connection between Mongolia and Russia has been also in-service on a small scale for importing electricity from Russia to Mongolia without exporting massive renewables to Russia.

Since 2019, 190MW of renewable generation has been in-operation in Mongolia:

- ♦ Wind: Salkhit 50Mw, Tsogt Tsetsii 50MW and Sainshand 55MW
- ♦ Solar: Darkhan 10MW, Monnaran 10MW and Naranteeg 15MW

- ♦ According to NAPSI, the construction of renewable energy generation at Gobi desert has been planned: 5GW by 2026 and then expanded realistically to 10GW by 2036.
- ♦ In addition, the feasibility study of 100GW is also investigated to provide perspective and to examine the feasibility.
- ♦ Moreover, the international power grid link has been raised among three countries: China, Japan and Korea.



These plans make them anticipate the likelihood to reduce Fine dust and CO2 emission from coal power plant by renewable power generation enabling to replace nuclear power generation.

In the future, the regulation for power trade market would be gradually enacted among 5 countries.

After NAPSI studies, discussions are now ongoing at the highest level of 5 countries.

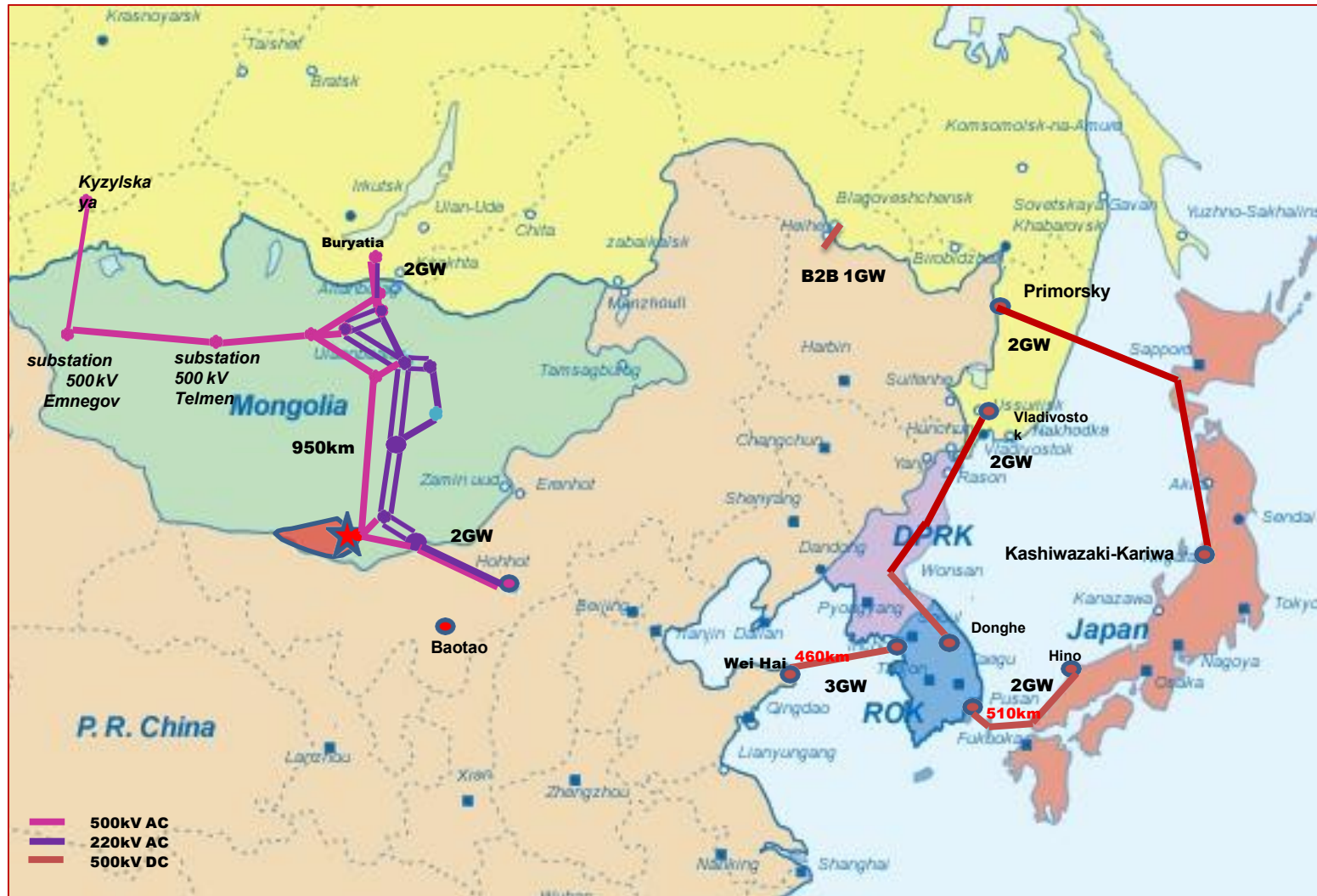
NAPSI Design: PHASE 0 in 2017

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NAPSI Design: Phase 1 in 2026 to 5GW

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NAPSI Design: Phase 2 in 2036 to 10GW

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NAPSI Design: Phase 3 in 2036 + 100GW

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NAPSI Plan employable to Korean Power Grid



In NEA region, NAPSI covers, at the same time, many issues such as Mongolian Renewable potential, Regional power trade implementation and Grid interconnection development.

According to its report, the construction of power grid interconnection has been already envisaged between Korea and China which would be completed by 2022 through the HVDC submarine power cable system.

2 Advantages for Korea:

- ① Korea could make use of the renewable electricity produced in Mongolia
- ② Korea also restrain significantly the construction of Coal and Nuclear power generation in the future to meet the CO2 emission required by Paris's agreement in 2015.

Korea, electrically isolated island, can benefit from foreign power including Mongolia RE in order to cut CO2 and to reduce the cost of electricity improving grid safety.

This is one of the advantages for Korea when the power pool is realized

In this regard, grid interconnection is a part of 3rd energy policy which is still in discussion but about to be validated by Korean government and parliament.



Moreover, prefeasibility studies have been made on the construction of submarine power cable system for China-Korea and Japan-Korea.

3 Benefits for NEA region :

- ① Relevant power trade for cost effective economy**
- ② Improved system safety**
- ③ Less CO2 emission**

- ♦ 22% reserved power ratio in Korea
➔ Highest ratios in the world.
- ♦ 40% of the total power generated by 25 Nuclear power + 2 plants are planned to be constructed.

In 2017, new energy policy for soft energy transition ➔ Nuclear power generation would be largely replaced by use of renewable resources.

- ♦ Fine dust pollution has been raised up due to mostly coal power and transportation.
- ♦ 37% reduction of CO2 Emission is impossible.



- ♦ Prefeasibility studies on the construction of submarine power cable system for China-Korea and Japan-Korea.
- ♦ In 2019, a SPC will officially be established at KEPCO via HVDC submarine power cable system ranging hopefully to 3GW.
- ♦ HVDC is justified for 2 reasons:
 - Long undersea cables and the
 - Difference in frequencies
- ♦ Korea & South Japan: 60Hz
The rest region: 50Hz

Stance of Korea toward NAPS I

- ◆ The governmental perspective has focused on “Energy transition” since last two years.
- ◆ In addition, the here and the hereafter of the denuclearization in North Korea depends on the political decision based on the proper stakes allocated to surrounding countries.

- ◆ Almost no attempts have been done for mutual cooperation among NEA countries on account of the international situation.
However, the need in diverse business has become recently one of their major concerns: railways, electric power grid and gas pipeline.
- ◆ In particular, power grid connection has become the in-depth issue to be tabled at the meeting among Korea, China and Russia in 2018. → SPC is going to be founded in Korea for constructing power pool between Korea and China.



- ◆ Unfavorable attitudes have been disclosed against the power pool. **Because there would be in reality a risk of the power supply interruption from the outside due to a sudden change of political situation beyond imagination.**
- ◆ Also a concern is that certain generations may lose the opportunity to generate electricity due to the external power imports.
- ◆ The power grid interconnection is now part of the Korean energy policy (3rd Energy plan)
→ **Good solution for energy transition for :**
 - ① **Improving System safety**
 - ② **Cheaper electricity price**



Thank you~:)