China's Perspective on Northeast Asia Electricity Interconnection

The second in a 2020 series of webinars from the Clean Energy Ministerial Regional and Global Energy Interconnection Initiative

March 24, 2020 1200(GMT)/2000(GMT+8, Beijing Time)

Event Link: https://zoom.com.cn/j/4215436495

Speaker: Mr. Lei Xiaomeng (China Electricity Council)

Mr. Lei Xiaomeng is the senior advisor of China Electricity Council (CEC) on regional international power interconnection since 2016. He has made an important contribution to establishment of Northeast Regional Power Interconnection and Cooperation (NEARPIC) Forum and he is NEARPIC steering committee member representing CEC. He worked for China Yangtz Power Co. Ltd (CYPC) as a vice chief engineer from 2003 to 2016. He worked in National Power Dispatching Center in State Grid Corporation of China for many years before working in CYPC. He was a member of Power System Operation and Control (C2) study committee of CIGRE and has been working in some working groups until now. He is also a working group member of Regional Power Trading Committee of Greater Mekong Subregion (GMS).

About the Regional and Global Energy Interconnection (RGEI) Initiative

The RGEI Initiative was established at the 9th Clean Energy Ministerial meeting in Copenhagen/Malmö in May 2018. RGEI's objectives are to:

* Discuss conducive policy and regulatory framework regarding regional and global power system integration
* Build consensus on facilitating energy transition via increased proportion of renewable energy in energy consumption and enhanced grid interconnection
* Encourage CEM member countries to engage in the process of RGEI and seize collaborative opportunities

CEM Members: China, Chile, Finland, Korea, South Africa, United Arab Emirates. RGEI works with other regional and national technical organizations in the field of power system integration including State Grid Corporation of China, the Korea Electric Power Corporation, and others.

Operating Agent: Global Energy Interconnection Development and Cooperation Organization (GEIDCO)

Contact: Zhu Zheng, zheng-zhu@geidco.org, +86-1063411675

China's Perspective on Northeast Asia Power Interconnection

CHINA ELECTRICITY COUNCIL
LEI Xiaomeng

2020. Beijing

Contents

1 Current status

2 Recent studies for NEA power interconnection

3 The key projects of power interconnection with neighbors

4 The challenges and benefits of regional power interconnections

1. Current Status

Generating capacity mix in 2019

Type	Capacity (GW)	Growth (%)	Share (%)
Total	2010.66	5.8	100
Hydro	356.4	1.1	17.7
including：conventional	326.11	1.1	16.2
pump storage	30.29	1.0	1.5
Fossil fuel	1190.55	4.1	59.2
Including: Coal	1044.63	3.6	52.0
Gas	90.22	7.7	4.5
Nuclear	48.74	9.1	2.4
Wind	210.05	14.0	10.4
Solar	204.68	17.4	10.2

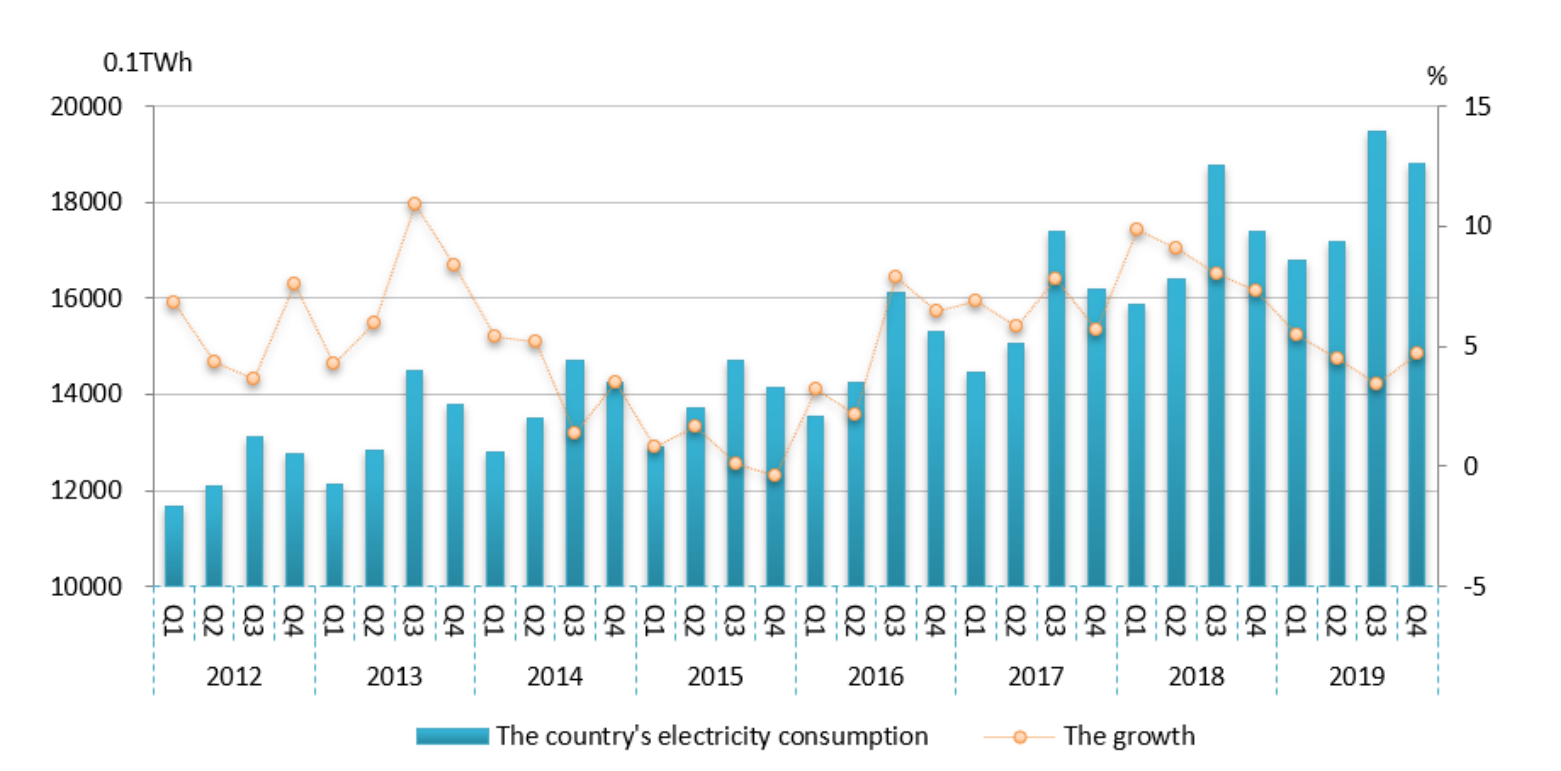
IRES shares:
2018: 18.9% in capacity 7.77% in generation

2019 : 20.6% in capacity 8.57% in generation

1. Current Status

Electricity consumption growth

The end of 2015: 100% electricity access



Source: CEC report 2019

1. Current Status

The 13th five year PDP implementation

		2015	2017	2020 Target	2015-2017 Implementation	2019	
Total	Total capacity TW	1.53	1.78	2	Exceed	20	Targets changed
	W-E Power transmission GW	140	230	270	Exceed		
	Total consumption TWh	5690	6300	6800-7200	Exceed	7343.7	（7600）
	Electrification %	25.8%	26.3%	27%	Conformance		
Generation mix	Non-fossil fuel consumption%	12%	13.8%	15%	Conformance		
	Non-fossil fuel capacity%	35%	38%	39%	Exceed	42%	
	Hydro GW	297	313	340	Lag	360	（No change）
	Pump storage GW	23.03	28.69	40	Lag		
	Nuclear GW	27	36	58	Lag	48.75	（53）
	Wind GW	131	164	210	Conformance	210	（220）
	Solar GW *	0.42	1.3	1.1	Completed ahead	200	（200）
	Fossil fuel capacity%	65%	62%	61%	Exceed expect		
	Coal fired capacity%	59%	55%	55%	Conformance		
	Coal GW	900	980	< 1100	Conformance		
	Gas GW	66	76	110	Lag	10.4	（No change）
	Biomass GW	10.31	17	15	Completed ahead	21.5	
Efficiency	Coal consumption/KWh	318	312*	< 310	Conformance		
	T&D loss %	6.64%	6.42%	< 6.50%	Completed ahead		

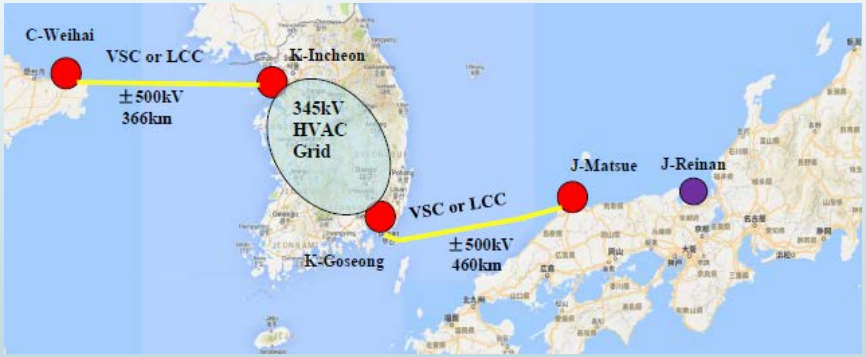
*: 42, 130, 110GW

2. Recent studies for NEA power interconnection

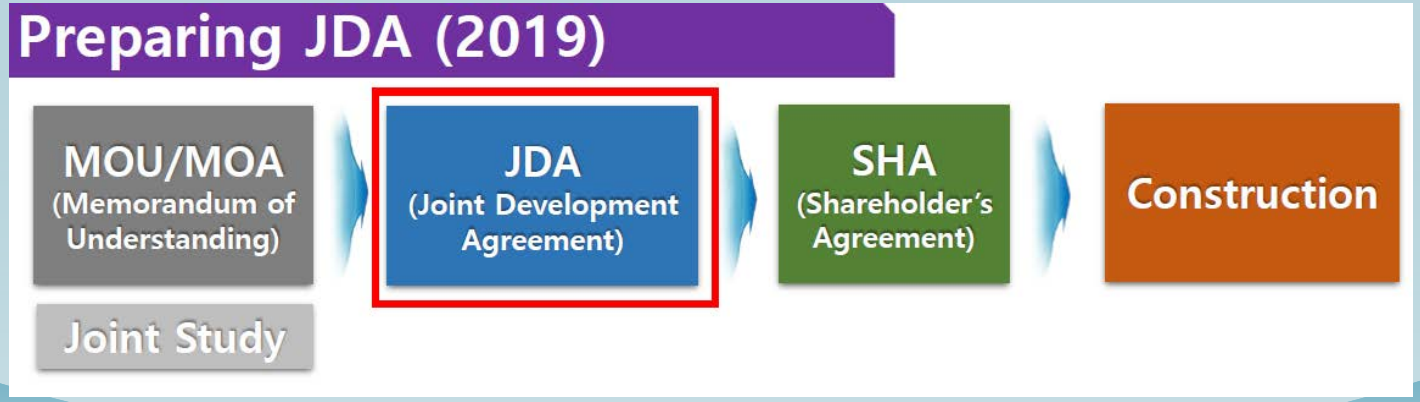
'16.03 MOU on Joint Promotion of Power Grid Interconnection between SGCC(China) - KEPCO - SoftBank(Japan) - Rosseti(Russia)

'16.06 ~ '17.03 Joint Pre-F/S on China-Korea-Japan Power Interconnection between SGCC – KEPCO - SoftBank

'17.12 MOA on Joint development of China-Korea Power Interconnection between SGCC-KEPCO-GEIDCO ※ MOU between Korea-China



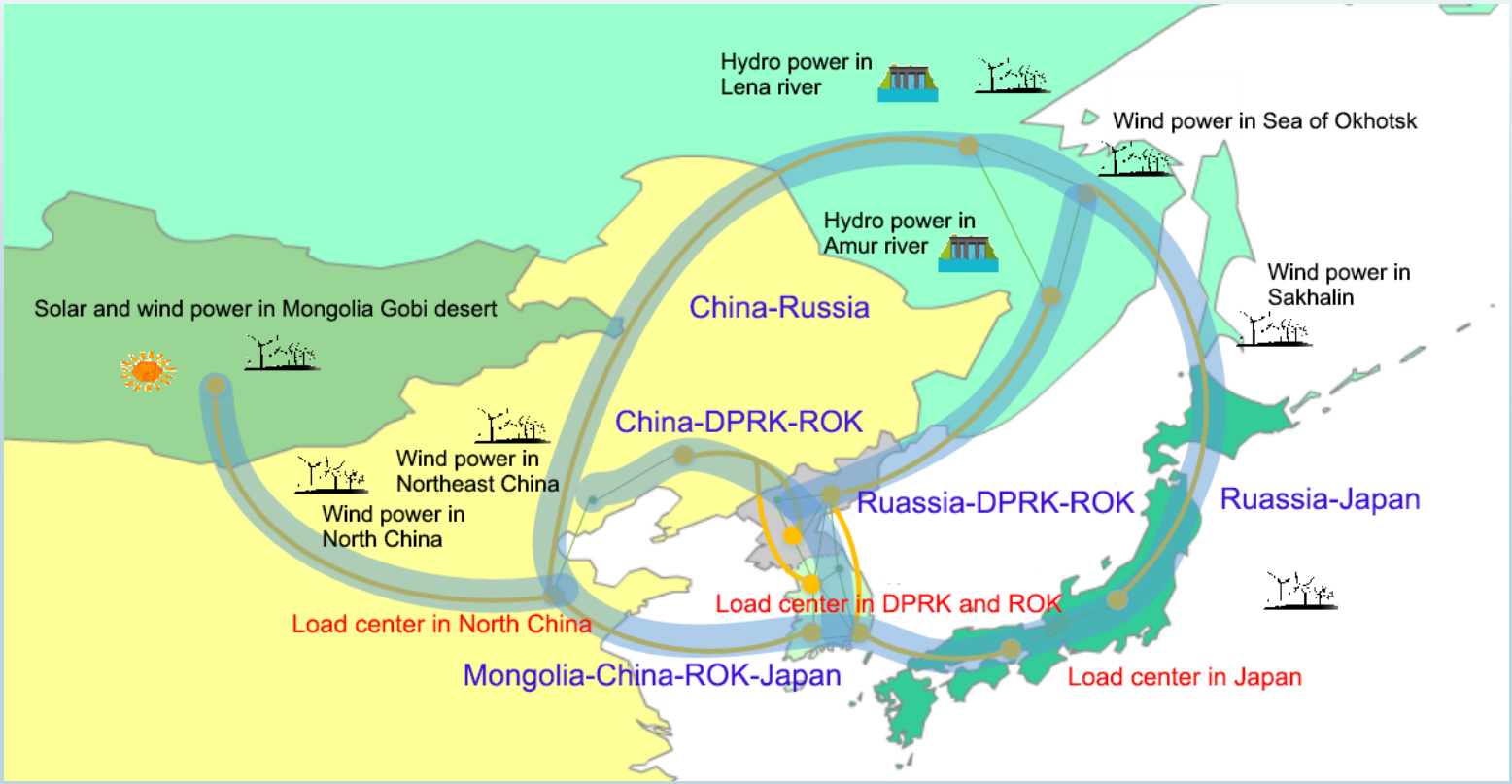
The China-Korea interconnection project as first step



Source: NEARPIC 2019

2. Recent studies for NEA power interconnection

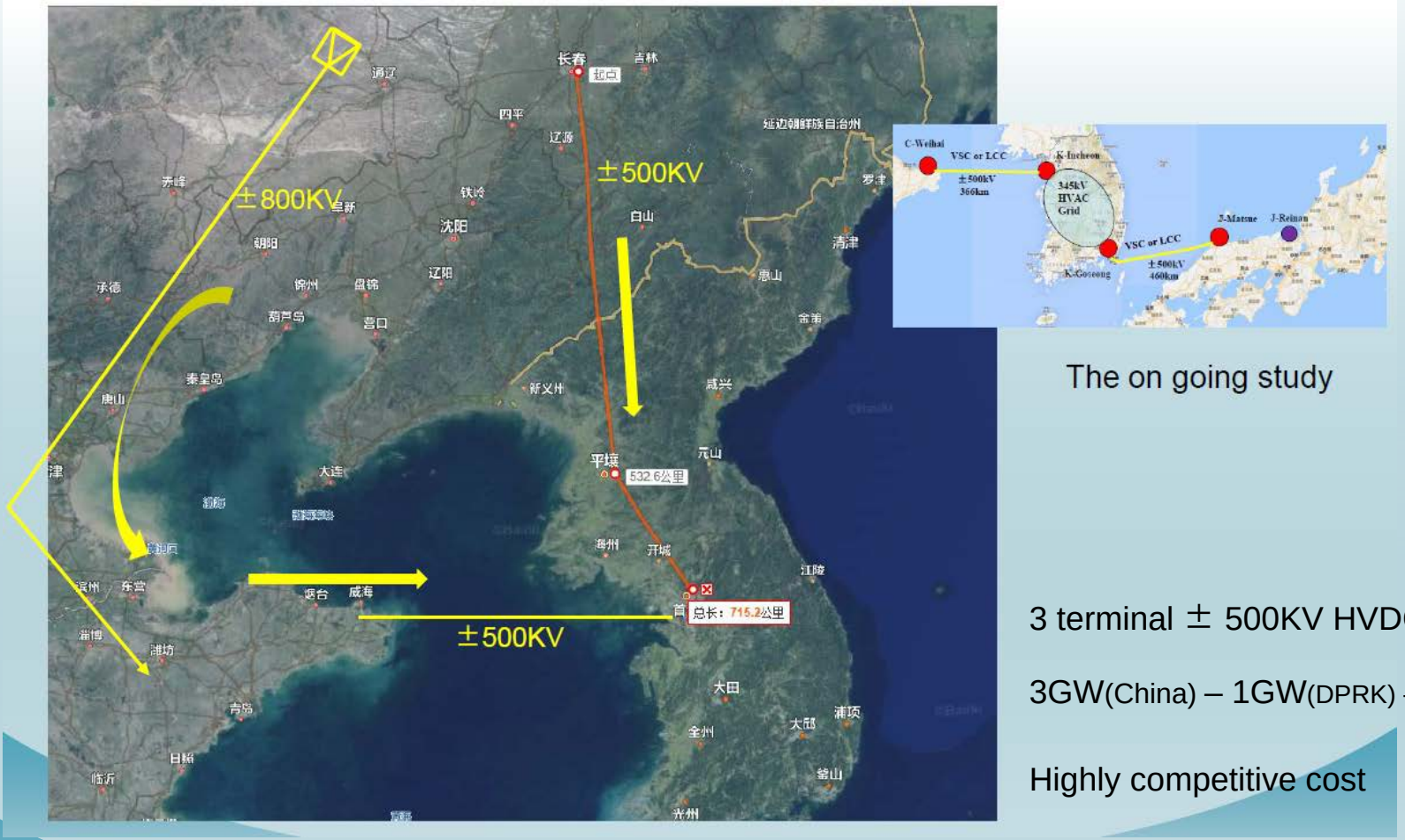
GEIDCO's planning study



Source: NEARPIC 2019

2. Recent studies for NEA power interconnection

China – DPRK – ROK interconnection



The on going study

3 terminal ± 500KV HVDC Scheme

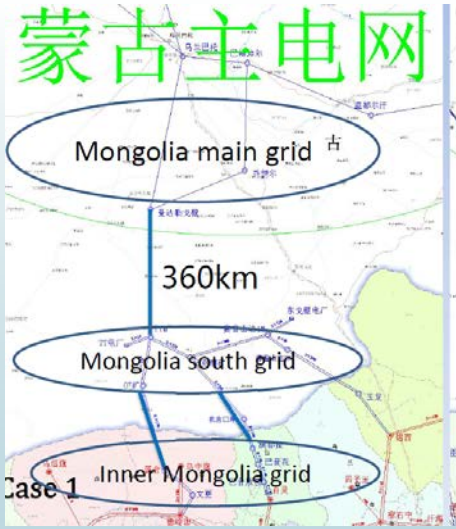
3GW(China) – 1GW(DPRK) – 2GW(ROK)

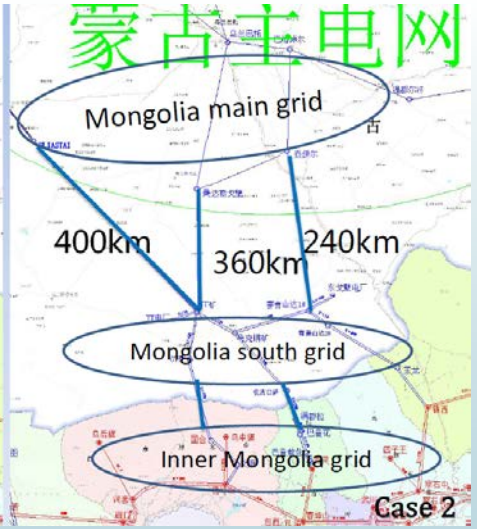
Highly competitive cost

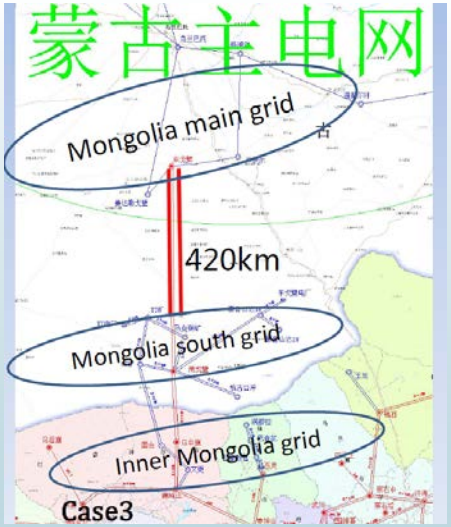
(CEC made the preliminary concept study)

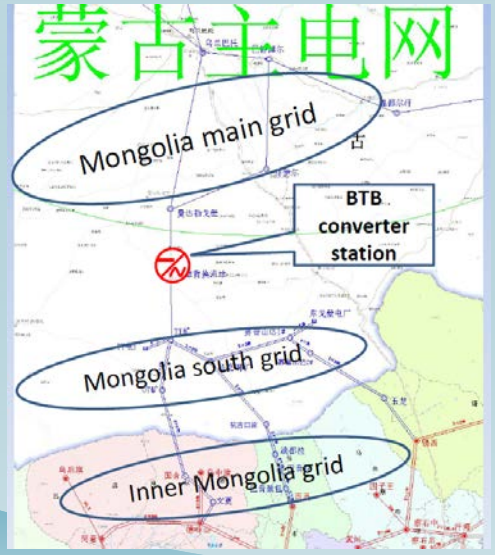
Source: NEARPIC 2018

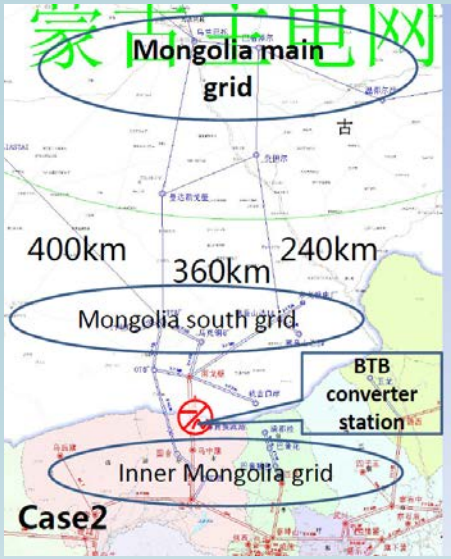
2. Recent studies for NEA power interconnection

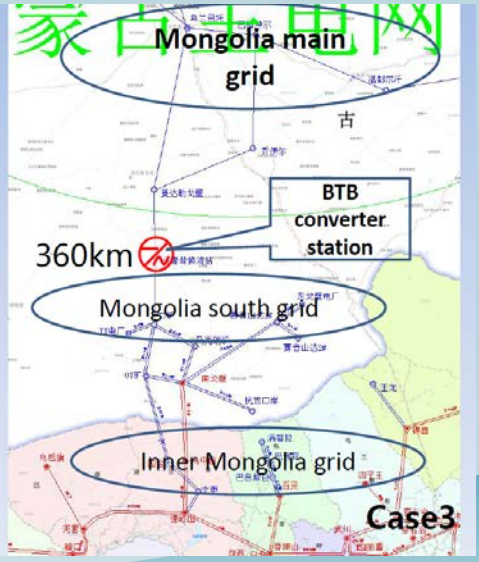












3. The key projects of interconnection with neighbors

Existing cross border transmission lines—Northeast Asia

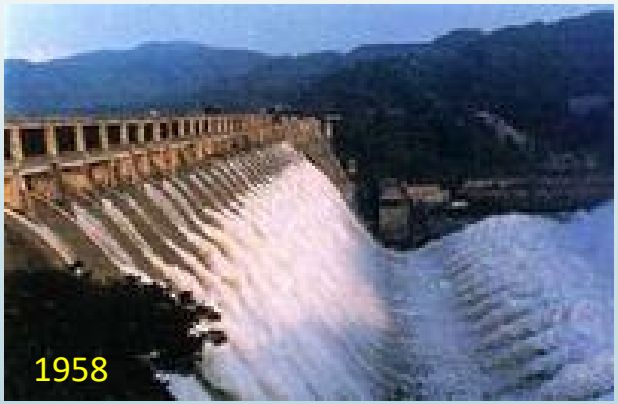
35KV and below not included

3. The key projects of interconnection with neighbors

China-DPRK Hydro Power Company

4 HPPs on the border river between China and DPRK

Yunfeng HPP, 630MW 3.3TWh/Y



Shuifeng HPP, 400MW 1.3TWh/Y

Taipingwan HPP, 190MW 0.6TWh/Y

Weiyuan HPP , 390MW 0.9TWh/Y

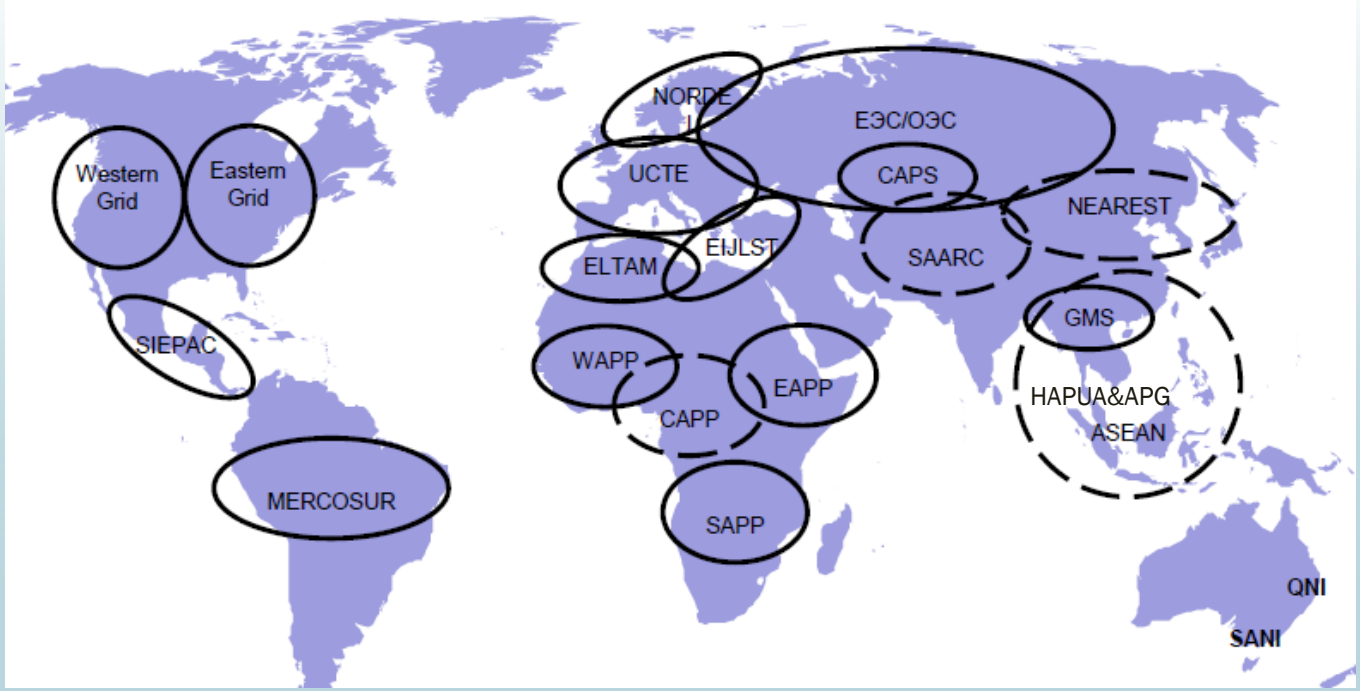
3. The key projects of interconnection with neighbors

Existing cross border transmission lines—GMS area

Adjacent to GMS countries, CSG has 12 AC cross-border lines with Laos, Myanmar and Vietnam.

4. The challenges and benefits of power interconnections

The Worldwide Overview of Regional Power Interconnection Organizations



NEAREST: Northeast Asia Region Electrical System Ties
Source: EN+ group in EWG APEC 2012

SAPP
Intergovernmental MOU
Inter-utility MOU
SADC leadership

SAARC
Intergovernmental Framework Agreement for Energy Cooperation (Electricity)

GMS-RPTCC
IGA for Power Trading
IG-MOUs
ADB supported

ASEAN-HAPUA
MOU on ASEAN Power Grid
HAPUA

Regional economic communities, International financial organizations, Power utilities and etc.

4. The challenges and benefits of power interconnections

4 the NEA Energy Security Forums
Expert Working Group on Energy Connectivity

2 workshops in Russia, 2014 and 2015

....., etc.

Conference on NEA Energy Connectivity in Ulaanbaatar, 2015

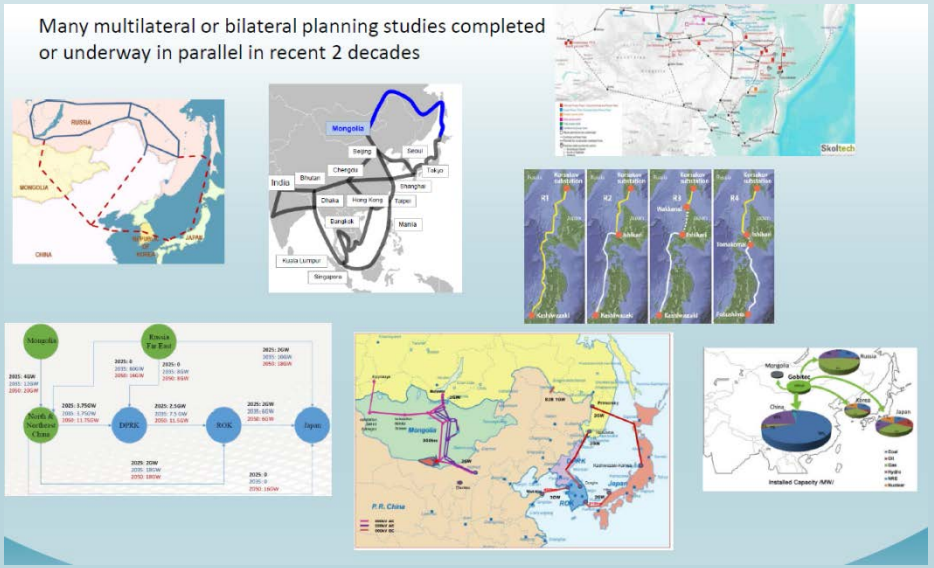
3 workshops, 2 in China and 1 in Russia from 2001 ~ 2003:
Power Grids Interconnection in Northeast Asian
NEA Regional Energy Security Working Group 2019

NEARPIC Forum 3 meetings

It is significant

to combine the similar activities into one platform

Many multilateral or bilateral planning studies completed or underway in parallel in recent 2 decades



to share outcomes of the studies

to avoid duplication of efforts and to enhance benefits of cooperation.

to promote understanding of the stakeholders and prepare reaching the multilateral framework.

4. The challenges and benefits of power interconnections

The 4 NEARPIC Forums with TOR and Steering Comittee

Joint Conference on Northeast Asia Regional Power Interconnection
Irkutsk, 29-30 August 2017

Programme

DAY 1
- Opening Session
- Session 1: Cooperation and progress on power interconnection
- Session 2: National and multilateral feasibility studies and planning

2DAY 2
- Session 3: Intergovernmental/ multi-stakeholder arrangements for power interconnection
- Session 4: Roundtable discussions on ad hoc/ interim arrangements and work plan
- Closing Session

UNITED NATIONS ESCAP · GOVERNMENT OF MONGOLIA · Ministry of Foreign Affairs · ADB Asian Development Bank

North-East Asia Regional Power Interconnection and Cooperation Forum 2018
Ulaanbaatar, Mongolia
31 October – 1 November 2018

UNITED NATIONS ESCAP · Ministry of Foreign Affairs · KEPCO · ADB

North-East Asia Regional Power Interconnection and Cooperation Forum 2019

Seoul, Republic of Korea
24 October 2019

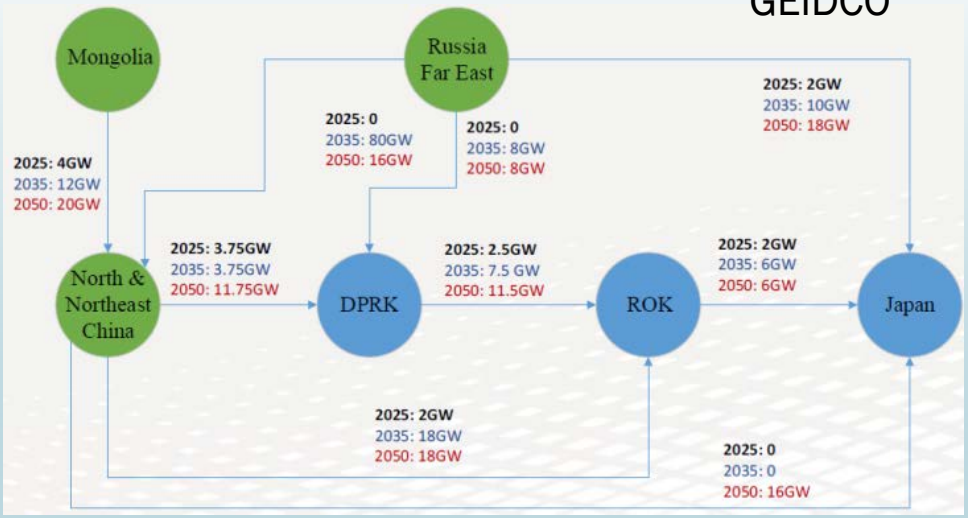
Organized by:
United Nations Economic and Social Commission for Asia and the Pacific, Ministry of Foreign Affairs, Republic of Korea, Korea Electric Power Corporation, and Asian Development Bank

Supported by
Korea Energy Agency

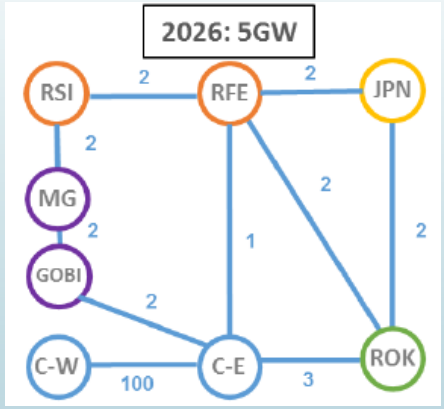
4. The challenges and benefits of power interconnections

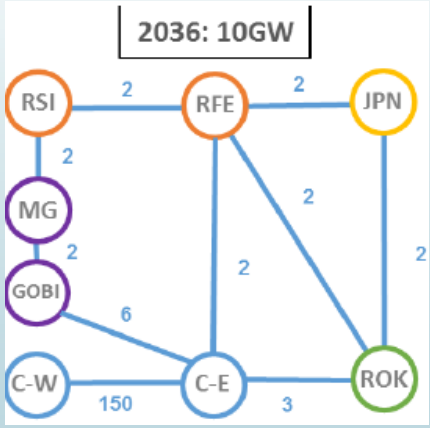
Power flows and priority projects recommended

GEIDCO



NAPSI





Year	2025	2026	2035	2036
	GEIDCO	NAPSI	GEIDCO	NAPSI
MN-CN	4	2	12	6
CN-DPRK	3.75		3.75	
DPRK-ROK	2.5		2.5	
CN-ROK	4	3	18 (via DPRK)	3
ROK-JP	2	2	6	2
RUS-JP	2	2	10	2
RUS-MN		2		2
RUS-ROK		2		2

Priority projects recommended

2020-2036

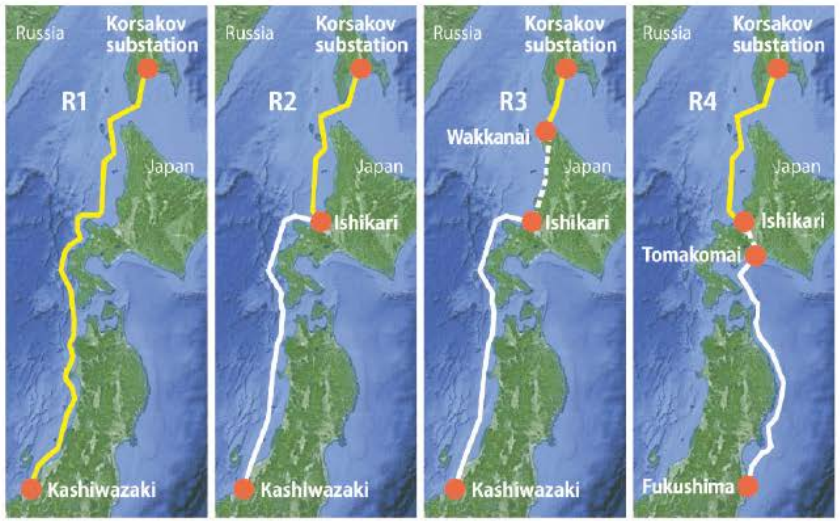
1. MN-CN 2 500kV AC 2GW
2. CN-ROK HVDC 2GW *(or 3GW)*
3. ROK-JP HVDC 2GW
4. RUS-JP HVDC 2GW *(Sakhalin-Kashiwazaki)* .
5. CN-DPRK-ROK 3Ts HVDC 3GW
6. MN-CN HVDC 4GW

(Lots of projects with few possibility if no DPRK participation)

4. The challenges and benefits of power interconnections

自然エネルギー財団
RENEWABLE ENERGY INSTITUTE

The outcomes of REI study

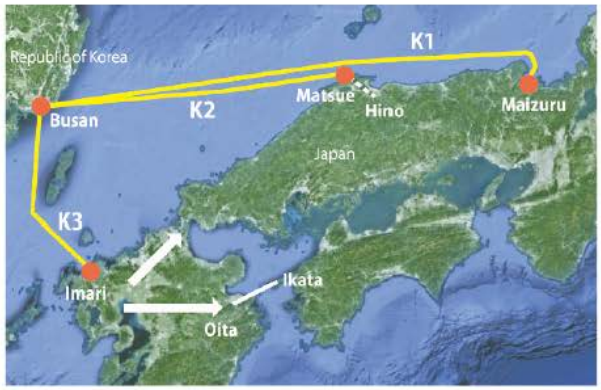


R1 Sakhalin—Kashiwazaki
Length: 1,255 km

R2 Sakhalin—Ishikari—Kashiwazaki
Length: 1,255 km

R3 Sakhalin—Wakkanai—Ishikari—Kashiwazaki
Length: 1,258 km
(161+297+800 km)

R4 Sakhalin—Ishikari—Tomakomai—Fukushima
Length: 1,246 km
(455+108+683 km)



K1 Busan—Maizuru
Length: 627km

K2 Busan—Matsue (→Kansai)
Length: 372km
+41 km grid reinforcement (Matsue-Hino)

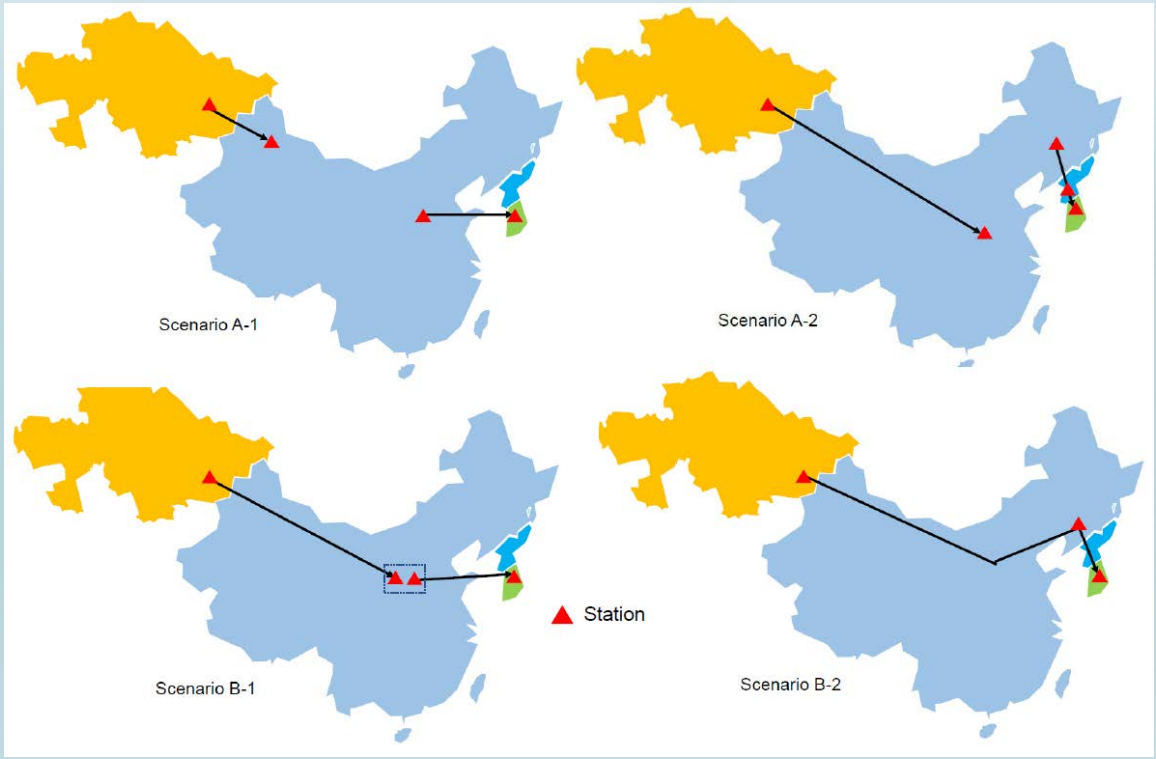
K3 Busan—Imari (→Kansai)
(via Chugoku & Shikoku region)
Length: 226km
+70 km grid extension (Oita-Ikata)

Japan-Russia			Japan-South Korea		
Route	Length	Max. Depth	Route	Length	Max. Depth
Sakhalin-Kashiwazaki	1,255 km	300 m	Busan-Maizuru	627 km	200 m
Sakhalin-Ishikari	455 km	300 m	Busan-Matsue	372 km	150 m
Sakhalin-Wakkanai	161 km	≤ 100 m	Busan-Imari	226 km	120 m

4. The challenges and benefits of power interconnections

IGTIC International green technologies and investment projects center

The ***Silk Road Super Grid*** project will open up opportunities for 64 countries along the New Silk Road, including Central Asian states, to tap into alternative energy production and export the energy to Europe, China, Japan and South Korea.



The ongoing study

4. The challenges and benefits of power interconnections

Policies

Institutional, regulatory, tax for power trading, energy security.....

Technical issues

Operation rules, planning criteria, gap analysis, high project cost.....

Proposals for next

1. To strengthen NEARPIC

More stakeholers participation

2. Compromising

Very big differences in the planning studies completed and underway

3. Priority projects list

Consensus needed

4. Overcome barriers

Institutional, technical, economic, financial, legal.....

5. Implementable road map

Thank You !

Welcome you to contact me:

LEI Xiaomeng
Senior Advisor on Regional Power Interconnection
CHINA ELECTRICITY COUNCIL

Tel(o): +86 10 63414851
Fax: +86 10 63415729
Email: leixiaomeng@cec.org.cn
ADD: No.1 Lane Two, Baiguang Road, Xicheng District, Beijing 100761, China