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 (CYP) 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 CYP. 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
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

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

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

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

* : 42, 130, 110GW
2. Recent studies for NEA power interconnection

- MOU on Joint Promotion of Power Grid Interconnection between SGCC (China) - KEPCO - SoftBank (Japan) - Rosseti (Russia)
- Joint Pre-F/S on China-Korea-Japan Power Interconnection between SGCC – KEPCO - SoftBank
- 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

Preparing JDA (2019)

MOU/ MOA (Memorandum of Understanding) → JDA (Joint Development Agreement) → SHA (Shareholder’s Agreement) → Construction

Source: NEAR PIC 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

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

- Yunfeng HPP, 630MW 3.3TWh/Y
- Shuifeng HPP, 400MW 1.3TWh/Y
- Taipingwan HPP, 190MW 0.6TWh/Y
- Weiyuan HPP, 390MW 0.9TWh/Y

4 HPPs on the border river between China and DPRK
3. The key projects of interconnection with neighbors

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

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

ASEAN-HAPUA
MOU on ASEAN Power Grid
HAPUA

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
4. The challenges and benefits of power interconnections

It is significant to combine the similar activities into one platform 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 NEARPIIC Forums with TOR and Steering Committee

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

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

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

North-East Asia Regional Power Interconnection and Cooperation Forum 2018
Ulaanbaatar, Mongolia
31 October – 1 November 2018
4. The challenges and benefits of power interconnections

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

The outcomes of REI study

<table>
<thead>
<tr>
<th>Route</th>
<th>Length</th>
<th>Max. Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakhalin—Kashiwazaki</td>
<td>1,255 km</td>
<td>300 m</td>
</tr>
<tr>
<td>Sakhalin—Ishikari—Kashiwazaki</td>
<td>1,255 km</td>
<td>300 m</td>
</tr>
<tr>
<td>Sakhalin—Wakkanai—Ishikari—Kashiwazaki</td>
<td>1,258 km (161+237+800 km)</td>
<td></td>
</tr>
<tr>
<td>Sakhalin—Ishikari—Tomakomai—Fukushima</td>
<td>1,246 km (455+108+683 km)</td>
<td></td>
</tr>
</tbody>
</table>
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.
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 stakeholders 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:

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