Realization of Energy Independence by Asia Super Grid

opportunity for countries

at Asia Super Grid Workshop in Seoul

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Director, Renewable Energy Institute
Asia Super Grid- opportunities for countries

REI was born in 2011 in the aftermath of 3.11

with 34/47 prefectures & 19/20 major cities

(Established in July 2011)

an institute brings global knowledges of RE to JP

(Established in Aug. 2011)
Asia Super Grid- opportunities for countries

Asia Super Grid

(Announced in September 2011)

- New Delhi ($0.14)
- Bhutan ($0.03)
- Dhaka ($0.13)
- Kuala Lumpur ($0.16)
- Chennai ($0.1)
- Chengdu ($0.09)
- Bangkok ($0.12)
- Singapore ($0.19)
- Hong Kong ($0.25)
- Vladivostok ($0.09)
- Seoul ($0.08)
- Shanghai ($0.15)
- Taipei ($0.21)
- Manila ($0.22)
- Ulaanbaatar ($0.06)
PV power expansion globally

cumulative end of 2015: 245GW (provisional)
annual installation 2015: 59GW (provisional)

*China 18GW, Japan 9.4GW (provisional)

source: SolarEurope (EPIA) 2014, GTM Research 2015

Globally, 50GW and 60GW in 2014 and 2015 accordingly, and prospected 70GW in 2016, surplus 300GW within the year.

Japan is expected to install the largest number of 9.4GW in 2016 (RTS).
benefits of grid integration

Wind power expansion globally

- Cumulative end of 2015: 432GW
- Annual installation 2015: 63GW
- *China 30GW, Japan 0.24GW

Source: Global Wind Energy Council

Japan’s introduction

- 2007: construction law revised
- 2011: subsidies for construction stopped
- 2012: July, FiT October, Environment Assessment

Source: NEDO, JWPA

*Numbers of abolished turbines are reduced from total
for getting benefits of grid integration

Generation capacity of renewables in FY

FiT

RPS + preminaly FiT for roof-top PVs

by the end of March 2015

for getting benefits of grid integration

renewables % in electricity mix in Japan

renewables in electricity mix
including hydro

9.7% 10.4% 10.0% 10.6% 14.2%

renewables in electricity mix
excluding hydro

1.1% 1.4% 1.6% 2.2% 3.5% 4.7%

for getting benefits of grid integration

GW in 2014

PV capacity and penetration rates

source: IEAPVPS TRENDS2015
benefits of grid integration

Electricity demand of Northeast Asia by fuel (BAU scenario)

source: based on the study “Gobitec and Asian Super Grid from Renewable Energies in Northeast Asia, 2014”
benefits of grid integration

Generation mix of 2030 and RE imports from Gobitec as an example

source: based on the study “Gobitec and Asian Super Grid from Renewable Energies in Northeast Asia, 2014”
Benefits of Regional Grid Integration

**Economic Benefits**
- Economic advantage from low cost renewable-based electricity
- Increase flexibility and maximize potential renewables in grid systems
- Stable electricity supply to realize energy security
- Job creation
- Creation of low carbon economy
- Diversify the local economy

**Social Benefits**
- Enhance regional cooperations
- Increase national energy security
- Improve infrastructure

**Environmental Benefits**
- Realization of low carbon economy
- Reduce air pollution
- Protect the natural environment

source: based on the study “Gobitec and Asian Super Grid from Renewable Energies in Northeast Asia, 2014”
benefits of grid integration

### Economic benefits for Mongolia
- Employment effects by manufacturing/construction/installation/O&M for Wind, PV and transmission lines.

<table>
<thead>
<tr>
<th>Employment and Income effects by 100GW PV and Wind from 2015 to 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct employment</td>
</tr>
<tr>
<td>Income generated by projects</td>
</tr>
</tbody>
</table>

### Economic benefits for Northeast Asia
- Economic benefits through importing low-cost electricity from wind and PV in Gobi desert

<table>
<thead>
<tr>
<th>Total Supply Unit Cost from Wind and PV</th>
<th>Wholesale Electricity Price in Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.056–0.168USD/kWh</td>
<td>0.113USD/kWh</td>
</tr>
</tbody>
</table>

| Weighted Average Electricity Charge                           | 0.115–0.136USD/kWh                   |

source: based on the study “Gobitec and Asian Super Grid from Renewable Energies in Northeast Asia, 2014”
benefits of grid integration

<table>
<thead>
<tr>
<th>CO₂ emissions per kWh from electricity (2010)</th>
<th>Unit</th>
<th>Korea</th>
<th>China</th>
<th>Japan</th>
<th>Mongolia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions per kWh from electricity (2010)</td>
<td>tCO₂/MWh</td>
<td>0.533</td>
<td>0.766</td>
<td>0.510*</td>
<td>1.492</td>
<td>-</td>
</tr>
<tr>
<td>Emission Reduction</td>
<td>GtCO₂</td>
<td>21</td>
<td>149</td>
<td>13</td>
<td>4</td>
<td>187</td>
</tr>
</tbody>
</table>
benefits of grid integration

for preparation of high integration of renewables

Increased flexibility of grid system

1) Greater spatial dispersion and portfolio diversification of VRE
2) Greater access to dispatchable power plants and storage facilities
3) Greater potential for demand smoothing across different time zones

source: based on the study “Gobitec and Asian Super Grid from Renewable Energies in Northeast Asia, 2014”
Asia Super Grid - opportunities for countries

(Announced in September 2011)
Asia Super Grid- opportunities for countries

Global Energy Interconnection Development and Cooperation Organization

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Former Chairman
State Grid Co. China

Vice Chairman
Dr. Shu Yinbiao
Chairman
State Grid Co. China

Vice Chairman
Steven Chu
Former Energy Secretary
USA

Vice Chairman
Mr. Masayoshi Son
Chairman & Founder
Renewable Energy Institute
Chairman & CEO
SoftBank Group Corp.
Renewable-EI’s activities for realizing Asia Super Grid

<table>
<thead>
<tr>
<th><strong>GEIDCO Working Groups</strong></th>
<th><strong>Asia Development Bank</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>WG for technology focused</td>
<td>Technical Assistance Fund</td>
</tr>
<tr>
<td>WG for market &amp; finance focused</td>
<td>2016-1018</td>
</tr>
</tbody>
</table>

**Studies: Asia Power Vision**
- opportunities and barriers of realization of ASG - what are the barriers in Japan?
- organizing workshops

**MoU for a pilot project by business companies**
- Softbank, SGCC, KEPCO, Rosetti
Paradigm Shift in Energy for Peace

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