From Possibilities to Reality: Discussion of interconnectors in Korea

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Energy Transition in Korea

- Expansion of renewable energy supplies: 20% of the gross electricity consumption by 2030

Estimated Renewable Resources Capacity (in 2030):

<table>
<thead>
<tr>
<th>Installed Capacity (GW)</th>
<th>PV</th>
<th>WIND</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>15.7</td>
<td>13.9</td>
<td>62.6</td>
<td></td>
</tr>
</tbody>
</table>

Share (%):

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<th>Share (%)</th>
<th>PV</th>
<th>WIND</th>
<th>Others</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>52.7</td>
<td>25</td>
<td>22.3</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Graph showing annual generation from 2015 to 2030, with categories for PV, Onshore Wind, Offshore Wind, Bio, Fuel Cell, Ocean, and ETC.
• How to operate an isolated power system with 50 GW variable sources and 100.5 GW loads
  ✓ Large balancing power is needed

• Possible balancing power
  ✓ Fast power reserve (power system flexibility)
  ✓ Energy storage
  ✓ Demand response
  ✓ Renewable energy curtailment
  ✓ Power system interconnection
Case with high RES penetration

Electricity production and spot prices in Germany in week 18 2016

- Wind
- PV
- Load

Day Ahead Auction
Intraday Continuous Average Price
Conventional Generation

Time

Negative price
Renewable Energy Curtailment Decrease

- **Effective surplus power distribution with interconnection**
  - Wind & PV curtailment decreases over 10 times

*The European Power System in 2030*
North-East Asia SuperGrid
Benefits of NEA SuperGrid

- Rich resources (Mongolia, China, Russia)
- High energy demand (China, Korea, Japan)
- Different power peak demand period
- Importance of sustainability

<table>
<thead>
<tr>
<th>Economy</th>
<th>Effective use of natural resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Utilization of eco-friendly resources</td>
</tr>
<tr>
<td>Reliability</td>
<td>Large-scale interconnected power system</td>
</tr>
<tr>
<td>International Cooperation</td>
<td>Extending to economic community</td>
</tr>
</tbody>
</table>
Preliminary Feasibility Study of C-K-J

- HVDC Transmission (2 GW)
- Sea depth (72m, 200m)
- Connection length (366km, 460km)
C-K-J Interconnection plans (865km)

Economic Plan: Nano Composite XLPE & VSC
- Developing technology
  - Cable: 400kV ('19~ Track record)
  - Converter: To be developed

Reliable Plan: MI PPLP & LCC & Bi-pole
- Available Technology (Track record)
- Reliable operation with one pole outage
Hybrid Muti-terminal HVDC Topology

- Addition of a VSC type terminal to LCC HVDCs

1. Voltage control by VSC
2. Power flow direction change according to fault locations
NEA SuperGrid Configuration Suggestion

- **NEA SuperGrid configuration with MTDC topology**
  - To improve system efficiency and increase the acceptability of renewable energy resources in Jeju island and southern sea.
Technical Barriers to NEA SuperGrid

- VSC HVDC technology for 2GW or more
- 500kV cable development & deep sea installation technology
- Coordination of power system operation, market operation, communication and grid code

=> can be solved!!
Thank you!