KEPCO’s Progress & Future of NEA Supergrid
1. Power System in Korea
2. Background & Purpose
3. Current Status & Progress
4. Challenges & Future plan
1-1 Power System in Korea

Power System Characteristics

- **Isolated Power Grid**
  - No Cross-border Power Grid Interconnection

- **Long Distance Transmission**
  - 40% of loads concentrated in metropolitan area
  - Base load Power plants located near to the coast
  - High generation cost in metropolitan area

- **Demand Growth**

<table>
<thead>
<tr>
<th>Nations</th>
<th>Increase ('01-'07)</th>
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</thead>
<tbody>
<tr>
<td>USA</td>
<td>1.30%</td>
</tr>
<tr>
<td>Japan</td>
<td>1.60%</td>
</tr>
<tr>
<td>Germany</td>
<td>1.10%</td>
</tr>
<tr>
<td>France</td>
<td>1.30%</td>
</tr>
<tr>
<td>England</td>
<td>0.50%</td>
</tr>
<tr>
<td>China</td>
<td>11.7% ('05-'08)</td>
</tr>
<tr>
<td>Saudi</td>
<td>5.8% ('05-'08)</td>
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</tbody>
</table>
**Government Policy on Nuclear & Coal**

- **Outlook of Power Source Mix (Installed capacity)**

  - **2017**
    - Nuclear: 11.3 GW (9.7%)
    - Coal: 37.4 GW (32.7%)
    - LNG: 36.9 GW (31.6%)
    - Oil: 4.7 GW (4.0%)
    - Hydro: 4.2 GW (3.5%)
    - RE: 22.5 GW (19.3%)
    - Total: 117 GW

  - **2030**
    - Nuclear: 58.5 GW (33.7%)
    - Coal: 47.5 GW (27.3%)
    - LNG: 39.9 GW (23.0%)
    - Oil: 6.1 GW (3.5%)
    - Pump: 1.4 GW (0.8%)
    - RE: 11.3 GW (6.9%)
    - Total: 173.7 GW

- **Phasing out of nuclear power plants**
  > Cancelation of 6 planned units (8.5 GW), Service life expansion not allowed

- **Early shut-down of the aged coal-fired power plants**
  > Early shut-down of 10 Units (3.3 GW), 6 existing units will be converted to LNG
Renewable Energy Vision 3020

- Renewable Energy Expansion
  - > 20% of power generated by Renewable Energy
  - > Waste, Bio-mass centered ⇒ Solar, Wind centered
2-1 Paradox: Renewable Energy Resources

Renewable Energy Resources vs Demand

- Unevenly distributed renewable energy resources
  - The area rich in renewable energy resources is remote from demand areas

"MORE renewable energy resources, LESS demand"
Paradigm Shift on Supergrid

New paradigm

- To overcome power shortage
- To enhance the stability of power system securing power reserve
- To integrate diverse energy sources
- To make effective use of electric power through power trading
KEPCO’s Vision of NEA Supergrid

Vision

- Joint development and utilization of renewable energy in NEA
  ⇒ Joint strategy for global climate change & environmental pollution

KEPCO’s NEA Supergrid Concept
KEPCO’s Progress (1)

Major Progress / China-Korea-Japan

- **‘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 Mongolia-China-Korea-Japan Power Grid Interconnection between SGCC-KEPCO-SoftBank
KEPCO’s Progress (2)

Major Progress / Russia-Korea

- **Feasibility Study for Korea-Russia Power Grid Interconnection**
  - KEPCO, KEEI, Korea University, Yulchon LLC
  - 2012.10 ~ 2014.09

- **President of Korea proposed NEA Supergrid Establishment**
  - Eastern Economic Forum in Vladivostok, Russia
  - 2017.09
Joint Project Development MOA

- KEPCO – SGCC – GEIDCO / ‘17. 12. 13. 14:00
- To develop China-Kore Power Grid Interconnection Project within the framework of the M-C-K-J Power Grid Interconnection Project

Major contents

- Establishment of Steering Committee & Joint Working Group
- Joint conduct of a further study;
  - Technical & economical feasibility
  - Power market, regular policy, etc.
- Development of addition agreements including JDA
Inter-Governmental Cooperation MOU

- Korea MOTIE – China NEA / ’17. 12. 14. 16:00
- To establish a cooperation channel in the energy sector including:
  - Energy policy exchange, High-level conference, etc.

Major contents

- Study on power grid interconnection
- New energy industry, Renewable energy, Energy efficiency related to climate change and Greenhouse Gas
- Natural gas trade, etc.
Government Policy: Implementation of NEA Supergrid

- Jointly utilize clean energy sources in NEA
## Potential Risks in Supergrid Project

### Risk Factors

<table>
<thead>
<tr>
<th>Factors</th>
<th>Rank</th>
<th>Risk Index(%)</th>
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<tbody>
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<td>Policy</td>
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<tr>
<td>Financial</td>
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<tr>
<td>Planning &amp; Consenting</td>
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<td>83.1</td>
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<td>Political</td>
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<tr>
<td>Infrastructure</td>
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<td>66.0</td>
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<tr>
<td>Operational</td>
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</tr>
<tr>
<td>Technical</td>
<td>7</td>
<td>50.0</td>
</tr>
</tbody>
</table>

Source: Dr. McKinstray, the European Supergrid – Messiah or Pariah, 2013

Policy, Financial, Planning & Consenting, Political Risks are much bigger than Technical and Operational Issues.
Key Factors

- European Commission forms regulatory frameworks for supergrid
- Cross-border transmission operator (ENTSO-E) has been introduced

EC: Policy making

- Trans-European Energy Network
  - Framework for cross-border development on interconnection, Inter-operability, etc.
- The Third Energy Package 2009
  - Common Rules and Regulations for cross-border grid interconnection

ENTSO-E: Coordination of TSOs

- Established in Dec 2008
- 42 TSOs from 34 countries in EU
- Major roles of ENTSO-E
  - Integration of renewable energy sources (RES)
  - Technical cooperation between TSOs, etc.

Cooperation between the Parties (or TSOs) required
4-3 Governance Establishment

Public: Inter-Governmental Agreement (IGA)

- Joint declaration of NEA Supergrid Promotion
  - Mitigate Policy/Political Risks
  - Less uncertainty & More comfort to the shareholders
- Principles & Foundation for mutual cooperation

Private: Joint Development Agreement (JDA)

- How to develop and implement NEA Supergrid
  - Mitigate Financial/Planning & Consenting Risks
- Define: Business model, Roles of each Party,
  Project development schedule, Financing plan, etc.

Addressing Inter-Governmental Agenda

Interaction
4-4 Challenges in the Future

Cooperation Field

Business Model
Regulatory Framework
Power Trading Mechanism
Taxation

Cooperation & Consensus

Feasible & Bankable

Smart Energy Creator, KEPCO
Towards One Asia
Thank you