KOEN’s Investment Cases in Renewable Energy

5th June, 2024
1. Company Overview
## Company Overview

### Company Profile

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Korea South-East Power Co. Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand Name</td>
<td>KOEN (Korea Energy)</td>
</tr>
<tr>
<td>Main Business</td>
<td>power generation &amp; related businesses</td>
</tr>
<tr>
<td>Established</td>
<td>April 2, 2001</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>2,800</td>
</tr>
</tbody>
</table>
| Ownership            | wholly owned by KEPCO (Korea Electric Power Co.)

※ Korean government holds 51% shares of KEPCO

### Financial Data

<table>
<thead>
<tr>
<th>Accounts</th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset</td>
<td>10,900</td>
<td>11,738</td>
<td>10,424</td>
</tr>
<tr>
<td>Liability</td>
<td>6,040</td>
<td>6,545</td>
<td>6,216</td>
</tr>
<tr>
<td>Equity</td>
<td>4,860</td>
<td>5,193</td>
<td>4,208</td>
</tr>
<tr>
<td>Revenues</td>
<td>6,079</td>
<td>7,252</td>
<td>4,486</td>
</tr>
</tbody>
</table>

Credit Ratings: AA (S&P) / Aa2 (Moody’s) / AA- (Fitch)
### Company Overview

#### Fully-owned projects in Korea

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-firing</td>
<td>Samcheonpo</td>
<td>2,120</td>
</tr>
<tr>
<td></td>
<td>Yeonghueng</td>
<td>5,080</td>
</tr>
<tr>
<td></td>
<td>Yeosu</td>
<td>669</td>
</tr>
<tr>
<td>LNG-firing</td>
<td>Bundang</td>
<td>922</td>
</tr>
<tr>
<td>Biomass</td>
<td>Yeongdong</td>
<td>325</td>
</tr>
<tr>
<td>Fuel-cell</td>
<td>multiple locations</td>
<td>72</td>
</tr>
<tr>
<td>Renewables</td>
<td>multiple locations</td>
<td>209</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>9,397</strong></td>
</tr>
</tbody>
</table>

#### IPP Projects in Korea

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>Multiple locations</td>
<td>620</td>
</tr>
<tr>
<td>Wind</td>
<td>Multiple locations</td>
<td>232</td>
</tr>
<tr>
<td>Coal-firing</td>
<td>Goseong, Gangneung</td>
<td>4,160</td>
</tr>
<tr>
<td>LNG-firing</td>
<td>Ansan</td>
<td>835</td>
</tr>
<tr>
<td>Heat-combined</td>
<td>Yeosu</td>
<td>48</td>
</tr>
<tr>
<td>ESS</td>
<td>Seosan</td>
<td>65</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>5,960</strong></td>
</tr>
</tbody>
</table>

#### Oversea Projects

<table>
<thead>
<tr>
<th>Type</th>
<th>Country</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>Chile, Bulgaria</td>
<td>141.62</td>
</tr>
<tr>
<td>Hydro</td>
<td>Pakistan, Nepal</td>
<td>318.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>459.62</strong></td>
</tr>
</tbody>
</table>
2. Investment in Overseas Renewable Energy Project - Case Study
Hydro Power Projects (with ADB)

☑️ [In operation] Gulpur Hydropower Project, Pakistan

☑️ [Under Construction] UT-1 Hydropower Project, Nepal

MDBs play an important role for investments can be flowed into developing countries. They make sure that social benefits by their investments be maximized and sustainable.
Hydro Power Projects (with ADB)

**Gulpur Hydro Power Plant, Pakistan [In Operation]**

- **Location**: Kotli City, AJ&K, Islamabad
- **Period**: Construction('15~'20), Operation('20~ '50)
- **Project Cost**: U$ 374.7 Mil (Equity $109 mil, Debt $265 mil)
- **KOEN owns 76 % ownership interest**
- **ADB invested 24% in debt financing**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity</td>
<td>102 MW (51MW×2)</td>
</tr>
<tr>
<td>Annual Generation</td>
<td>475 GWh</td>
</tr>
<tr>
<td>Plant Factor</td>
<td>53 %</td>
</tr>
<tr>
<td>Turbine Type</td>
<td>Kaplan Type</td>
</tr>
<tr>
<td>Design Discharge</td>
<td>201 m³/s</td>
</tr>
</tbody>
</table>

**1st Overseas HP project by KOEN**

- Location : Kotli City, AJ&K, Islamabad
- Period : Construction('15~'20), Operation('20~ '50)
- Project Cost : U$ 374.7 Mil (Equity $109 mil, Debt $265 mil)
- KOEN owns 76 % ownership interest
- ADB invested 24% in debt financing
Hydro Power Projects (with ADB)

- **Gulpur Hydropower Project, Pakistan** [In Operation]

## Sponsors

- KOEN (76%)
- DL E&C (18%)
- Lotte Const. (6%)

## Pakistan Gov.

- NEPRA
- PPIB

## Off-taker

- CPPA-G

## Lenders

- ADB
- IFC
- K-EXIM
- BII

## EPC

- DL E&C (75%)
- Lotte Const. (25%)

## O&M

- KOEN (100%)

※ NEPRA: National Electric Power Regulatory Board / PPIB: Private Power and Infrastructure Board
CPPA: Central Power Purchasing Agency / IA: Implementation Agreement / PPA: Power Purchase Agreement
BII: British International Investment
Gulpur Hydropower Project, Pakistan [In Operation]

- **Project History**
  - 2012. Mar - KOEN’s board approval for developing Gulpur Project
  - 2012. Dec - Establishment of Project Co. ("MIRA POWER")
  - 2014. Apr - Execution of Implementation Agreement and PPA
  - 2020. Mar - Commercial operation
  - 2024. Jan - 9th repayment (34% been repaid)
**Highlights in Gulpur Hydropower Project, Pakistan**

Co-operation with ADB in solving environmental issues enabled KOEN to successfully complete Pakistan’s 1st hydropower project located in National Park Area.

> **Critical Habitat Assessment**

- (Golden Mahseer Tor Putitora) ‘Endangered’
- (Kashmir Catfish Glyptothorax kashmirensis) ‘Critically Endangered’

> **Fish Hatchery for Protection of Fish Species**

<table>
<thead>
<tr>
<th>Year</th>
<th>Bio Diversity</th>
<th>Fish Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>16</td>
<td>430</td>
</tr>
<tr>
<td>2020</td>
<td>23 x1.4</td>
<td>1,207 x2.8</td>
</tr>
</tbody>
</table>

2016 2020
**UT-1 Hydropower Project, Nepal [Under Construction]**

**1st IPP Project in NEPAL**

- **Location**: 70km north from Kathmandu
- **Period**: Construction('22~'26), Operation(30 years)
- **Project Cost**: US$ 647 Mil (Equity $194 mil, Debt $453 mil)
- **KOEN owns 50% interest, ADB invested 13% of debt financing**
- **Construction Progress**: 34% (as of Apr. 24)

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**UT-1 Layout**

- **Upstream**
  - Head : 349m

<table>
<thead>
<tr>
<th>Dam</th>
<th>Headrace Tunnel</th>
<th>Underground Powerhouse</th>
</tr>
</thead>
</table>
| • Dam construction(’23.09~)      | • Headrace Tunnel (9.5km, 7 sites excavated simultaneously) | • Powerhouse excavation
|                                  |                | • Outlet excavation   |

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Hydro Power Projects (with ADB)

✓ UT-1 Hydropower Project, Nepal [Under Construction]

**Equity**
- KOEN: $97mil (50%)
- KIND: $48.5mil (25%)
- IFC: $29.5mil (15%)
- LOCAL: $19mil (10%)

**Debt**
- ADB: $60mil
- IFC: $171mil
- K-EXIM, K-Sure: $126mil
- AIIB: $36mil
- DFIs: $60mil

**Project Co. (“NWEDC”) ($647mil)**
- O&M (KOEN)
- EPC (Doosan)

**Contract**
- PPA
- PDA
- LLA

**Counter Parties**
- NEA
- MOE
- DOF

※ NEA: Nepal Electricity Authority / MOE: Ministry of Energy / DOF: Department of Forest
AGB: Asian Infrastructure Investment Bank / DFI: Development Finance Institution / LLA: Land Lease Agreement
KIND: Korea Infrastructure and Urban Development Corporation
**Hydro Power Projects (with ADB)**

- **UT-1 Hydropower Project, Nepal [Under Construction]**

**Project History**

- 2012. Feb - KOEN’s board approval for developing UT-1 project
- 2013. Oct - Commencement of track opening and camp site
- 2015. Apr - Nepal Earthquake(M7.8) hit the project site

![Project Images]

- 2016. Dec - Signing of PDA (Project Development Agreement / NWEDC ↔ MOE)
- 2018. Jan - Signing of PPA (NWEDC ↔ NEA)
- 2020. Dec - Signing of EPC contract (NWEDC ↔ Doosan Heavy Industry)
- Present - Under Construction (Progress: 34% as of April 24)
Hydro Power Projects (with ADB)

☑ UT-1 Hydropower Project, Nepal [Under Construction]

■ Risk Management Case

CAR(Construction All Risk) Insurance
- due to earthquake in Nepal(2015), accident in hydro power project in Laos(2018)
- low participation of reinsurance companies, conditions of CAR worsened
- insurance premium soared, more challenging to meet insurance requirements under financing agreement

<table>
<thead>
<tr>
<th>Item</th>
<th>At Financial Closing (2019. Jun)</th>
<th>At entering into CAR (2021. Sep)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>- All risk including natural disasters</td>
<td>(Earthquake) max. $155 mil, differ by magnitude</td>
</tr>
<tr>
<td></td>
<td>- Cap : EPC contract amount</td>
<td>(Flood) max. $100 mil</td>
</tr>
<tr>
<td>Deductible</td>
<td>15% of loss amount</td>
<td>20% of loss amount</td>
</tr>
<tr>
<td></td>
<td>- min. $2 mil ~ max. $10 mil</td>
<td>- min. $2 mil ~ max. $30 mil</td>
</tr>
</tbody>
</table>

- by technically proving the risk levels relating to the reoccurrence of earthquake and flood to be low → successfully lowered sponsor’s liability ($100 mil → $30 mil)
Hydro Power Projects (with ADB)

☐ UT-1 Hydropower Project, Nepal [Under Construction]

- Weir Construction
- Powerhouse Overview
- Powerhouse Construction
- Vertical Shaft
PMGD Solar Power Projects in Chile

### (Phase 1: 48MW)

- **3 Sites (28MW)**
  - Sol del Norte: 8.6 MW
  - Los Andes: 9.7 MW
  - Desierto: 9.7 MW

- **2 Sites (6 MW)**
  - Ariztia: 3.0 MW
  - Laigua: 3.0 MW

- **5 Sites (14.6 MW)**
  - Luna: 3.0 MW
  - Manzano: 2.6 MW
  - Acacia: 3.0 MW
  - Chacras: 3.0 MW
  - Mariano: 3.0 MW

### (Phase 2: 52MW)

- **1 Site (10.4MW)**
  - Caldera A9: 10.4 MW

- **2 Sites (20.8MW)**
  - Centauro: 10.4 MW
  - Draco: 10.4 MW

- **1 Site (10.4MW)**
  - Cabrero: 10.4 MW

### Project Cost
- Phase 1: $61 mil.
- Phase 2: $70 mil.

### COD
- Phase 1: May 2022
- Phase 2: Sep 2023

### Sponsors
- (EPC) Hanwha Q-cell
- (FI) KIND, Sprott

### Off-taker
- SEN (Central Power System)

### KOEN’s Role
- Equity Investor, O/E*, O&M

*O/E: Owner’s Engineer
Solar Power Project

PMGD Solar Power Projects in Chile

PMGD Market

- **Definition**: Pequeño Medio de Generación Distribuido (Small Distributed Generation Unit)
  - applicable to small-medium sized project with 9MW capacity or less (transmission basis)
- **Purpose**: To boost up renewable energy investment by protecting small-scale power producers
- **Advantages**:
  - Energy Authority announces a fixed price* every half-year (fixed for the next 6 months)
    * stabilization payment + capacity payment
  - low volatility compared to spot price
  - can transmit or distribute power as produced without dispatch order
  - USD indexation, less exposure to exchange risk
3. KOEN’s Way Forward to Energy Transition
Management Vision
(Strategies and Goals)

(In past)
KOEN, with the largest coal-fired generation capacity in Korea,
> Served as a backbone of Korean economy with stable supply of electricity with low cost
> Near zero failure rate throughout the 23 year-history of KOEN

(Now)
Big challenges to reduce GHGs emissions and make a rapid clean energy transition,
In response, KOEN has set a ‘2050 Net-Zero & Green Growth Target’

[2030] Reduce GHGs by 47% (compared to 2018) ➞ [2050] Net-zero

[2050 Net-Zero Pathway Scenario]

- Expanding Renewable Energy and Leading Hydrogen Economy
- Coal-fired Generation Phase-down in Systematic Energy Transition
- Offsetting Surplus Emissions through Reduction Projects (CCUS, Blue Carbon, domestic/overseas afforestation, etc)
- Improving Sustainability of Korean Energy Industry
Clean Energy Transition Actions

☑️ Contributed to the national reduction by proactive energy transition

- Shut down old coal-fired plants (1.1GW)
- Operating coal-fired plants at lower load factor
- 38% GHGs reduction achieved by using greener fuels
  - Conversion from coal-firing to biomass (325MW)
  - Wide use of clean/low-carbon coal

⇒ 31% of national total reduction in 2022 contributed solely by KOEN

☑️ First GENCO in Korea to reach 1.0GW milestone in RE installed capacity (2019)

- First off-shore windfarm in Korea to start commercial operation (30MW)
- Holds the largest offshore wind pipeline capacity in Korea (4.5 GW)
- Various small-scale RE projects including agricultural solar, small-hydro power to maximize its renewable energy capacity

⇒ As on today, KOEN owns and operates 1.3 GW renewable energy projects in Korea, and developing 4.5 GW offshore wind projects
Clean Energy Transition Actions

✔️ [CCUS] Technology for GHGs Reduction

- Specialized in developing Mineral Carbonation Technology
  > applied in Desulphurization(Samcheonpo#5), Coal Ash(Yeosu)
- CO2 capture technology is being developed in cooperation with KEPCO group companies
  > LNG-fired (capture rate : 10tCO2/day), Coal-fired (200tCO2/day)

✔️ [Offset] Creation of Carbon Sinks(Green/Blue/Soil) & Scope 3 Reduction

- Creative social value connected with business value chain
  > Urban forests for carbon offset, sea forest creation project (blue carbon in Yeongheung)
  > Methane emission reduction in agricultural sector (soil carbon)*
    * ICT connected to existing farmlands help minimize water usage → anaerobic decomposition prevention
- Cost-effective carbon reduction through cooperation with various parties (Scope 3, etc)
Energy Transition - Future Task (Clean Ammonia & Hydrogen Business)

Korea’s Hydrogen Drive

■ Hydrogen Act Announced by Korean Government (2022)
  - Announced CHPS (Clean Hydrogen Portfolio Standard) mechanism

■ 10th National Power Mix (2023) with Power Generation by Hydrogen/Ammonia
  - Co-firing (Coal+NH₃ / LNG+H₂) mechanism and target generation volumes for 2030 & 2036

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Nuclear</th>
<th>Coal</th>
<th>LNG</th>
<th>Renewables</th>
<th>NH₃+H₂</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030 volume</td>
<td>201.7</td>
<td>122.5%</td>
<td>142.4</td>
<td>134.1</td>
<td>13.0</td>
<td>8.1</td>
</tr>
<tr>
<td>sharing ratio</td>
<td>32.4%</td>
<td>19.7%</td>
<td>22.9%</td>
<td>21.6%</td>
<td>2.1%</td>
<td>1.3%</td>
</tr>
<tr>
<td>2036 generation</td>
<td>230.7</td>
<td>95.9%</td>
<td>62.3</td>
<td>204.4</td>
<td>47.4</td>
<td>26.6</td>
</tr>
<tr>
<td>sharing ratio</td>
<td>34.6%</td>
<td>14.4%</td>
<td>9.3%</td>
<td>30.6%</td>
<td>7.1%</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

■ National CHPS Auction for Thermal Power Generation Companies
  - Auction for CfD (Contract for Difference) recently opened on May 23, 2024
  - Bids to be submitted by September, 2024
## NH₃ Consumption Estimates (in thousand tons)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>2027/28</th>
<th>2029</th>
<th>2030 onwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yeosu #1,2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-firing rate(%)</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Consumption</td>
<td>150</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Yeongheung #5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-firing rate(%)</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Consumption</td>
<td>250</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Yeongheung #6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-firing rate(%)</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Consumption</td>
<td>-</td>
<td>-</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>400</td>
<td>800</td>
<td>1,300</td>
</tr>
</tbody>
</table>

※ Yeosu #1,2 are selected as demonstration project by the government
※ Timelines and volumes are only estimates and subject to change
**Energy Transition - Future Task**
*(Clean Ammonia & Hydrogen Business)*

**KOEN** is planning to participate in projects as an investor and off-taker based on 4 principles:

- **Competitiveness** for CHPS auction
- **Supply Stability** with feasible structure
- **Project Advancement** for realization
- **Investment Risk** for minimization

**KOEN’s Role**: Strategic investor (equity), SPC management, project co-development, off-taker, O&M contractor (for renewable energy production)

**KOEN’s Clean Ammonia Pipeline Projects**

- **(AUS)**
  - Green / KEPCO group, Korean Co, global developer
  - ※ subsidies, infrastructure, transportation

- **(USA)**
  - Blue / Global/local developer, Korean Co.
  - ※ subsidies, tax credit, infrastructure

- **(Canada)**
  - Blue / Global developer
  - ※ subsidies, tax credit, transportation

- **(ME)**
  - Green NH3, co-developing KEPCO Group companies and global developers
  - ※ Through tendering process

- **(Africa)**
  - Green, Large-scale

- **(Chile)**
  - Green (N-solar, S-wind) /global developers
  - ※ abundant renewable energy resources
## KOEN - 2036 Goals

<table>
<thead>
<tr>
<th>Vision</th>
<th>Clean &amp; Smart Energy Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Directions</strong></td>
<td>Carbon-free power production</td>
</tr>
<tr>
<td><strong>Mid &amp; Long-Term Goals</strong></td>
<td><strong>Greenhouse gas reduction 48%</strong> (as compared to base-year level)</td>
</tr>
<tr>
<td></td>
<td><strong>Carbon-free power generation 9 TWh</strong> (with H₂, NH₃ co-firing)</td>
</tr>
</tbody>
</table>
THANK YOU