NUS INVESTMENT SOCIETY

Fixed Income Department
South Korea Utilities Industry Research

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Section 1: Introduction

a. Overview of the Utilities Sector

The utilities sector encompasses companies that are involved in the provision of utility services relating to power, gas, water, and sewage. With utility services recognized as essential to daily living, utility companies generate stable and consistent revenues and dividends. Hence, utility companies are characterized as defensive in nature as their stable returns allow them to typically perform relatively better amidst economic downturns and recessions but act as headwinds during periods of economic growth and peaks. With their services demanded regardless of the business cycle phase, utility companies are viewed by investors as lower volatility, long-term investments with regular and predictable dividends.

Companies within the utilities sector can be categorized into three main industries:

Electric Power Generation, Transmission and Distribution
Companies in this industry group are involved in the production and/or the distribution of electric power through both renewable and non-renewable sources. Apart from selling electric power, these companies operate generation facilities that produce electric energy, operate transmission systems to transmit electric power generated at the generation facilities to the distribution systems which then conveys it to the end-users.

Natural Gas Distribution
This industry comprises of companies that are involved in the distribution and/or transmission of natural and manufactured gas. It does not include companies which are primarily engaged in gas exploration or production.

Water, Sewage and Other Systems
Companies that fall under this industry group are primarily engaged in water treatment and distribution, sewage collection, treatment, and waste disposal.

b. Market Size

The global utilities market size is poised to continue expanding with a CAGR of 7.9% from approximately US$5.9t in 2022 to approximately US$3.1t in 2026. This is largely driven by the electric power industry which is expected to grow from US$4.4t in 2022 to US$5.9t in 2026, translating to a 7.6% CAGR. Hence, of the three industries, this report will focus on the electric industry. This growth over the forecast period is attributed to the increase in investments in renewable power generation capacities. In addition to governments offering incentives and subsidies to promote renewable energy sources, many electric power companies are investing in renewable energy sources to accelerate the transition towards cleaner energy. One example is the US$21.2t Infrastructure Bill enacted by the US government in August 2021 which is expected to boost investments into renewables. Additionally, electric power companies are increasingly investing and incorporating advanced technologies such as microgrids.

c. Typical Business Models

Like the other industries under the utilities sector, the electric power industry is typically highly regulated by governments. In many countries, the electric power industry tends to be monopolized by large private for-profit companies that are backed by political players. Furthermore, significant barriers to entry such as high economies of scale, enormous capital requirements arid long investment lead times impede new entrants into the industry. Such regulatory oversight means that their revenue and related margins are dependent on pricing regulations, making it difficult for these companies to significantly raise rates to boost profitability. Moreover, many companies in the electric power industry invest in and operate infrastructures such as transmission grids which result in large capital expenditures and costs to continuously maintain and upgrade them. The traditional business model of electric power companies vertically integrates upstream and downstream of the value chain from electric power generation to distribution and retail businesses. These vertically integrated companies own the generation facilities, transmission, and distribution lines, and deliver electricity to the end customers directly. However, with increasing deregulation, especially in Europe and United States, it is observed that generation, distribution, and retail business units are increasingly segmented into different entities.

The electric power industry is made up of both the wholesale and retail market:

Wholesale market
The wholesale market consists of electric power generators which produce electrical power from various renewable and non-renewable sources such as fossil fuels, wind, sunlight, coal, natural gas, nuclear fission reactions, biomass, and hydropower. The market also consists of energy network operators that operate electric power distribution networks such as grids and sell access to these networks to energy service retailers.

Retail market
The retail market is comprised of energy service retailers that sell electric power to end-consumers such as the public.

d. Key Countries

The top ten countries in terms of electricity generation and demand in 2021 are China (30.7% of the global energy generation), United States (15.2%), India (6.2%), Russia (3.9%), Japan (3.5%), Brazil (2.3%), Canada (2.3%), South Korea (2.1%), Germany (2.1%) and France (1.9%). In 2020, Asia Pacific was the largest region in the electric power market with a 43.7% market share. This was followed by Western Europe and North America with 25.7% and 12.8% market share, respectively. The region with the smallest market share in the electric power market is Africa.

e. Key Companies

The top ten companies by their market value are CATL (US$149.1b), Nextera Energy (US$138.4b), Equinor (US$110.54b), Duke Energy (US$83.9b), LG Energy Solution (US$80.2b), China Yangtze Power (US$79.4b), Southern Company (US$77.9b), Iberdrola (US$72.4b), Dominion Energy (US$66.7b) and Enel (US$65.5b) as of 20 May 2022.

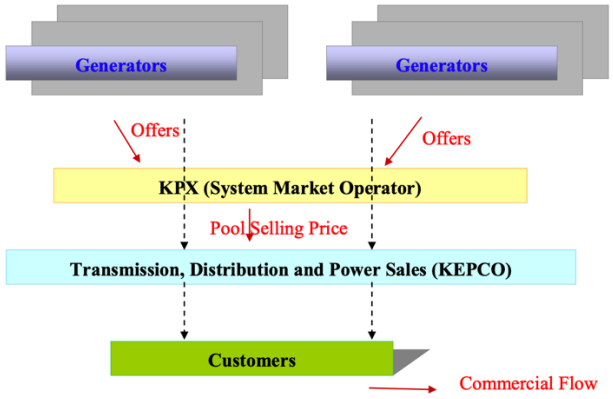
Section 2: Korea Industry Overview

a. Historical Developments

Apart from the country's lack of domestic energy resources, South Korea's isolated geographic location on the Korean peninsula meant that importing and exporting electricity to and from neighbouring countries is not feasible. Through the Electricity Enterprises Act, three electric power companies namely Kyungsung, Chosun, and Namsun were merged by the government in 1961 to form Korea Electric Power Company ("KECO") to provide a stable source of electricity to support economic and industrial growth. Through the expansion of energy supply infrastructures and diversification of energy supply sources to include nuclear power, electric power production soared from 0.37 GW in 1961 and exceeded 10.30 GW in 1982. In 1982, Korea Electric Power Corporation ("KEPCO") was established after KECO became a government-owned establishment. Organized as a vertically integrated company, KEPCO monopolized the generation, transmission, distribution, and sales of electricity in South Korea. In 1989 and 1994, KEPCO was listed on the Korean Stock Exchange and New York Stock Exchange, respectively. As of Dec 1998, 94.2% of Korea's total electricity generating capacity was owned by KEPCO. KEPCO served as South Korea's sole electric power utility from 1961 to 2001. It was able to support Korea's rapid industrialization by supplying affordable power and successfully expanding its electric generating capacity and transmission-distribution grids.

Following the Asian Financial Crisis in 1997, KEPCO's increasing debt was the subject of criticism as the public questioned its corporate governance structure and the lack of free competition. Legislation for the proposed restructuring of the electricity industry to encourage competition was passed in 2001.

Chart 1: Illustration of South Korea's Electricity Utility Business

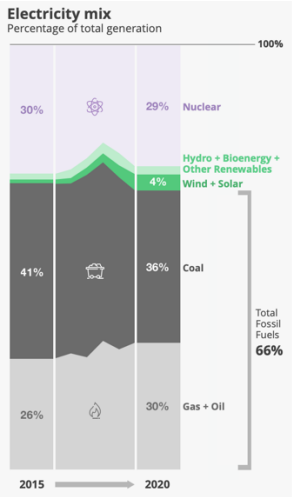


In 2001, KEPCO's generation business was split into six subsidiary power generation companies (one nuclear-hydro and five thermal). The restructuring also led to the establishment of the Korea Power Exchange (KPX) which operates and mediates the wholesale trading of power between generators and the retail supplier (KEPCO).

Hence, the responsibility of determining the wholesale price of power shifted to KPX. Although KEPCO remained the sole buyer of electricity, it still functioned as a grid operator and retail supplier, without engaging in generation.

This restructuring also led to the adoption of the cost-based pool model where generators will submit their bids according to the costs incurred in generating the electricity. KPX will then determine the wholesale price with a price setting schedule based on the submitted bids and forecast demand.

Chart 2: Illustration of South Korea's Electricity Sources in 2020



South Korea has been historically and continues to be reliant on fossil fuels and nuclear which accounted for 66% and 29% of its total electricity generation in 2020. This has allowed South Korea to achieve energy self-sufficiency and become one of the top electric power producers globally with a total energy production of 618,949 MWh in 2020.

Although slow in its transition to green energy, South Korea has demonstrated its commitment with its Third Energy Master Plan (2019-2040) that outline plans to significantly cut back on coal power and raise the share of renewables to 35% by 2040.

Presently, in Korea, there is competition on the supply side (generators and independent power producers can submit their bids to KPX). However, there is still a regulated monopoly on the demand side with KEPCO owning the distribution network (grids), controlling wholesale purchases from generators and retail sales to customers. The lack of continued restructuring and tightly controlled retail tariffs meant no new private generators entering the market, facilitating the continued monopoly by KEPCO. Without market competition arising from privatization, it is unlikely that South Korea's electricity market will grow exponentially going forward.

b. Market Size

South Korea's electricity market size is estimated to be US$9.7b in 2021. The electricity power market is expected to record a CAGR of more than 3.5% from 2022 to 2027. South Korea is one of the most energy-intensive economies globally, consuming 567 TWh of electricity in 2020.

c. Regulatory Implications

The electric power industry is highly regulated in South Korea, hindering free market competition. Segmenting the electricity utility business into generation, transmission, distribution and retail sales, companies apart from KEPCO are generally prohibited under the Electricity Business Act to be licensed to operate in two or more electricity utility businesses.

KEPCO remains the sole holder of a business transmission license, distribution license and retail sales business license in South Korea as privatization of the electricity sector remains suspended. Hence, authorization to construct or operate transmission and distribution facilities is not granted to any other entity apart from KEPCO.

Foreign investments in the nuclear power generation business are prohibited by the Electricity Business Act and the Foreign Investment Promotion Act. Foreign investments in the non-nuclear power generation business are only allowed if the total installed capacity purchased from KEPCO or its subsidiaries is less than 30% of the total installed domestic capacity.

Foreign investments in the transmission and distribution businesses are only permitted under the Electricity Business Act if the total shareholding ratio of foreign investors is less than 50% and the voting shares owned by foreign investors are not more than those owned by the largest domestic shareholder. This mandates the government to own at least 51% of KEPCO's shares.

In addition to the restrictions on foreign ownership of KEPCO shares, the Financial Investment Services and Capital Markets Act and KEPCO's articles of incorporation set a 3% limit on a single investor's purchase of KEPCO common stock.

d. Key Companies

Segmenting the electricity utility business into generation, transmission, distribution and retail sales, the key companies are:

Generation
The six GenCos, which are subsidiaries of KEPCO, dominate electricity generation in South Korea. The five non-nuclear GenCos alone account for almost 67% of the total installed generation capacity in South Korea in 2022.

The six GenCos are:
1. Korea East-West Power Co. Ltd (EWP)
2. Korea South-East Power Co. Ltd (KOSEP)
3. Korea Southern Power Co. Ltd (KOSPO)
4. Korea Western Power Co. Ltd (WP)
5. Korea Midland Power Co. Ltd (KOMIPO)
6. Korea Hydro & Nuclear Power Co. Ltd (KHNP)

Additionally, there are 17 independent power producers operating in the generation business.

Transmission, Distribution & Retail Sales

KEPCO retains sole control over the nationwide grid connection, with transmission and distribution facilities constructed and operated by KEPCO. KEPCO is also the sole wholesale purchaser/retailer of electricity in South Korea.

Section 3: Key Players

a. Korean Gas Corporation (KRX: 036460)

Executive Summary

Korean Gas Corporation is a South Korean public natural gas company established by the Korean government. It is the largest LNG-importing company in the world and is the sole provider of LNG in South Korea. It operates 4,971km worth of pipelines supplying 19,250 thousand households. Unsurprisingly, it has a household penetration rate of 83.4%. In 2021, it adopted a new cost distribution process to evenly distribute the costs of gas use between households in cities and commercial entities like power plant operators. Its LNG is mainly imported from the Middle East, Southeast Asia, Russia, Australia, and the United States.

Ownership

The Korean Government owns a majority stake in KOGAS.

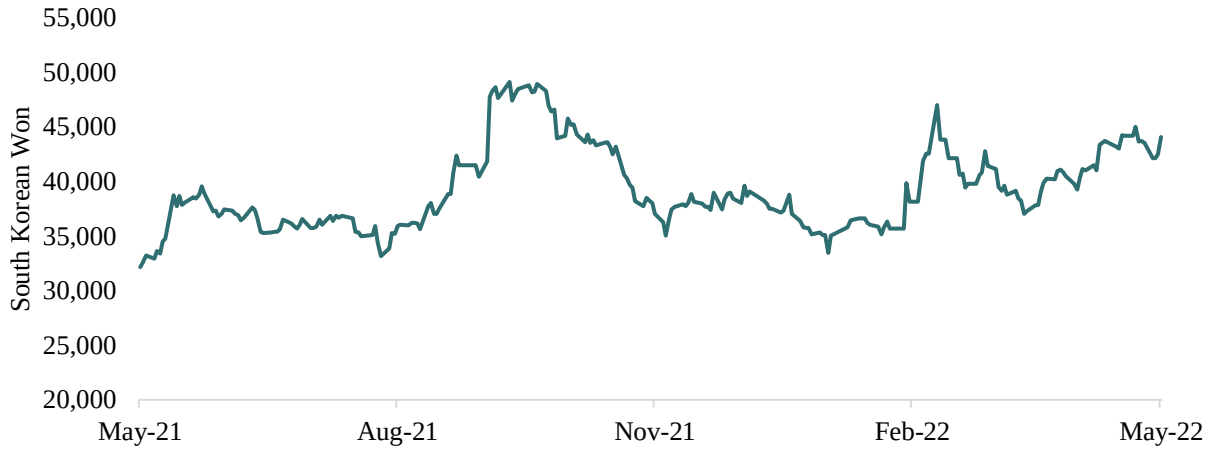
Chart 3: Top 5 Shareholders of KOGAS

Entity	% Ownership
South Korea	28.1
Korea Electric Power Corp.	22.0
National Pension Service	9.6
Korea Gas Corp. ESOP	2.7
Vanguard Group Inc.	1.0

Recent Developments

Despite the ongoing LNG shortages, investor sentiment for the Company remained high, owing to state owned support, a shutdown of several nuclear plants in South Korea, and long-term contracts with state owned entities like Qatar Petroleum (SP Global).

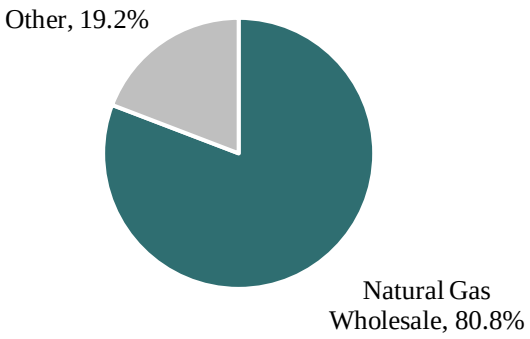
Chart 4: Share Price Of KOGAS



Segment Analysis

Most of KOGAS's revenue is generated from natural gas wholesale. It collects and processes LNG imports, and then distributes the gas to power plants or other general city gas companies. In response to the growing demand for environmentally friendly fuel, the Company has also expanded into the hydrogen energy business. It now produces and supplies hydrogen gas, with goals of supplying 1.2m tons of overseas green hydrogen into Korea by 2040. To bridge the gap between its hydrogen and natural gas business, KOGAS plans to convert natural gas into hydrogen through natural gas reforming.

Chart 5: Business Segment of KOGAS



Financial Analysis

	2017A	2018A	2019A	2020A	2021A
Profitability					
EBITDA margin	12.41%	11.76%	12.29%	12.13%	10.76%
Operating margin	(5.37%)	2.11%	0.23%	(0.77%)	3.51%
Net margin	(5.44%)	1.95%	0.16%	(0.83%)	3.46%
Gearing					
Total debt / Equity	279.89%	307.84%	327.25%	312.36%	309.60%
Net debt / EBITDA	8.63x	8.40x	8.57x	9.42x	9.32x

1. Profitability

Net margins have remained tight over the past five years due to a lowering of regulated returns by the Korean Government. Profitability is mostly determined LNG sales, which are primarily driven by changes in temperature and changes in power generated from other sources, such as nuclear.

2. Gearing

The Group's gearing ratio has remained relatively stable as KOGAS continues expanding its infrastructure base in South Korea. Its expansion into the hydrogen gas space would mean CAPEX would remain elevated for the foreseeable future.

Credit Rating

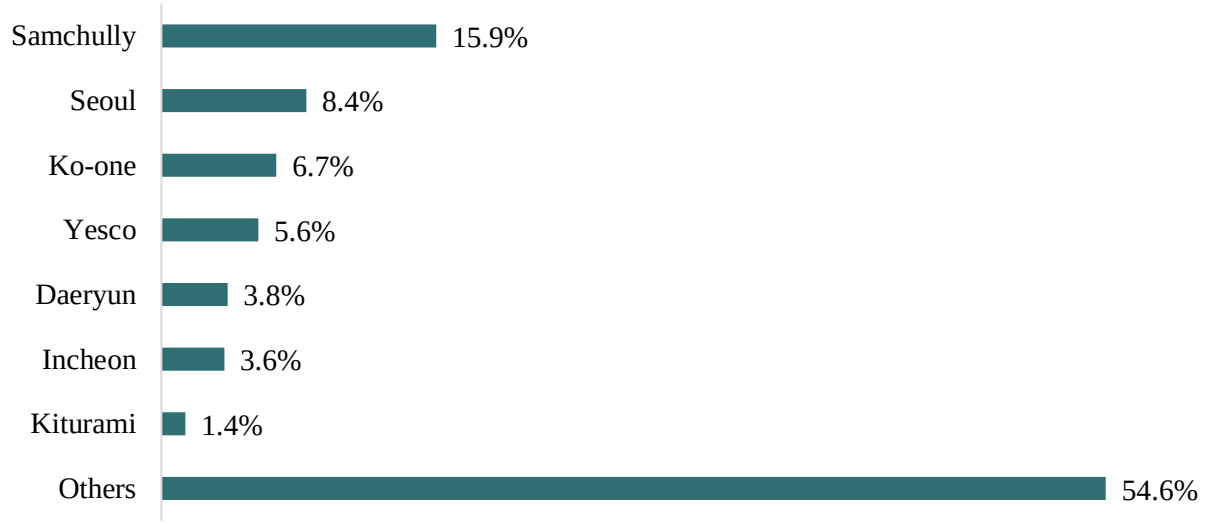
KOGAS was awarded a AA-/Stable rating by Fitch, due to the high likelihood of state support given the Company's strategic importance. Similarly, it also received an AA rating from S&P and a Aa2 rating from Moody's.

b. Samchully Co Limited (KRW: 004690)

Executive Summary

Samchully Co Limited is the largest city gas company in Korea, supplying approximately 4.1b m^3 of city gas annually to 3.3m homes in 13 cities. It provides end to end city gas services, including power generation, supply, and provision of total energy solutions. It also has diversified business segments, including being an official dealer for BMW.

Chart 6: Market Shares of Samchully and Other City Gas Providers



Business Segment

Natural gas sales provide most of the revenue of the company. The Company generates electric power and resells the electric power to energy resellers. In addition to natural gas, the Company also deals with thermal power generation. The Company also has business ventures in asset management, car dealership, provision of heating and heating equipment for commercial and household buildings, and renewable energy business centered on hydrogen gas.

Chart 7: Business Model of Samchully

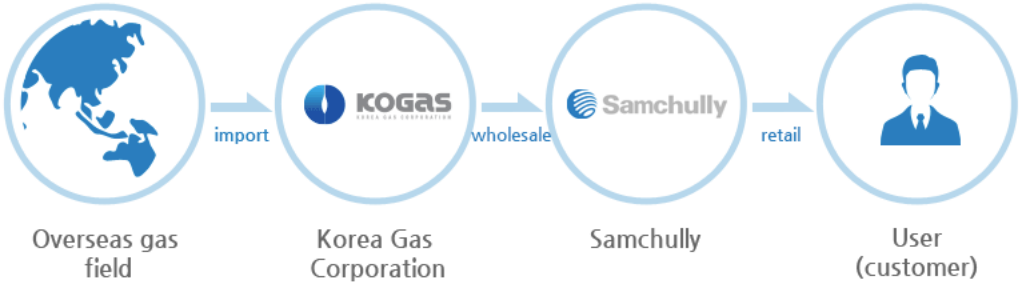
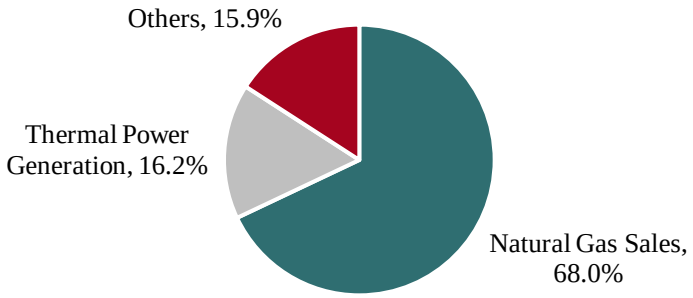


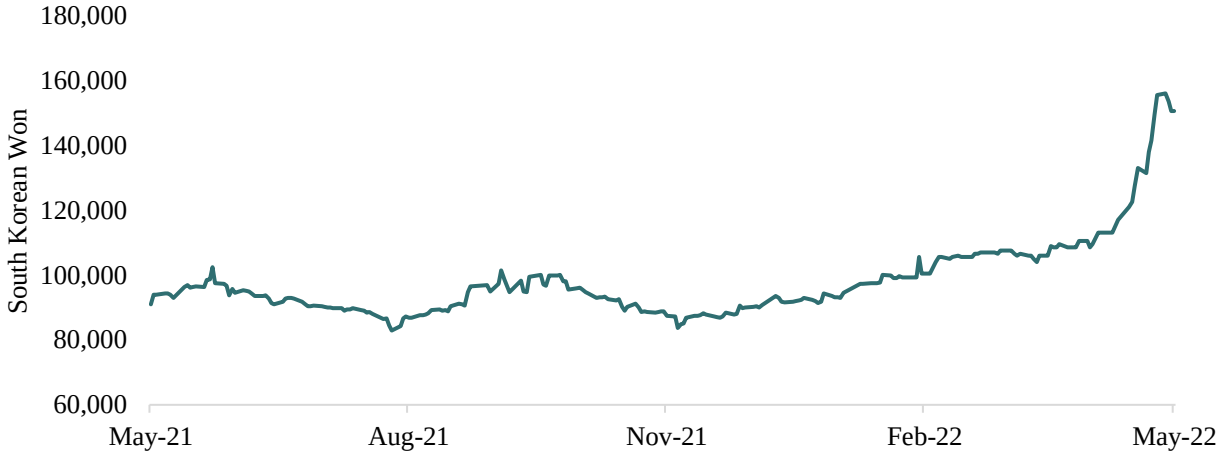
Chart 8: Revenue Breakdown of Samchully



Recent Developments

Despite the volatile LNG prices, due to the aforementioned contracts of KOGAS, the share price of Samchully has risen, boosted by factors such as the shutting down of several nuclear plants.

Chart 9: Stock Price of Samchully



Financial Analysis

	2017A	2018A	2019A	2020A	2021A
Profitability					
EBITDA margin	5.38%	5.50%	5.97%	6.96%	5.40%
Operating margin	0.18%	0.94%	1.05%	0.67%	1.93%
Net margin margin	0.40%	0.93%	1.09%	1.00%	1.58%
Gearing					
Total debt / Equity	84.58%	81.57%	83.90%	93.64%	88.76%
Net debt / EBITDA	3.06x	2.91x	2.16x	2.40x	2.08x

1. Profitability

The company has been able to maintain its profitability ratios despite the sharp fall in revenue during FY2020 due to income tax annulment.

2. Gearing

Prudent fiscal policy enabled the company to decrease its debt ratio in FY2021. As such, it has maintained its credit rating of A1 from the National Information & Credit Evaluation Group.

c. Korea Electric Power Corporation (KRX: 015760)

Executive Summary

Korea Electric Power Corporation (KEPCO) is South Korea's largest electricity provider responsible for the generation, transmission, and distribution of electricity. The South Korean government (51%), the Korea Development Bank, the national pension service, and minority shareholders share ownership of the national electricity provider. KEPCO owns six nuclear and thermal power generation companies, giving the group a market share of 68.5% as of 1Q22. As of 1Q22, KEPCO's generation mix comprises coal (41%), nuclear (41%), LNG (14%), oil, and others (4%). Operating revenue was KRW16.5trn in 1Q22, a 9.1% increase from KRW15.1trn in 1Q21. Power sales volume and revenues increased by 4.5% and 7.1% respectively, due to the effect of economic recovery. As of 2021, KEPCO's current capacity is 134GW, with a future capacity of 193GW by the end of 2034. KEPCO also has a global presence, with 45 projects in 23 countries.

Chart 10: KEPCO's 1Q22 Generation and Capacity Mix

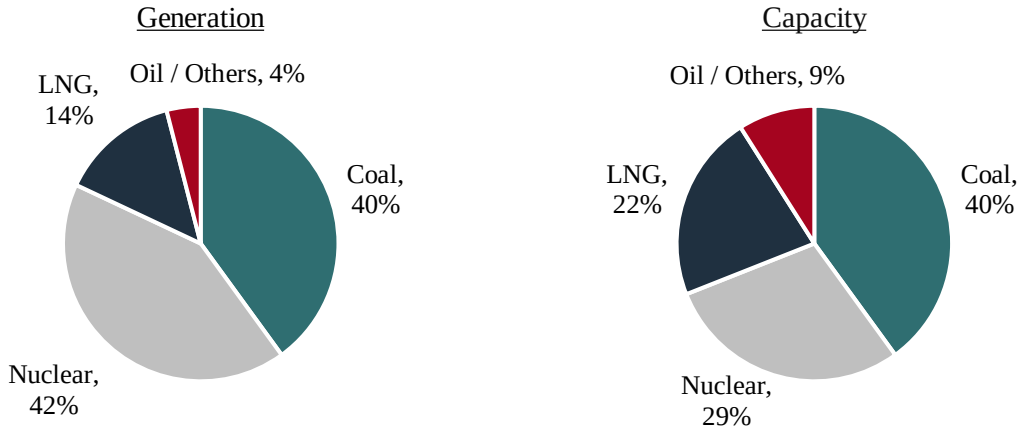
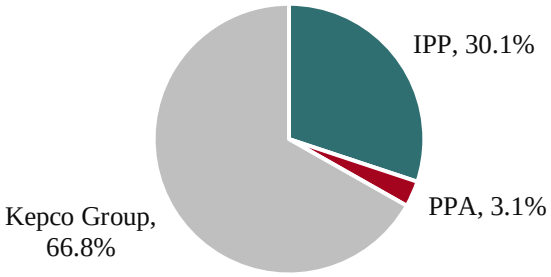


Chart 11: KEPCO's 1Q22 power purchase



Ownership

Chart 13: Shareholder breakdown of KEPCO

Entity	% Ownership
Korean Development Bank	32.9
Korean Government	18.2
Public (non-Koreans)	14.2
Others	34.7

Recent Developments

KEPCO launched the KEPCO Carbon Neutrality Promotion Committee on 28 December 2021 to work towards achieving carbon neutrality in the generation sector. The Committee has been formed to discuss strategic directions and major policies for the generation sector, which takes up 37% of total domestic greenhouse gas (GHG) emissions, and to find the optimal path toward carbon neutrality based on solidarity and cooperation with external/internal experts and stakeholders.

KEPCO has been selected as successful bidder for the HVDC-VSC subsea transmission system construction and operation project of UAE procured by Abu Dhabi National Oil Company (ADNOC) and Abu Dhabi National Electricity Company PJSC (TAQA) and clinched the deal on 22 December 2021. This $3.6bn project will supply sustainable power for ADNOC's offshore production operations and is expected to generate a stable profit through a long-term transmission with the Procurer for 35 years. This allows KEPCO to greatly expand its overseas renewable energy and grid project portfolio, in line with their carbon neutrality vision.

On 14 September 2021, KEPCO's Barakah NPP Unit 2 was successfully connected to the UAE grid, allowing for the distribution of electricity produced from the nuclear power plants to households and businesses. This contributes to the stable clean electricity supply in the UAE, along with the commercially operational Unit 1. Unit 2 is scheduled to commence commercial operation in the coming months, while Unit 3 is currently remaining commissioning tests to complete system turnover for operations and Unit 4 is currently preparing for the Hot Functional Test.

Financial Analysis

	2020A	2021A	2022E	2023E	2024E
Profitability					
EBITDA margin	26.7%	10.0%	(17.9%)	7.0%	20.7%
Operating margin	7.0%	(9.7%)	(37.0%)	(10.9%)	2.6%
Net margin	3.4%	(8.8%)	(28.4%)	(10.5%)	(1.5%)
Gearing					
Net debt / Equity	98%	123%	219%	287%	304%
Net debt / EBITDA	4.5x	13.2x	(8.6x)	21.9x	7.5x

1. Profitability

Despite the increase in operating revenue of KWR16.5tn in 1Q22, a 9.1% increase from KWR15.1tn in 1Q21, KEPCO posted worse than expected 1Q22 results, with an operating loss of KWR7.8tn. The big operating loss is mainly attributable to a spike in power purchase costs. As

the coal and gas rally continues, its unit power purchase has also spiked to KWR203/KWh as compared to its ASP of KWR110/KWh. There is also a sharp inflation in both coal and LNG transportation due to disruptions and geopolitical tensions.

KEPCO's profitability has taken a hit over in 2021, with EBITDA margins declining by 16.7% from 2020 to 2021 and is expected to further decline to (17.9%) in 2022.

Under the current market backdrop, there is a likelihood for KEPCO to hit the debt ceiling next year. Given ongoing large net losses, KEPCO's equity is set to decrease rapidly, while its debt is expected to rise sharply. Without additional tariffs hikes during the remainder of this year, there is a chance for KEPCO's parent retained earnings of KWR30tn as of FY2021 to decrease.

2. Gearing

KEPCO'S net debt is already at all-time highs and its net debt/equity has also exponentially increased from previous years. Interest burden will rise unless KEPCO's profitability improves meaningfully.

KEPCO has been financing its operations mainly through debt rather than equity, resulting in a high gearing ratio. With a high net debt to equity ratio, there may be a sudden increase in the borrowing cost, and further losses incurred will be compounded. KEPCO may not be able to service its debt which can eventually lead to a credit event such as default.

Section 4: Key Industry Trends

Korea finally stepped away from coal and is committed to phase-out coal-fired generation.

Coal generation is forecasted to decline from 2024 as more old coal-fired plants are retired by 2030. There is an increased commitment to move away from the fuel source and the share of coal generation will fall over the coming decade, with a corresponding increase for LNG-fired generation.

The Ministry of Trade, Industry and Energy (MOTIE) has finalized its Ninth Basic Electricity Plan to reduce the share of coal to 29.9% of the power mix by 2030. The government has also confirmed that 24 coal-fired units owned by KEPCO, with a combined capacity of approximately 12.7GW, will be expected to run on gas by 2034. The government also plans to reduce coal capacity to 32.6GW and increase gas capacity to 55.5GW by 2030.

Major insurance companies have also announced an exit to coal, in line with the market from other financial institutions and utilities away from the fuel source. As of June 2021, Hyundai Marine & Fire Insurance, Hana Insurance, DB Insurance, and Hanwha General Insurance announced that they will no longer insure for the construction and operation of new coal power projects.

As part of President Moon's aggressive attempt to shift away from coal, the Energy Ministry announced the closure of 10 coal-powered plants that were above 30 years old before 2022 and called for the re-evaluation of all coal-fired facilities that were under construction, including the conversion of coal projects to gas. In June 2017, it was announced that four of nine new coal-fired plants under construction would be asked to convert to run on LNG. The South Korean Cabinet approved the Energy Ministry's new energy plan in 2019, reaffirming the government's commitment to their energy agenda to phase out coal and nuclear in preference for cleaner sources. New targets for renewable sources (including hydropower) were raised to account for 35% of the country's power mix by 2040. The plan also proposes a ban on new coal-fired plants and for some existing coal plants to be converted to run on LNG.

Korea has been increasing the share of LNG and other renewable energy sources.

Gas-fired power generation will increase by an annual average of 2.3% between 2021 and 2030, increasing its share in the power mix from an estimated 26.7% in 2020 to 30.1% in 2030. Several measures have been introduced to lower rates for LNG generators, including lowering the taxation on LNG, expanding domestic LNG storage capacity, and forming an LNG buyers' alliance with regional LNG powerhouses Japan and China to push for more flexible and favorable LNG contracts.

Robust growth rates in South Korea's non-hydro renewables sector are expected, with non-hydro renewables capacity more than doubling between 2020 and 2030 to total over 40GW, predominantly by solar and wind power, and generating 12.9% of the total power mix by 2030.

The non-hydro renewables sector will generate the largest number of opportunities within the South Korean power sector, given a strong focus and ambitious targets on the use of renewable energy sources by the government.

SDN Co Ltd has announced plans to build a new heterojunction solar module factory at its facility in Gwangju, producing 550MW solar panels with a total capacity of up to 385MW. Korea Hydro & Nuclear Power has signed a memorandum of understanding with Hanwha E&C and Eco Green Wind Power Generation to build three wind farms in the Taebaek Mountains in Gangwon Province to power the region, with a total capacity of 300MW. The government has also approved an electricity business license for the first phase of the 1.5GW floating offshore wind project in Ulsan, with a total capacity of 504MW. The construction is targeted to begin in 2024.

In 2019, the government has reaffirmed its commitment towards renewable energy and raised the renewables capacity target figure to 35%. Of South Korea's total electricity consumption by 2040 from the initial 20% by 2030. The latest Ninth Basic Power Supply Plan has also seen a much stronger focus for renewables and has further boosted capacity target to 77.8GW by 2034.

President Moon and his Democratic Party have signaled intentions to establish a zero-carbon economy by establishing a Green New Deal similar to Europe. This increases investment in clean technologies and encourages the development of more renewable capacity. The government is also looking to cut taxes for 'green businesses' while introducing carbon taxes concurrently. They will look to divest their stake in the fossil fuels industry and launch programs to incentivize energy efficiency.

Growth will however be limited by land availability and growing public opposition to large-scale inland solar and wind. South Korea lacks the ideal geographical features for solar due to its mountainous region and has been destroying forests and farmlands to build them, resulting in a strong and growing backlash towards solar projects in these areas and have already led to the withdrawal of multiple solar projects. Rooftop solar installed in Seoul has also faced multiple headwinds, and high installation and maintenance costs with limited incentives and poor generation reliability have led to severe under-utilization. Some public buildings, such as the Seodaemun National History Museum, have announced that they will remove their rooftop solar plant.

Any renewables growth potential will remain largely concentrated in the offshore wind sector, where South Korea's large coastal zones offer an alternative to meet the country's ambitious renewables growth targets. While offshore wind remains an underdeveloped sector in the South Korean renewable energy industry at present, the project pipeline in this sector is strengthening and contains more than 8GW of projects, in line with growing investor interest in the market. For example, Canadian company Northland Power and KEPCO have formed a consortium with Korea East West Power to build a 200MW floating offshore wind facility at its existing Donghae platform, with construction expected to begin in 2022 and commercial operation in 2024.

South Korea continues to enjoy a well-developed and efficient transmission grid network and will see ongoing improvements by incorporating new and smart technologies to ensure network reliability and an efficient integration of more intermittent renewable sources.

With a vision of becoming a hydrogen-based economy, Korea has been emphasizing the development of a comprehensive hydrogen ecosystem.

Hyundai has signed an agreement with Doosan Fuel Cell to explore the role of hydrogen fuel cells as a distributed power source for microgrids. The pilot project is located in Ulsan and was completed in October 2021. KEPCO and GE Renewables Energy's Grid solutions have also upgraded a 300MW high-voltage direct current link between South Korea's mainland and Jeju Island, which will improve the bi-directional flow of power and renewables utilization. KEPCO successfully commercialized superconducting cables in November 2019, which have the ability to transmit five times more power and one-tenth the amount of transmission losses compared to conventional cables. The company built a 23kV 50MVA power transfer system for a 1km section between Shingal and Heungdeok substations using superconducting cables manufactured by LS Cable & System and has started testing it in July 2019. This makes Korea the first in the world to operate a commercial superconducting power transmission system that extends for 1km.

KEPCO holds an effective monopoly in South Korea's T&D network. For its transmission network, the company has 749 substations in operation with an installed transformer capacity of 264.4MVA, which further comprises 31,249km of 765kV and other lines, including high-voltage direct currents. Its distribution system consists of 2.0mn units of transformers, 8.5mn units of support and a total line length of 435,549km. The country's Eighth Basic Electricity Plan has highlighted a few directions towards the transmission, including the enhancement of system capacity to integrate renewable energy, timely system reinforcements and improved stability for stable electricity supply, improved social and environmental acceptance about transmission and transformation facilities and Northeast Asia Super Grid (China-Korea-Japan transmission line and Korea-Russia transmission line).

Impact of industry trends

Institutional investors are increasingly focused on building greener portfolios that have reduced exposure to climate transition and physical risks. ESG factors can impact the fundamental credit risk of a company and, in turn, a company's bond price. These changes in investor behaviour have affected prices in the corporate-bond market. "Green spreads" is a measure of how spreads have varied with the environmental-component scores of ESG ratings, while adjusting for credit ratings and sectors. With this shift in market sentiments and perspectives, it may be even costlier to access debt for a company that is not embracing ESG. Companies with good ESG characteristics showed a lower likelihood of suffering from issuer-specific risks than companies with low ESG ratings, after accounting for common factors including credit ratings. Minimising defaults is crucial—and more responsible companies tend to have fewer defaults.

With the increasing demand for green bonds, companies are issuing more green bonds to secure financing for projects that will have a positive environmental effect. This, in turn, will likely drive their yields lower. Sustainability-linked bonds may also offer issuers a slight pricing advantage when compared to their non-ESG-linked comparables. Through a research done by MSCI, the yield difference is more consistently positive for high-scoring issuers, and only bonds of high-scoring issuers appear to demonstrate any consistent green-bond yield difference, while those of low-scoring issuers did not seem to benefit as much.

Section 5: Conclusion

The electric utility industry remains highly regulated in South Korea, with stated-owned KEPCO almost monopolizing the industry. The observed trends such as the liberalization of economy and transition towards greener energy sources will encourage more free market competition which will increase efficiency within the electric utility industry and enhance energy security for the energy-intensive economy.
