

# South Korea's New Electricity Plan

## Cosmetic Changes or a Breakthrough for the Climate?

**Sylvie CORNOT-GANDOLPHE**

Shortly after his inauguration in May 2017, the President of South Korea, Moon Jae-In, announced a major policy shift away from nuclear and coal power, and toward renewables and gas.<sup>1</sup> This would have meant a complete U-turn from previous policies, considering that nuclear and coal produced 40% and 30% respectively of Korea's total electricity in 2016. The move responded to growing domestic and international safety concerns over nuclear power, alongside rising public hostility to coal power due to worsening air quality. In addition, coal burning is the main source of greenhouse gas (GHG) emissions in the country. This issue had to be addressed in order to comply with South Korea's 37% emissions reduction target by 2030 compared to a business-as-usual (BAU) level of 851 Mt. Has South Korea embarked on this radical energy policy shift? The new administration adopted its 8<sup>th</sup> Basic Plan for Long-Term Electricity Supply and Demand 2017-2031 (8<sup>th</sup> BPE) on 29 December 2017.<sup>2</sup> The plan entails significant changes to the power mix. However, it is less ambitious than previously expected, reflecting the challenges of raising the share of renewables, reducing nuclear and coal power, while, at the same time, keeping power tariffs under control.

### The electricity plan 2017-2031: a reality check

The 8<sup>th</sup> BPE aims to take into account the commitments made at the Paris Agreement on Climate. Peak power demand is estimated at 100.5 GW in 2030 (85.2 GW in 2017) and power demand at 579.5 TWh (506 TWh estimated in 2017).<sup>3</sup> This is a significant decrease compared to the 7<sup>th</sup> Basic Plan for Long-Term Electricity Supply and Demand 2015-2029 (7<sup>th</sup> BPE), which projected peak demand at 112.3 GW in 2029 and power demand at 657 TWh.<sup>4</sup> The difference is mainly explained by a lower economic growth rate, greater energy conservation efforts and the development of demand side management.

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Power capacity is expected to increase significantly, due to rising renewable capacity. The Ministry of Trade, Industry and Energy (MOTIE) projects total installed capacity to increase by about 50% from 117 GW at the end of 2017 to 173.7 GW in 2030. By then, combined renewables (excluding large hydro) and liquefied natural gas (LNG) capacity are expected to reach 106 GW (61% of total power capacity). At the same time, nuclear and coal capacity is expected to decrease as some nuclear and coal units reach the end of their operating life and are closed.

Power generation by fuel deviates significantly from the 7<sup>th</sup> BPE, but also from initial announcements which projected the share of gas in power generation at 37% by 2030.<sup>5</sup> In contrast, the 8<sup>th</sup> BPE projects the share of gas at 18.8% in 2030 (16.9% in 2017) while those of coal and nuclear power are 36.1% and 23.9%, respectively (45.3% and 30.3% in 2017). As expected, the share of renewables is raised to 20% by 2030 (from 6.2% in 2017). Despite efforts to boost renewables and natural gas, South Korea's power generation mix would remain dominated by nuclear and coal, still accounting for 60% of power generation in 2030.

Faced with strong opposition from the nuclear industry and concerns about rising electricity prices, the government made compromises to reduce the cost of the energy transition. According to the 8<sup>th</sup> BPE, electricity rates may rise by 10.9% by 2030 (based on expected costs of future generation), a slower pace than the 13.9% increase registered in the past 13 years.

Despite the still high share of coal, the implementation of the new plan will help cut GHG emissions down to 237 Mt by 2030 – below the current emissions reduction target of 258 Mt (and down from 306 Mt in 2015). This is a 26.4% reduction from the 322 Mt projected in the BAU scenario for emissions from the power sector. The reduction is achieved thanks to the substitution of coal generation by renewables and gas and efficiency improvement of thermal power generation.

### **Accelerating the development of renewables**

The key policy target of the new administration is to raise the share of renewables in electricity generation to 20% by 2030 compared to only 11.7% by 2029 in the previous BPE. The goal is to fight climate change, but also to set up renewables and associated industries as a new engine

of domestic and export driven growth for the South Korean economy. To reach the 20% target, MOTIE projects renewable capacity (i.e. excluding large hydro) to increase from 11.3 GW in 2017 to 58.5 GW in 2030. Solar and wind power should dominate with 88% of all non-hydro renewables installed capacity in 2030.

Although the 20% target is not particularly high by global standards, there are some obstacles in South Korea to develop renewables, such as the lack of space, local opposition and reluctance on the part of local authorities to issue permits. The government has unveiled an ambitious plan to reach the target, which includes public support and investment in renewables, opening of the power generation and supply market for renewable facilities, rising renewable portfolio standard (RPS), and easing of permit regulations. The scale of public support to the sector and the dynamism of the Korean manufacturing industry make this target realistic though.

### **Old nuclear reactors closed or replaced by new-builds**

Since the closure of the oldest nuclear reactor (Kori 1) in June 2017, South Korea has been operating 24 nuclear reactors with a total capacity of 22.5 GW. In addition, as of May 2017, South Korea had five reactors under construction, of which three near completion, and the other two about 30% complete (Shin Kori 5 and 6). In addition, six reactors were at a planning stage. During his presidential campaign, Moon Jae-In promised to cancel construction plans for eight new nuclear plants (the six planned reactors and the two uncomplete reactors).

Amid growing public concerns over nuclear safety, the Moon administration established an independent *ad hoc* committee on managing public debate and launched a deliberative opinion poll on whether to permanently abandon Shin Kori 5 and 6 projects. In October 2017, the public consultation showed support for both restarting construction of the two reactors and scaling down of nuclear power generation<sup>6</sup>. The government therefore announced the immediate resumption of construction work on the two reactors. Simultaneously, they announced its nuclear phase-out roadmap, which includes: 1. the cancellation of plans to build the six planned nuclear reactors; 2. no extension of the lifespan of 14 aging nuclear power reactors, totalling 12.5 GW of capacity; and 3. the closure of

Wolsong 1 (which is now the oldest reactor) earlier than scheduled.

South Korea will gradually reduce the number of nuclear reactors from 24 in 2017 to 18 in 2030 (after an initial rise to 27 reactors in 2022). Nuclear power capacity will first increase to 27.5 GW by 2022, and then will gradually decline to 20.4 GW by 2030.

Until recently, the success story of nuclear energy was considered a national pride for South Korea. In 2009, South Korea won its first nuclear contract abroad when the United Arab Emirates selected a consortium led by KEPCO, the Korean state-owned power company, to build four APR1400 units at Barakah. Currently, KEPCO and local construction companies are eyeing nuclear projects in Britain, Saudi Arabia and the Czech Republic. Opponents to the nuclear phase-out feared that if the shift was too rapid, it would compromise South Korea's role in the global industry. But the announced phase-out is very gradual; by 2030, the nuclear capacity is expected to be reduced by only 2 GW (20.4 GW in 2030 vs. 22.5 GW in 2017). Furthermore, new plants are still under construction and the decision to resume the construction of Shin Kori 5 and 6 reactors means that the Korean industry will keep its experience and knowledge up-to-date. In addition, the new administration has vowed active support for local industries' efforts to export indigenous designed nuclear reactors. KEPCO has already been very successful. In December 2017, Japan's Toshiba, in charge of building nuclear reactors in Britain, picked KEPCO as its preferred bidder<sup>7</sup>.

### **A marginal reduction in coal capacity in the 2020s**

During his presidential campaign, Moon Jae-In promised that he would tackle local air pollution by closing the ten oldest coal plants of the country by 2022, re-examining nine coal plants under construction, and replacing them with LNG plants. At the end of 2017, South Korea had 61 operating coal-fired power plants with 38.6 GW capacity, supplying 45% of the country's electricity generation. However, not all the capacity is operational. In May 2017, the new administration took immediate measures to improve air quality. Consequently, coal-fired power plants that were over 30 years old, accounting for 3.3 GW of capacity, were temporarily closed for one month in June 2017 and will be closed again from March to June each year (when seasonal air pollution peaks), before their final

closure by 2022.

Despite a strong willingness to stop new coal-based plants, the review of the nine coal plants under construction was challenged by economic and contractual commitments issues. Of the nine units, seven will be built by 2022 as planned and two will be converted to LNG. In addition, four other coal units will be converted to LNG during the period 2023-2030. Overall, coal capacity is expected to rise to 42 GW by 2022 and then decrease to 39.9 GW in 2030.

Despite this high capacity, coal demand (and imports) may decrease in the medium and long term as the utilisation rate of coal power plants gradually declines due to new taxes levied on coal power generation and an expected rise in CO<sub>2</sub> prices on the Korean Emission Trading Scheme (ETS), launched in 2015. In the meantime, South Korean total coal imports jumped to 145 Mt in 2017, mainly driven by a 13% increase in coal-fired generation. Combined with rising coal imports by China, this rise (up 17 Mt over 2016), contributed to the tightness of the global coal market and the strength in steam coal prices in 2017.

In addition, the new administration is putting in place new policy tools (revision of electricity tariff rates, environmental and social taxes, reform of the merit order on the Korean Power Exchange (KPX) to integrate environmental and safety costs of power generation, opening of the power market for renewables) that will allow to move to a safe and clean power mix in the medium and long term. Coal-gas competition will be altered significantly by the adjustments made to fuel consumption taxes, the adoption of an environmental tax and the rising price of CO<sub>2</sub> on the Korean ETS. This will gradually erode the competitiveness of coal against gas and reinforce the role of gas in the future.

### **LNG generation to play a bigger role, but not in the short to medium term**

In the new policy, gas is the source that fills the gap left by the reduced reliance on coal and nuclear and helps integrating an increasing contribution from intermittent renewables. But given the high share of coal in 2030, the room left for gas is much smaller than anticipated. This means that gas plants will ensure peak and mid loads. In addition to the conversion of coal plants to LNG plants, new

combined cycle gas turbines (CCGTs) are expected to be commissioned after 2026 to ensure the stability of power supply produced from a larger share of variable renewables. Gas-fired capacity, which increased to 37.4 GW at the end of 2017, with almost 5 GW of capacity added in 2017, is expected to reach 42 GW at the end of 2022 and 44.3 GW at the end of 2030.

Based on the 8<sup>th</sup> BPE, power generation from CCGTs will increase by an average annual growth rate of 1.9% over the next 13 years. Although this is significantly lower than what was expected, it is nevertheless a significant shift from the 7<sup>th</sup> BPE, which projected a drastic fall in gas generation to only 8.9% of electricity generation in 2029.

## Global implications

All gas consumed in South Korea is imported in the form of LNG, mainly from Qatar, Australia, Indonesia, Oman and Malaysia. South Korean LNG imports rose by 12% to 37.5 Mt in 2017, mainly driven by the filling of LNG storage tanks (one new terminal was commissioned at the beginning of 2017 at Boryeong and the Samcheok terminal was expanded), as gas demand did not increase significantly (+2% over 2016 to 35 Mt in 2017). South Korea was the second-largest LNG importing country until 2017, when it was outpaced by China.

Based on a 1.9% increase in power generation, rising city gas sales and increased gas demand by combined heat and power (CHP) plants, total gas demand can be estimated at around 47 Mt in 2030, an increase by 34% compared to 2017.<sup>8</sup> This is a major change compared to the 12<sup>th</sup> long-term natural gas supply and demand plan, published in 2015, which projected a long decline in total gas demand to 34.7 Mt in 2029.<sup>9</sup> South Korea is going to provide an unexpected outlet to global LNG producers. Its LNG imports may grow by 25% (almost 10 Mt) over the next 13 years (this excludes filling of LNG tanks). Although these additional needs are significant, they need to be put into perspective. This is less than the growth in Chinese LNG imports in just one year (+ 12 Mt to 38 Mt in 2017).

In addition, as its contracts with two major suppliers expire in 2024, South Korea will have to renew and/or negotiate new LNG supplies. The state-owned gas company, KOGAS, has already approached the market and signed four non-binding memorandums of understanding

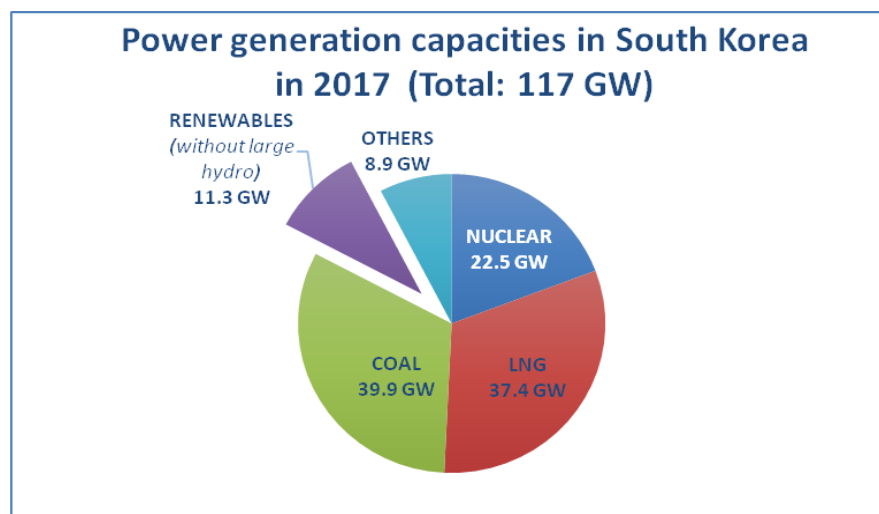
with US LNG suppliers. A move towards more flexible destinations and a new price indexation is expected. Which type of contracts South Korea signs in the future may strongly influence the Asian and global LNG market and its flexibility.

As far as steam coal imports are concerned, the huge coal power capacity commissioned in 2017 and to be added by 2022 means that coal imports will stay on a growing trend in the short to medium term, reinforcing the pressure on the global steam coal market.

### **In sum: the embryo of a serious energy transition**

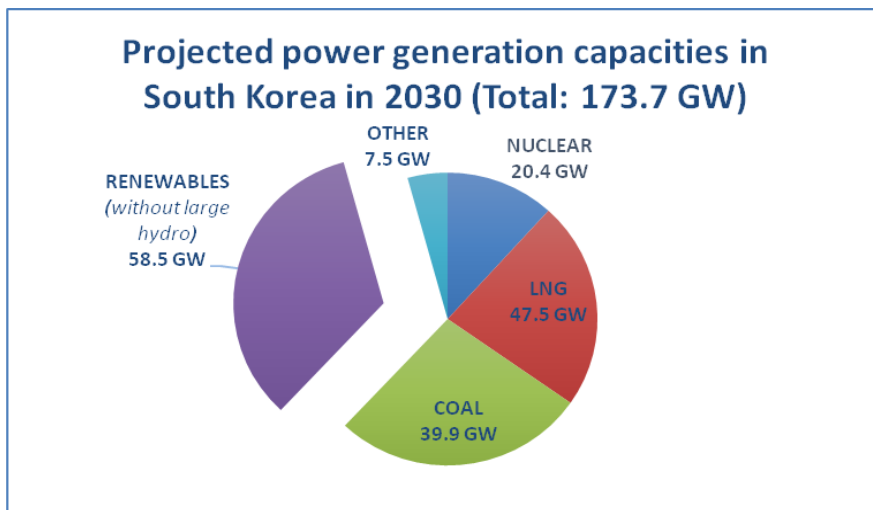
The energy transformation is not the complete overhaul expected when President Moon took office, except for renewables. The 8<sup>th</sup> BPE brings significant changes to the electricity mix that will take time to materialize. While the new direction is clear, more ambitious goals would be welcome in the next electricity plans. The nuclear phase-out will not happen in the short term. The reduction in coal generation is small. The share of gas-fired power generation is increasing modestly. Yet nuclear and coal's contribution are no more increasing in the long term as was expected in the previous plan. South Korea is thus avoiding the Japanese electricity mix trap, but its adjustments can be further strengthened. The new plan also shows how difficult it is to reduce coal and nuclear power at the same time, an issue shared by German policy makers.

### **Annex 1**





## Annex 2



1. Greenpeace Unearthed, "South Korea to Scrap Coal and Nuclear Power", 19 June 2017, available at: <https://unearthed.greenpeace.org>.
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