

South Korea nuclear power policy change and its implications

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1.0 Introduction

The president of the Republic of Korea, has indicated his intention to phase out nuclear power and coal from the energy mix by changing the nuclear energy policy among other decisions. The new nuclear energy policy proposes phase out of coal and nuclear power in favor of both natural gas and renewable sources such as hydro, wind, and solar. So far 10 old coal power plants have been closed down while Kori 1 nuclear power plant, which had received license operation, has been permanently shut down. There will be no extension of operation license for power plants. The president's decision to phase out nuclear power stems from 2011 Fukushima Daiichi nuclear accident and the 2016 high magnitude earthquake that occurred in S. Korea. Although this move is towards reduction of greenhouse gas emissions, it has several implication on the stability and sustainability of energy.

2.0 Energy overview in S. Korea

South Korea ranks among the world's top five importers of liquefied natural gas, coal, crude oil, and refined products. In terms of electricity generation, fossil fuel sources account for nearly two-thirds of South Korea's electricity generation. In 2016, the gross generation capacity was as follows: Coal (38.7 %), Nuclear (31.2 %), LNG (19.1%), oil (6.0%), hydro (1%) and other alternative (4%). Base load generation is primarily made up of coal and nuclear power, while peak demand is generally met by the country's LNG imports [1]. More than half of energy use has for many years been the industrial sector (55-58%) followed by residential and transport sectors (20-23%). Renewable sources (primarily solar, wind, biomass, and waste) remain a small share of South Korea's electricity generation.

3.0 Implications of Policy Change

Although it is a good move to increase the percentage of natural and renewable gases and also

consider reduction of environmental pollution by coal power plants, it will not be advisable to phase out nuclear energy as one of the power source because it contributes a large proportion of overall power generated. Nuclear and coal are the main base load power sources in the energy mix thus it's very risky to completely phase out the major base load sources and replace them with renewables, which are mostly peak loads. This will result in energy unsustainability and eventual loss in production, industrial, and economic development at a large.

Also, halting of nuclear and coal power does not guarantee that renewable sources can meet the current and future energy needs. The geothermal plants which were under construction in Pohang, Ulleungdo, and Jeju, with a capacity of 1-10 MW [2] cannot compensate, for example, for a one unit NPP of approximately 1000MW. In his keynote speech, at Korea Atomic Power Annual Conference, 2017 in S. Korea, Michael Shellenberger raised concern about S. Korea plan of phase out of nuclear power. He quoted the worrying worldwide declining trend of nuclear energy (7% down from 1999-2015) which has not been made up by wind and solar (+4.5 % up in the same period). In his speech, he stated that nuclear power is a key solution to the world environmental problems.

“If we're going to tackle global warming, nuclear is the only way you can create massive amounts of power. Only nuclear can lift all humans out of poverty while saving the natural environment. Nothing else — not coal, not solar — can do that. Bluntly, renewables are no substitute for either nuclear or fossil fuels.”

To elaborate his point, when nuclear power plants are phased out, they are likely to be replaced entirely with fossil fuels, which in turn affects the environment. Furthermore, replacing an equivalent of nuclear energy by renewables such as solar and wind will mean clearing a very large area of land. Cutting down trees, which plays role in absorption of carbon dioxide (CO₂) from the environment, will lead to an increased amount of CO₂ in the environment and in the long run, more burden on the environmental and continuous global warming. Thus, with mountainous topography, contested and militarized water, and high population density, Korea may face greater challenges in development of renewable energy which mostly

require a large area of land for an equivalent amount from nuclear source.

Some of renewable sources such as solar and wind are not reliable in the long run. For instance, South Korea tends to have a humid continental climate and a humid subtropical climate with four distinct seasons; spring, summer, autumn, and winter. As of 2015, the annual average of total monthly sunshine hours in South Korea was about 189 h which is approximately 26% sunshine hour/month [3]. Furthermore, solar energy cannot be harvested at night resulting in low power at night, this source cannot be relied upon as a base load for industrial purposes and other utilities which require power 24 hours a day. With continued climate change, global warming has seen reduction in water levels such that dependence on hydro power is being put at stake.

As much as these sources are important, they are not reliable to run an industrialized developed country, they are suitable for peak loads hence the need for reliable power source such as nuclear for base load applications. Also, limitation in terms of land makes it difficult to utilize renewable energy for a lot of electricity production. Moreover, it is difficult to trade electricity through grid connections with neighboring countries, which are far away and separated by water bodies, the only neighboring country-North Korea, has unstable relationship.

Removal of nuclear from energy mix will force S. Korea to import additional power in order to cater for the growing energy demand and fill the deficit created by nuclear and coal. Considering the scarcity of natural resources and the already almost dependence on imports for a large fraction of power, it will be forced to totally dependent upon imports to satisfy all its energy demands. If importation was to be considered, it will be very expensive to construct transmission lines between S. Korea, China and Japan because of the distance and the separation by water bodies. The cost of importing such a large amount of power will be so large compared to the amount spent on running these NPPs.

In addition, this will mean increasing the prices of electricity for consumers. As of the year 2014, Korea's electricity prices in household and industrial sectors were cheaper than those of OECD member countries' total. The low prices of electricity in Korea was thought to have been mainly attributable to the relatively high shares of nuclear power and coal power generations which are the lowest generation sources. It's therefore necessary to manage the demand and strengthen the roles of generation sources, especially nuclear, responsible for the base load.

Taking Germany as an example, their effort to phase out nuclear forced them to totally depend on coal as a base load and import most of its electricity from neighboring country. Currently, Germany gets most (about 43%) of its electricity from coal. This dependence on coal has so far had economic and environmental implications in terms of CO₂ emissions. Germany's decision to shut its nuclear plants means that back-up for its massive investment in intermittent new renewables needs to be from coal and gas. To further sustain its electricity stability, the country relies on import through the significant interconnection with France, Netherlands, Denmark, Poland, Czech Republic and Switzerland. The main reason for Germany's high self-sufficiency has been the abundance of domestic coal [4]. However, Germany has been able to sustain its energy demands by use of coal and good interconnectivity with numerous neighbors- an advantage that S. Korea lacks.

If South Korea opted to phase out both nuclear and coal, they are likely to face more challenges than those faced in Germany such that it will not be able to sustain the energy demands and also achieve greenhouse gas reduction. This implies that complete phase out of nuclear leaves a huge deficit in power that cannot be filled by all other natural and renewables without another alternative which is not environmental friendly. On the same issue, if nuclear has to be phased out, it has to be replaced by another stable and reliable source that can produce such a large amount of power. Such source of power is geothermal or hydro. Unfortunately, Korea have little potential for geothermal hence it won't harvest much from it.

Concerns about nuclear accidents and the earthquakes experienced last year are valid. However, the current APR1400 reactor has incorporated lessons learned from Fukushima nuclear accidents and advanced safety measures have been taken into account [5]. Therefore, the design can handle such an accident and the effect of a high magnitude earthquake. In addition, S. Korea has attained a self-reliance status in nuclear power plant construction, fuel generation, operation and export. The standardization of nuclear power puts the country at the forefront in ensuring safe operation of the plants. This growth and development is crucial in the economy of S. Korea because of the revenues generated in the technology export. So far, APR1400 reactor model has been exported to United Arab Emirates and more contracts have been signed with other countries.

On the other hand, phase out of coal power plants is highly encouraged to enable Korea meet its commitment towards reduction of greenhouse gas

emission by 2030. Thus, phase out of coal power plant, development of renewable sources, and strengthening energy demand management will be essential to reach the target in climate change contribution.

4.0 Conclusions

With continuing economic growth, electricity consumption by industries, households and other sectors, is expected to continue rising thus a need for secure and adequate energy reserves. Renewable energy sources are important in helping the country increase its energy self-sufficiency and limit the CO₂ generation. Thus, it is advisable to increase renewable energy percentage but not to phase out nuclear power, a reliable source, which has no direct effect on environment and population. Increasing the percentage of renewable energy should be adopted to complement the removal of coal power plant so as to sustain existing energy and power demands. Also, it is recommended that the ongoing construction of the advanced power reactor with improved safety features, APR1400, should be encouraged so that power deficit, which would have been created by nuclear and coal phase out, will be filled and this will ensure continuous economic growth and development for S. Korea.

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