South Korea

A Closer Look

Photo source: Kallanish Energy
Key Findings

Minimum cost of replacing nuclear plants is $20 billion per year

Coal, oil, natural gas likely alternative given scarcity of land for wind and solar

Wind & solar would require natural gas as back-up

Nuclear phase-out means South Korea could not meet Paris climate agreement

Nuclear phase-out domestically would result in loss of nuclear export market
South Korea’s electricity mix, 1980 - 2014

Total generation (TWh)

Source: U.S. Energy Information Administration
Replacing Korea’s nuclear electricity would require either:

~13,000 wind turbines*  or  ~4,400 solar farms†

*5MW turbine, 25% capacity factor  †SinAn solar farm equivalents

Sources: Conergy, RVO, IAEA
Replacing Korea’s nuclear electricity would require either:

~13,000 wind turbines*

or

~23.5 million solar roofs†

*5MW turbine, 25% capacity factor
†23.6 square meter roof, 5KW solar system, 15% capacity factor

Sources: EnergySage, RVO, IAEA
2016 Korean total solar and wind capacities are equivalent to:

~206 wind turbines*

or

~181 solar farms†

*5MW turbine, 25% capacity factor
†SinAn solar farm equivalents

Sources: Conergy, RVO, WindPower, Wikipedia
Replacing Korea’s 2016 fossil fuel electricity and nuclear electricity would require either:

- ~40,000 wind turbines*
- ~14,000 solar farms†

*5MW turbine, 25% capacity factor
†SinAn solar farm equivalents

Sources: Conergy, RVO, IAEA, KEPCO
South Korean emissions, business-as-usual, and Paris commitment

Source: IAEA, NDC Registry, KEPCO, Greenhouse Gas Inventory & Research Center of Korea
Paris climate agreement emissions goals

Without Nuclear Electricity

With Nuclear Electricity Displacing Gas and Coal

Source: IAEA, NDC Registry, KEPCO
Nuclear closures increase Paris emissions burden 19 - 45%

Source: IAEA, NDC Registry, KEPCO
Paris agreement requires larger emissions reductions than all total emissions from electricity.
Meeting Paris requires replacing all coal and natural gas with zero-carbon electricity + more.

Source: IAEA, NDC Registry, KEPCO
South Korea’s electricity mix, 2014

- Nuclear: 69%
- Hydroelectricity: 29%
- Geothermal, Solar, Biomass, Wind, Fossil Fuels: Very small percentages

Source: U.S. Energy Information Administration
South Korea’s clean electricity mix, 2014

- Nuclear: 96%
- Wind: 2%
- Hydroelectricity: 0%
- Geothermal: 0%
- Tide and Wind: 0%
- Solar: 0%

Source: U.S. Energy Information Administration
South Korea’s renewable capacity, 1980 - 2014

Source: U.S. Energy Information Administration
South Korea’s share of clean electricity, 1980-2014

Source: U.S. Energy Information Administration
Nuclear closure would increase emissions the equivalent of adding 27 million cars to road

Sources and notes: Increase in emissions calculated based on estimated annual generation of all South Korean nuclear reactors using a capacity factor of 0.92. Emissions factors are calculated based on values from the U.S. Energy Information Administration. Calculations of cars added to the road assume an average emissions per passenger vehicle of 4.7 metric tons CO\textsubscript{2} per year, as per the U.S. Environmental Protection Agency. Calculations involving coal emissions factors assume all coal is bituminous.
Average Cost of Korean Electricity by Fuel Type, 2015

Source and notes: KHNP Korea Electric Power Statistics. Values converted from South Korean Wons to US Dollars using a conversion factor of 0.00089. The 2015 average includes the cost of decommissioning and spent fuel management which was not included prior to 2015.
Replacing current and near future South Korean nuclear would cost ~$200 to $400 billion over 20 years.

- **Natural Gas**:
  - Cost of new plants/one time: $200 billion
  - Cost of LNG/20 year: 27 billion

- **Solar**:
  - Cost: 400 billion

- **Wind**:
  - Cost: 170 billion

Sources: Environmental Progress. Data accessible: https://docs.google.com/spreadsheets/d/1hOYm-J5naH5P1cvT8Lz8Br5b-TsyP6sDpnBNFxKSOXw/edit#gid=2130475146