

The Role of Nuclear Power in Korea's Energy Mix: Current Status, Policy Direction, and Future Outlook

KI BOG LEE

*Korean Nuclear Society/
Korea Atomic Energy Research
Institute*

(34057) 111, Daedeok-Daero
989beon-Gil, Yuseong-gu,
Daejeon, Korea
kblwhl@hanmail.net,
kblee@kaeri.re.kr

This invited lecture provides an overview of the current status of nuclear energy in Korea and its role within the national energy mix. It introduces the structure and performance of Korea's operating nuclear fleet, recent developments in plant operation and lifetime extension, and ongoing efforts to maintain high standards of safety, reliability, and public trust.

Particular attention is given to the policy framework guiding Korea's energy mix, including the balance between nuclear power, renewable energy sources, and other low-carbon technologies.

Korea, a country with limited natural resources, launched its national nuclear power program in the late 1950s. Beginning with the commercial operation of Kori Unit 1 in 1978, Korea is currently operating a fleet of 26 nuclear power plants, which provide approximately 30% of the nation's electricity. Through joint design and technology cooperation with the United States, Korea achieved technology self-reliance and supply-chain and successfully exported nuclear power plants to the United Arab Emirates in 2009 and the Czech Republic in 2025. Looking ahead, Korea seeks to further develop its nuclear industry as a strategic export sector and as a key pillar supporting sustainable national economic growth.

Korea has developed one of the world's most comprehensive and mature nuclear energy programs, with nuclear power playing a central role in ensuring reliable, low-carbon electricity supply. As of today, nuclear energy constitutes a significant share of Korea's electricity generation, supporting energy security, price stability, and climate change mitigation.

To ensure the stability of electricity supply and demand, Korea establishes a long-term (15-year) Basic Plan for Electricity Supply and Demand every two years. This plan forecasts future electricity demand and outlines the corresponding generation capacity and energy mix.

Under the 11th Basic Plan (2024–2038), two large-scale nuclear power plants and one small modular reactor (SMR) have been approved for new construction. In 2026, the government plans to formulate the 12th Basic Plan (2026–2040), which will serve as a mid- to long-term roadmap for managing electricity supply and demand in a stable and sustainable manner, with a strong emphasis on expanding renewable energy and achieving carbon neutrality.

The plan will more accurately project overall electricity demand, taking into account additional drivers such as the 2035 Nationally Determined Contribution (NDC) for greenhouse gas reduction, the growth of artificial intelligence (AI), data centres, and electrification. Based on these projections, it will establish

a carbon-free-oriented energy mix that carefully balances carbon neutrality, energy security, and economic efficiency. In this context, emerging technologies such as Small Modular Reactors (SMRs) and advanced reactor concepts are briefly introduced as potential contributors to future energy systems, especially in synergy with renewable energy sources.

Finally, the lecture shares key lessons learned from Korea's nuclear experience, including institutional arrangements, human resource development, and industry-academia-government cooperation.

Keywords: *Korea, Nuclear Role, Energy Mix, Policy, National Plan*