The 22nd Annual Conference on Global Economic Analysis
Warsaw, Poland, June 19-21, 2019

An Analysis of the Effects of Korea's Energy Transition Using the GTAP-E-Power Model

Jong-Hwan Ko
Pukyong National University, Korea
jonghko@pknu.ac.kr

Abstract

The Korean government adopted its 8th Basic Plan for Long-Term Electricity Supply and Demand for 2017-2031 (8th BPE) on December 29, 2017. The plan entails significant changes to the power mix, 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 8th BPE aims to take into account the commitments made at the Paris Agreement on Climate and 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). The share of renewables will be raised to 20% by 2030 from 6.2% in 2017. Since the closure of the oldest nuclear reactor (Kori 1) in June 2017, Korea has been operating 24 nuclear reactors with a total capacity of 22.5 GW. Amid growing public concerns over nuclear safety, the government announced its nuclear phase-out roadmap in October 2017, which includes: a) the cancellation of plans to build the six planned nuclear reactors; b) no extension of the lifespan of 14 aging nuclear power reactors, totaling 12.5 GW of capacity; and c) the closure of Wolsong 1 (which is now the oldest reactor) earlier than scheduled. Korea will gradually reduce the number of nuclear reactors from 24 in 2017 to 18 in 2030. Nuclear power capacity will first increase to 27.5 GW by 2022, and then will gradually decline to 20.4 GW by 2030.

This paper aims to quantify the economic and environmental impacts of Korea's energy transition using the GTAP-E Power model (Peters, 2016). The GTAP-E Power model extends the GTAP-E model (Burniaux and Truong, 2002) to include transmission and distribution as well as substitution between nuclear, coal, gas base load, gas peak load, oil base load, oil peak load, hydro base load, hydro peak load, wind, solar, and 'other' power. Electric power substitution is represented with a nested additive constant

elasticity of substitution which, opposed to the traditional constant elasticity of substitution, ensures that the sum of demands for generation from each technology is equal to total demand for electricity generation.

In this study, scenarios for Korea's energy transition are formulated based on the 8th BPE. The potential macroeconomic and microeconomic effects and environmental impacts of the implementation of the 8th BPE are measured.

The final version will be uploaded soon.

References

Burniaux, Jean-Marc and Truong P. Truong (2002), "GTAP-E: An Energy-Environmental Version of the GTAP Model", *GTAP Technical Paper No. 16*.

Peters, Jeffrey (2016a), "The GTAP-Power Data Base: Disaggregating the Electricity Sector in the GTAP Data Base", *Journal of Global Economic Analysis*, Vol. 1, No. 1, pp. 209-250.

Peters, Jeffrey (2016b), "GTAP-E-Power: An Electricity-detailed Economy-wide Model", *Journal of Journal of Global Economic Analysis*, Vol. 1, No.2, pp. 156-187.