# The Analysis of Security Cost for Energy Sources in Korea

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**Overview**

With rising global concerns for the energy security, unstable supply of fossil fuels and massive energy demand of developing countries require urgent policy responses for national energy security. However, little attempt has been made at defining energy security and measuring the cost of energy security.

In this study, classifying the energy security into supply security, economic security, and climate change mitigation effect, we calculate security cost of different energy sources for producing electricity in Korea, such as coal, oil, liquefied natural gas (LNG), nuclear, as well as photovoltaic and wind, which are regarded as new energy sources. Through the comparison of the energy security costs, we suggest new energy policy based on reducing county-wide energy security cost.

**Methods**

Following the method used in the study of Jun et al. [1], total security cost of each energy source is calculated by summing the cost of supply security, economic security, and climate change mitigation effect

together.

First, the cost of supply security is defined as the opportunity cost that a country pays in electricity generation under the possibility of supply disruption of certain energy source. The cost is calculated by multiplying the net GDP loss from supply disruption by the disruption probability stemming from both depletion and geopolitical instability.

Second, the cost of economic security for each energy source is calculated by multiplying four elements together: (1) the degree of supply and demand concentration, (2) the portion of the fuel price which is used to generate electricity, (3) the volatility of a price, (4) the unit cost to generate electricity from each energy source. Here, we use the *normalized Hirschman-Herfindahl Index* (HHI) in order to measure the degree of supply and demand concentration.

Finally, the climate change mitigation effect is crucial in energy security. We consider the environmental cost from some major environmental pollutant such as $CO_2$, $SO_2$, $NO_2$, and TSP (total suspended particle). The environmental damage from the pollutants is distinguished into six types: the damage from dust, the damage to the visibility, the damage in agricultural production, the mortality risk, the risk of diseases, and the global warming. Total environmental cost for each energy source is calculated by summing these six types of cost together.

**Expected Results**

Through the analysis of security cost for six energy sources, we expect that the security cost of nuclear energy, photovoltaic, and wind is much cheaper than that of traditional fossil fuels. Especially, in terms of economic security cost, we expect that photovoltaic and wind are superior to fossil fuels as well as nuclear energy. Therefore, through the results, we will be able to suggest the expansion of electricity generation from new energy sources in Korea: photovoltaic and wind.

**References**

[1] Jun, E., Kim, W., Chang, S. H., 2009, "The Analysis of Security Cost for Different Energy Sources," Appl. Energy, Vol. 86, No. 10, pp. 1894-1901, 2009.