Analysis of the Relationship between Energy (Useful Work) and Economic Growth of Korea

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ABSTRACT

Over the last half-century, Korea has achieved remarkable economic growth enabling it to become the world's 11th largest economy. There have been various efforts to identify the driving forces of its rapid economic growth and the relationship between energy and economy has also attracted attention. However, conventional energy analyses have limitations since they did not consider the actual services energy provides for economic activities.

Useful work measures the amount of exergy finally used at the end-use stage and is focused on the result of an energy use rather than energy input. Moreover, it considers both of quality of energy and the thermodynamic second-law efficiency, which gives better insights on the role of energy in economic growth. Useful work has been a main driver for Korea's economic development and it has been affected by industrial structures, economic shocks, and energy policies.

Korea's industrialization in the 1960s and 1970s has driven a rapid increase of useful work consumption until the oil shocks in the 1970s, which have slightly slowed down the growth of useful work consumption and have contributed to the diversification of energy sources. In the late 1980s and 1990s, Korea's useful work consumption has accelerated due to the increasing demand in industry and transportation sectors. After Korea's financial crisis in 1997, the growth rates of GDP and useful work consumption have slowed down.

Korea's rapid industrialization has increased the shares of mechanical & high temperature heat uses and aggregate exergy efficiency has improved faster than other countries. As a result, Korea became to be able to produce more with less energy inputs and energy intensity has declined. However, useful work intensity has shown more stable appearance thanks to the improvement of exergy efficiency, which was clearer when residential & transportation sectors are not included since they have shown different appearances from industrial and services sectors.

In this paper, Korea's energy sectors are briefly introduced in advance and the processes to estimate useful work consumption is summarized. The evolution of Korea's useful work consumption, exergy efficiency, useful work intensity, and their relationships with Korea's economic development history are also mentioned.

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