Synthetic Fuel Production in Prewar and World War II Japan: A Case Study in Technological Failure

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Abstract

Japan is a country largely lacking supplies of many essential natural resources including petroleum, coal, and iron ore. As her industrial base and economy expanded in the 1920s and 1930s, Japan's dependence on imports of these resources became increasingly evident. The onset of the Depression in the 1930s further threatened Japan's lifeline, and in effort to become economically independent and self-sufficient in natural resources (autarchy) Japan's militaristic government pursued a policy of territorial expansion. Beginning in 1937, Japan's military forces swept out of Manchuria into China and then into Southeast Asia in search of strategic materials such as petroleum, coal, copper, zinc, and rubber.

To achieve independence in petroleum, the Japanese developed a dual approach: they would acquire natural petroleum sources in Southeast Asia and at the same time establish a synthetic fuel industry for the conversion of coal to oil. Actually, the Japanese had begun research on synthetic fuel in the 1920s, only a few years after other countries like Germany and Britain that lacked sources of natural petroleum. They did excellent laboratory research on the coal hydrogenation and Fischer-Tropsch (F-T) conversion processes, but in their haste to construct large synthetic fuel plants they bypassed the intermediate pilot-plant stage and failed to make a successful transition from small to large-scale production. Unable to synthesize liquid fuels from coal, they instead derived significant quantities from the technologically simpler coal carbonization and shale oil distillation processes. In the last year of World War II, the Japanese attempted to revive their synthetic fuel industry and entered into an agreement with IG Farben for technical assistance. Germany's defeat ended this final effort. The Japanese synthetic fuel industry presents a good case study of technological failure. It shows that high-quality basic scientific research does not necessarily translate into large-scale technological success. Although the argument holds for both coal hydrogenation and F-T, this paper will examine only the F-T process.