RECENT DEVELOPMENT

CHINA’S CONFIDENCE IN COAL LIQUEFACTION RESTS ON AN UNSTEADY FOUNDATION

I. INTRODUCTION

The rapid pace of China’s economic growth is widely recognized. However, the national policies underpinning that growth are less well-known. In 1993, China became a net importer of oil, primarily from the Middle East, and ever since that time, the country’s leadership has been working aggressively to diversify energy supplies. Coal liquefaction is part of that energy policy, which also includes stabilizing domestic oil output, improving other alternative energy technologies, and enhancing energy efficiency.

Coal liquefaction has a long and infamous history. Developed in Germany in the early 20th century and perfected there during the Nazi era, the coal liquefaction process has been favored by countries like Germany, South Africa, and China that have abundant coal reserves but little petroleum. Coal liquefaction converts low-quality coal into synthetic oil products, such as methanol or dimethyl ether that can be used as fuels.


themselves or as feedstock for further refining.\(^5\)

The process seems like a win-win situation: a seemingly-inexhaustible domestic basic material can be turned into a fuel supply that is invulnerable to foreign embargoes. China relies on coal liquefaction as part of a larger plan to become free from international constraints so that it might exercise its influence more vigorously.\(^6\) However, China’s large wager on the future of coal liquefaction rests on an unsteady foundation. While China’s coal supply is huge,\(^7\) its mines remain in a state of disarray. In addition, while central planning of the coal liquefaction policy may be advantageous in some situations, it can present impediments to economic efficiency and lead to schedule delays. Furthermore, rapidly-accumulating environmental dangers may scupper the buildup of coal liquefaction plants before the national energy policy can really take shape.

II. CHINA’S ENERGY POLICY

China’s energy policy is developed by the country’s main economic planning body, the National Development and Reform Commission (“NDRC”).\(^8\) China began working with coal liquefaction in the 1980s, but lately, interest in the technology has intensified because of high global oil prices, a voracious domestic consumer demand for fuel, and China’s strategic and national interests.\(^9\) Three large-scale coal liquefaction projects are underway and thirty more are in the planning stage around the country.\(^10\)

The development process for a single plant is long and expensive. A single coal liquefaction plant can cost five to thirteen billion dollars and take six years to build.\(^11\) China is engaging foreign companies in research and development deals, but it never grants significant influence over Chinese companies or anything close to majority ownership to those foreign

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6. Evans, supra note 2, at 631–32.
7. *Alchemists*, supra note 5 (citing the size of China’s coal reserves relative to other coal-producing nations).
8. *Id.*
9. Qi, supra note 3; Fairley, supra note 4; Evans, supra note 2, at 632.
10. *Alchemists, supra* note 5; Qi, supra note 3.
companies in the Chinese projects being developed.\textsuperscript{12} Sasol, a South African oil company, along with a unit of Shell, are the main foreign players for coal liquefaction projects in China.\textsuperscript{13} Partial or complete state ownership all but guarantees that "China's government will support this project until the liquid flows," says Shanghai-based coal expert Zhou Zhijie, noting the importance of coal liquefaction to China's energy security policy.\textsuperscript{14}

China's huge coal reserves play an important role in its energy policy. China has the third-largest reserves in the world, behind the United States and Russia, and just ahead of India and Australia.\textsuperscript{15} China's reserves account for about 13\% of the world's total, enough to sustain the country's growth for another century, even at today's breakneck economic growth pace.\textsuperscript{16} China also consumes more coal than the United States, Japan, and the European Union combined,\textsuperscript{17} and its demand for coal is sparking development in far-flung portions of the world's most populous and fourth-largest country.\textsuperscript{18} For example, Inner Mongolia is home to the world's seventh-largest coalfield and lately has become the hub of new highways, railways, an airport, and a coal liquefaction plant.\textsuperscript{19}

### III. The Process of Coal Liquefaction

There are two main types of coal liquefaction processing: Fischer-Tropsch and Bergius. China relies on both processes.\textsuperscript{20} Fischer-Tropsch reduces coal to a mixture of hydrogen and carbon monoxide known as "syngas."\textsuperscript{21} A catalyst is introduced into the syngas mixture, causing carbon and hydrogen atoms to
reconnect and yield fuels.\textsuperscript{22} The Bergius process pulverizes the coal, blends it with existing synthetic oil, then treats the mixture with hydrogen and heat in the presence of a catalyst, which once again yields fuels.\textsuperscript{23} Bergius, which bypasses the Fischer-Tropsch syngas step, is the more efficient of the two processes, capturing 55\% to 65\% of the energy in the coal.\textsuperscript{24} Fischer-Tropsch, in contrast, only captures only 45\% of coal’s energy.\textsuperscript{25} However, the Bergius process tends to be more complicated, requiring several additional processing facilities than the Fischer-Tropsch process.\textsuperscript{26}

IV. PROBLEMS WITH RELIANCE ON COAL LIQUEFACTION

A variety of factors make China’s heavy reliance on coal and coal liquefaction a risky proposition. First, China’s coal mines are characterized by their high levels of deadly mining accidents. The human cost of extracting coal in China is sobering and surpasses that of similar mining operations in other countries. In 2006, 4,746 miners lost their lives in 2,845 separate incidents, while 3,786 miners died during 2007.\textsuperscript{27} It seems to be a trend that goes on year after year, resulting in thousands of deaths. About one-third of China’s coal is produced from tiny, inefficient, and especially unsafe mines.\textsuperscript{28} The presence of illegal mines, formed to take advantage of high coal prices and operating with no oversight, further complicates safety issues.\textsuperscript{29} Apart from the obvious human costs of mine disasters, these incidents also affect coal supplies to liquefaction plants as production is interrupted, sometimes to seek scapegoats before restarting production while other times the mines are shut down altogether.\textsuperscript{30}

\begin{itemize}
\item \textsuperscript{22} Id.
\item \textsuperscript{23} Id.
\item \textsuperscript{24} Fairley, supra note 4.
\item \textsuperscript{25} Id.
\item \textsuperscript{26} Id.
\item \textsuperscript{28} Fairley, supra note 4.
\item \textsuperscript{29} A Ravenous Dragon, supra note 1, at 20–21. See also Chinese Government’s Official Web Portal (noting that China’s government made the crackdown of illegal mines a national priority), http://english.gov.cn/2006-05/02/content_273030.htm.
\item \textsuperscript{30} See, e.g., Du Guodong, Nine Managers Jailed for Coal Mine Blast in N. China
\end{itemize}
Second, coal liquefaction is a water-intensive process, and China’s water resources are precarious. A typical plant will consume ten tons of water for every ton of synthetic oil produced. Most coal-rich provinces lack adequate water resources before new coal liquefaction operations are fully implemented. This puts coal liquefaction plants in competition with growing, thirsty cities and other industries. In addition to consuming water, coal liquefaction plants create waste water, industrial effluent, and waste gas. For example, coal combustion releases sulfur dioxide, a deadly gas that is believed to contribute to 400,000 deaths in China per year. China already contains some of the world’s most polluted cities, which have produced a startling amount of pollution-related “[p]remature deaths, morbidity, restricted activity, chronic bronchitis, and other health effects.” These impacts, thanks in part to the coal-fired power plants that provide China with 70% of its electricity, cost the country $32.3 billion each year.

Third, there is also considerable economic risk. In 1999, it ordered the country’s first coal liquefaction plant to be built near a deposit of coal that was only later determined to be unfit for


31. Fairley, supra note 4; A Large Black Cloud, THE ECONOMIST, Mar. 15, 2008, at 17 (reporting that China’s water supply is in a precarious state because of “ever-increasing industrial and agricultural use. The amount of water available per head of population is only a quarter of the global average. In the arid north and west of the country that figure falls to a tenth. Two in three cities already suffer from shortages. Groundwater is being pumped out much faster than it is being replenished. Not even Beijing treats all its sewage; other cities treat none at all.”). See generally THE WORLD BANK, COST OF POLLUTION IN CHINA: ECONOMIC ESTIMATES OF PHYSICAL DAMAGES, (2007), available at http://siteresources.worldbank.org/INTAPREGTOOPENVIRONMENT/Resources/China_Cost_of_Pollution.pdf (discussing the environmental impacts of China’s economic growth).

32. Kosich, supra note 11.
33. Qi, supra note 3.
34. Qi, supra note 3.
37. Id. See also PBS supra note 35.
liquefaction. In addition, the profitability of coal liquefaction depends on high global oil prices to make the coal energy source a less expensive alternative. Experts disagree at what point coal liquefaction ceases to be a less expensive alternative to oil, and estimates vary from $25 to $50 per barrel of oil. If prices fall below this point, then China could be left with a vast, expensive, and unprofitable infrastructure dedicated to coal liquefaction. China’s rapid economic growth may slow down, or China may be forced to seek alternatives to coal for its fuel supplies, which may also threaten the expensive investments in coal liquefaction.

Finally, economic risk is inherent whenever a project depends on foreign expertise, as is the case in China’s partnerships with Sasol and Shell. If those companies decide to pull out, or if they are bullied out as some energy companies in Russia have been, important research and development deals would collapse. This would harm Chinese energy production and potentially the overall Chinese economy until such investment could be replaced.

V. CONTRAST WITH AMERICA’S ENERGY POLICY

The lure of energy independence and profit has also tempted American energy companies to revisit coal liquefaction with a vigor not seen since the Arab Oil Embargo of the late 1970s.

A tax credit to promote the production of synthetic fuels from coal liquefaction became law in 1980. The coal liquefaction industry in America still depends on tax credits to steady its volatile financial condition. The federal government provided tax credits totaling $2 billion in 2003. However, the

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38. Qi, supra note 3.
39. Qi, supra note 3; Fairley, supra note 4.
40. Qi, supra note 3; Fairley, supra note 4.
41. China may continue to pursue coal liquefaction even if it becomes uneconomical. See generally Robert W. Gee et al., China’s Power Sector, 28 ENERGY L.J. 425 (2007) (observing that China’s economy continues to be driven by the dictates of central planning and socialist-centered political philosophy). Whether an uneconomical policy could or would be sustainable is a matter of speculation, but it would be a drag on the overall Chinese economy.
42. See, e.g. Another Inspector Calls, THE ECONOMIST, Mar. 29, 2008, at 83.
44. Gee et al., supra note 41.
45. Id.
46. Id. Also, President George W. Bush’s final State of the Union Address hinted at continued commitment to coal power, but coupled that commitment to development of carbon sequestration. Both policies could benefit the coal liquefaction industry going
VI. ANALYSIS

One of the United States’ great strengths is that its states are laboratories of democracy, including energy policy. States like California and Pennsylvania have taken the lead in crafting green policies to meet fast-growing energy needs. The United States also has a tradition of legislative oversight, agency oversight, science, and activism that has advanced the cause of environmental conservation. While the political climate affects regulation, a baseline has been created by a national bureaucracy and civil society to maintain and advance energy policy and environmental protection.

It is difficult to imagine broad implementation of such hybrid green- and market-driven energy policies in China, given China’s unique combination of a command economy coupled with elements of capitalism. The loosening of tight central controls
helped spark an economic boom in China. However, economic expansion now appears to be advancing beyond the government's ability to keep pace with regulatory, safety, alternative energy, and conservation mechanisms to simultaneously protect the environment and sustain economic growth.\textsuperscript{54} China's first general environmental protection law was passed in 1979 and was followed by a series of others, breaking down environmental issues into categories such as air quality, water quality, and open space.\textsuperscript{55} Environmental protection is subordinated to the Communist Party's will, which today is preoccupied with economic development, global strategic aims, and staging the Olympic Games in Beijing in 2008.\textsuperscript{56} In addition, existing environmental protection agencies are constantly reshaped, renamed, and understaffed.\textsuperscript{57} For example, the State Environmental Protection Administration has a staff of only 200 workers at the national level.\textsuperscript{58}

It is unlikely China will experience a reconciliation of its desire to pursue coal liquefaction or its broader energy policy with environmental protection until legal mechanisms are strengthened. As such, China appears to be acquiring the trappings of energy regulation and unified national energy policy, including coal liquefaction, without any concomitant compliance and enforcement.\textsuperscript{59} For example, mine managers

\footnotesize {54. See generally Oster, supra note 53. (observing that “China’s energy predicament is rooted in the decision it made three decades ago when it began to embrace a market economy”). Now that economic modernization is occurring at a rate faster than either the United States or Japan achieved, China’s top energy policy planner is faced with a threat to Beijing’s authority and has conceded that “[i]t is impossible for our central government to go everywhere to see [energy and environmental problems on a national scale.” Id.

55. Alford & Liebman, supra note 28, at 710.


57. Alford & Liebman, supra note 36, at 707.

58. Id. at 709.

59. See generally, Jianjun Tu, supra note 27 (noting that the State Administration of Work Safety that investigates coal mine accidents is overworked and hamstrung by
may be punished severely for deadly incidents, but many coal mines remain in operation despite orders by the central government to shut down. 60 Similarly, while there is discussion of creating a new energy ministry to develop a national energy strategy, 61 such a ministry would still be a tool of the Communist Party and thus unlikely to be an independent agent to ensure compliance and enforcement. Widespread corruption also remains a barrier to any genuine national energy scheme that includes coal liquefaction. In 2005, “the central government found that more than 4,500 government officials illegally held stakes in coal mines and frequently covered up safety violations.” 62

Finally, coal technology can be cleaner than that which China is currently pursuing. 63 Applicable nascent technologies include recycling the heat from waste gas and drying coal before it is processed to make exhaust cleaner. 64 China could also reduce transportation pollution by ending its curious practice of exporting coal at the same time it imports coal to meet domestic demand. 65

VII. CONCLUSION

As a result of these problems, the development of coal liquefaction in China is occurring somewhat irrationally, the product of strategic concerns, unevenly enforced government

corruption between local officials and mine owners.); Gee et al., supra note 41, at 435–36; Dali L. Yang, Total Recall, THE NATIONAL INTEREST, Feb. 29, 2008, http://www.nationalinterest.org/Article.aspx?id=16996 (noting that “[w]hile the central government imposes increasingly stringent regulations to counter the widespread corruption in the coal mining industry, there remain places in China where ‘the mountains are high, and the emperor is out of sight.’”).


61. Gee et al., supra note 41, at 436.

62. See Oster, supra note 53.

63. See Can coal be clean?, THE ECONOMIST, Nov. 30, 2006, at 40 (explaining the variety of options available to coal-burning utilities to make them cleaner); Bradsher & Barboza, supra note 53 (explaining that the Chinese central government is requiring all new coal-fired power plants to have smokestacks that remove ninety-five percent of sulfur dioxide emissions and all existing plants are supposed to have the modified smokestacks by 2010). However, like many other environmental initiatives in China, this initiative will likely be hampered by insufficient oversight, corruption, and illegal operations that exist outside government oversight. China’s central government also could couple coal-fired power plants and coal liquefaction with a greater emphasis on renewable energy.

64. Id.

controls, and apparent disregard for mine safety. China’s coal liquefaction policy is further muddled by a 2006 central government order that limited new coal liquefaction plants to only large-scale projects that the government could presumably better control. In contrast to the United States, China has assumed a large concentration of risk in large-scale coal liquefaction projects that rest on an unsteady foundation.

Historically, countries turned to coal liquefaction in times of distress—such as Germany during World War II or South Africa during the Apartheid era—when it presented the only viable option for producing high quality liquid fuels. Now China is turning to this technology as a matter of choice rather than necessity. Due to strong state support and control, its coal liquefaction companies are cushioned against economic downturns, mishaps, strict timelines, and domestic competition that would otherwise impact a novel venture. So what does all this mean for the future of coal liquefaction in China?

China is hungry for all kinds of raw materials, from oil to metals to timber, and it is scouring the globe to obtain them. It is engaged in the “economization of international security affairs” to ensure a sound and varied energy supply to fuel its economy and military buildup. This policy is unlikely to change because of strategic reasons. Thus, coal liquefaction will likely continue to play a small, but growing role in China’s energy supply. However, it will likely grow slowly and painfully as problems with safety at coal mines and liquefaction-related environmental effects continue to go unaddressed.

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66. See generally Gee et al., supra note 41, at 425–6 (recounting the obstacles in China to energy policy implementation).
68. Evans, supra note 2, at 642.
69. See generally A Ravenous Dragon, supra note 1 (detailing China’s global quest for natural resources).
70. Evans, supra note 2, at 628.