

The Influence of the Shale Gas Revolution upon the U.S. and China's Manufacturing Industry

Heng Wu *

School of International Studies, Peking University, Beijing100033, China

*286410209@qq.com

Abstract

The vigorous development of shale gas in the United States will drive the drop of natural gas price and power generation cost, reduce the manufacturing cost in U.S. and help revive the U.S. manufacturing industry. The increasing competitiveness of the U.S. manufacturing makes China's manufacturing industry face serious challenge in this energy reform.

Keywords

Shale Gas, Energy, Manufacturing.

1. Shale Gas Revolution Helps Manufacturing Return to the U.S.

The U.S. manufacturing used to be brilliant. After the end of World War II, the additional value of U.S. manufacturing accounted for two-thirds in the world. Relying on advanced manufacturing technology and complete manufacturing system, it used to be so far ahead in manufacturing field that all other places were thrown into the shade. However, with the shift of the U.S. government's industrial policy, into the 21st Century, the status of U.S. as the "world manufacturing plant" has gradually been replaced by China, which owned strong policy support, cheap labor and land. In 2010, China overtook the U.S. in manufacturing scale and leaped to No.1 in the world. The heavy inflow of manufacturing jobs and capital into China caused a great panic in the American society. The U.S. government put forward the strategy of "reindustrialization" and the policies of *Manufacturing Enhancement Act* and *National Export Initiative*, etc., which highlighted the U.S. determination to reshape manufacturing.

After 2010, the competitiveness of U.S. manufacturing showed indications of recovery and there was more and more evidence of this. The output of U.S. manufacturing increased, the investment sped up, the rate of capacity utilization rose and the rebound of manufacturing employees suggested the fact that the U.S. manufacturing has recovered. Among them, the energy cost advantage due to shale gas revolution is an important impetus for U.S. manufacturing.

The U.S. had begun to exploit shale gas since 1982. After 20 years of efforts, it has realized horizontal drilling, hydraulic fracturing and other technical breakthroughs. In 2005, the shale gas yield in the U.S. was only 29.6 billion cubic meters. In 2015, the shale gas yield in the U.S. jumped to 376.6 billion cubic meters, 12 times higher than that of 2005. The increase of shale gas yield enabled the U.S. to surpass Russia and become the world's largest natural gas producer in 2009 and an LNG exporter in 2016.

At present, the development of shale gas makes the U.S. build a huge cost advantage in the upstream and downstream industries of natural gas and energy-intensive industries. The once-depressed chemical industry in the U.S. is also reinvigorated with the aid of the low costs of shale gas. Natural gas chemical industry tends to replace the petrochemical industry. This is undoubtedly a cardiotonic for the policy of "reindustrialization" and boosts U.S. manufacturing to enter a period of rapid revitalization.

2. The Influence of Lower Electricity Cost on the U.S. and China's Manufacturing Industry

Along with the constant progress of shale gas exploitation technology, the total natural gas yield in the U.S. continues to grow. In 2015, the U.S. natural gas yield increased by 19% over the previous year and set up a new record of 770.2 billion square meters. Sufficient yield allowed natural gas price in the U.S. to have an income parable low cost advantage, only about 1/5 the price of Asia and 1/4 the price of Europe. Low natural gas price further promoted the decline in the price of coal, electricity and other U.S. energy as a whole and endowed U.S. with very strong comparative advantages in energy price. In 2015, the average price of U.S. industrial power was about RMB 0.43 yuan/KWH (as per the average exchange rate in 2015, 6.2284), while the price of China's industrial power was about 0.79 yuan/ KWH. The price of U.S. industrial power was nearly 1/2 that of China's industrial power. Among them, as a result of shale gas revolution, the proportion of gas generation in gross generation rose from 18.76% in 2005 to 32.7% in 2015. The generation cost was about 0.33yuan/KWH, while China still gave priority to coal-fired unit generation. The generation cost was about 0.37yuan/KWH. The decline in U.S. generation cost allowed U.S. industrial enterprises to reduce operation costs, which in turn made its manufacturing gain more cost advantages, in comparison to some international competitors, for example, China.

Today, China's and U.S. labor costs are gradually diminishing. Low energy price is undoubtedly a huge temptation for manufacturing enterprises. Not only have some developed countries tended to move their plants to India and Vietnam, etc., due to changes in China's manufacturing environment, i.e., the aging of population, the year-by-year growth of labor costs, land price and commodity price, too high taxes and energy price, etc., but also the U.S. has offered a series of preferential conditions to attract enterprises to withdraw because of policy support and mandatory requirements.

3. The Influence of Lower Raw Material Costs on the U.S. and China's Manufacturing Industry

Low natural gas price and adequate natural gas supply make the U.S. manufacturing regain competitiveness. The petrochemical industry, in particular, yields significantly. With the sharp decrease of natural gas price, many large-scale chemical enterprises announced to establish a new chemical production base in the U.S. or expand its existing production base. Low natural gas price has a huge impact on the chemical industry. On the one hand, the chemical industry is a high energy-intensive industry. On the other hand, natural gas and natural gas condensates (mainly ethane) can be directly used for raw materials.

Raw material costs account for a large proportion in chemical industry. In 2006, the consumption of fuel and non-fuel energy in the whole chemical industry accounted for 1/4 in the U.S. manufacturing. With the decrease of natural gas price, the U.S. chemical industry has been able to compete with peers in other areas in the world, especially chemical producers in Asia and Europe using crude oil as the raw material.

In the petrochemical industry, ethylene is one of the most important chemical products. Whether plastic bottles, building materials or household chemicals, i.e., shampoo, detergent, etc., products based on ethylene are ubiquitous in our daily life. In China, raw materials used to make ethylene mainly come from naphtha- a kind of crude oil product. While in the U.S., ethane isolated from natural gas is more used to manufacture ethylene. The prices of these two kinds of raw materials are closely related to those of oil and natural gas, respectively.

Relative to China, which mainly used naphtha as a raw material of ethylene, the price of naphtha fluctuates dramatically, due to the influence of international oil price. While manufacturing ethylene using ethane acquired from low-cost and stable natural gas provides more cost advantages for U.S. chemical manufacturers. Before 2008, in the U.S. ethylene manufacturing, ethane accounted for about 50% of the raw material structure of ethylene and naphtha for about 22%. In 2012, ethane accounted for 65% and naphtha for only 10%. According to the statistics of *Global Ethylene Industry in 2015*

and the Development Trend, in 2015, the manufacturing cost of ethylene from ethane in the U.S. was about \$290/ton, while the cost in China was about \$690/ton. It was by taking the advantage of cost that the competitiveness of U.S. basic chemical industry had increased its operation rate from less than 60%, which was almost the worst in the world from 2008 to 2009, to more than 93%, which is now the strongest operation rate across the industry in the world.

In 2015, the ethylene yield in China was 17.146 million tons. The apparent consumption was 18.368 million tons. That is to say, China was still unable to suffice itself in ethylene. Facing a series of products with natural gas and ethane as raw materials in the U.S. and Middle East, domestic ethylene has no price advantage. While the CIF price of polyethylene and other ethylene derivatives manufactured in Middle East, even after long-distance transportation, is still \$300-400 per ton lower than products manufactured in coastal chemical plants in China. Due to the launch of massive low-cost capacity in the Middle East, both the competitiveness and profitability of Chinese ethylene derivatives have fallen dramatically. Even the net export of polyvinyl chloride (PVC) products, which the U.S. has lost export advantage in, has increased by several times over the past few years. With the sharp increase of China's PVC capacity, still 40% of the U.S. PVC yield is used for export.

In 2016, the excess capacity of U.S. ethylene derivatives is expected to exceed 4 million tons. This part of excess capacity will be entirely used for export. Facing strong market competitiveness of U.S. with cheap raw materials and technical advantages, Middle East countries have developed downstream chemical industries, extended product lines and manufactured high value-added products in succession. This undoubtedly "adds insult to injury" in the highly competitive ethylene derivative market in China.

4. Conclusion

The U.S. shale gas revolution not only brings a significant reform to the field of energy and impacts the global oil gas pattern, but also triggers a huge opportunity for global economy or reshuffling. How China's manufacturing can stand erect in this "revolution" is worth pondering and extensive research. First of all, I think, China should set up a view on energy security in the new period, enhance its energy supply capacity and strengthen the exploitation and development of unconventional energy, such as shale oil gas, tight oil gas and coal-bed methane, etc. Meanwhile, make use of the status quo that OPEC member states reduce oil price jointly and that Russian natural gas price continues to go down to study how to import low-cost oil gas in multiple ways to guarantee energy security under open conditions.

Secondly, to accelerate energy production and consumption reform and transform from coal era to oil gas era. Although the total energy consumption in China ranks first in the world, the per capita consumption is still a far cry from developed countries. If we don't accelerate energy production and consumption structural reform, we won't be able to improve the existing environmental pollution or solve the problem of too high energy cost fundamentally.

Thirdly, it is necessary to gradually adjust the structure of manufacturing industry and improve the level of "made in China". In the whole industrial chain, the top is innovation. The bottom is mechanical processing and manufacturing. Currently, the advantage of China is processing and manufacturing, while the most sophisticated and innovative technology is still in the hands of the U.S. At present, only by giving consideration to both will China's manufacturing become the biggest winner.

Finally, China should make full use of Asian advantages and lead the development of Asian production chain to achieve win-win. Whether from the manufacturing system or the integrity of chain, the Asian manufacturing industry is in a leading position in the world. This is closely related to the all-round development of China's manufacturing industry and also related to the cultural tradition of some Asian countries and nations. For the next transformation and development of Chinese economy, this is also a huge opportunity. With the support of "one belt, one road", "made in China in 2025" and other policies, China needs to further strengthen and expand the domestic market,

change from overseas demands to domestic demands, drive and promote the improvement of Asian production chain through strong domestic consumption demands, guide and adjust the overall layout of Asian manufacturing industry through the operation of capital, technology and trade, etc., when low-end manufacturing shifts outward.

References

- [1] Electric Power Annual 2015——U.S Energy Information Administration
- [2] Annual energy outlook 2016——E.I.A
- [3] Fan, Bi. New Pattern of Global Energy: The Impact of the U.S. “Energy Independence” and China’s Response, China Economy Press, 2014.
- [4] Zhang, Jingming, Effects of Shale Gas Revolution on United States and the World, Technology & Economics in Petrochemicals, Feb 2013.
- [5] Harold L. Sirkin, Boston Consulting Group, Expertise & Impact Made in America, Again
- [6] <http://m.chinairn.com/news/20140917/175856862.shtml>
- [7] <http://m.chyxx.com/view/402585.html>
- [8] <http://m.chyxx.com/view/413004.html>
- [9] Ai, Huawei. 6 Truths about China’s Electricity Price. <http://www.chinapower.com.cn/>, Aug 25, 2016.
- [10] http://www.askci.com/news/201208/20/175158_51.shtml7
- [11] People’s Daily: Bring Manufacturing Back to America? Come off It! Jan 4, 2017.
- [12] Xu, Haifeng. Global Ethylene Industry in 2015 and the Development Trend, International Petroleum Economics, 2016.