

## Turning the Sea From Black to Green

I grew up in a small city called “Wu Hai” in Inner Mongolia. While few people around the world, including Chinese people, have heard of the city, Inner Mongolia is well known for its unbounded green grass-land, and is widely perceived that people in Inner Mongolia should be riding horses and drinking milk in their daily lives. However, that is not true for me. In fact, I rode a horse for the first time after I went to college in a suburban area close to Beijing.

Instead of meaning green grassland, “Wu Hai” actually means something else, yet something that is similarly elegant and romantic-“the Sea of Black Gold”. The name comes from a reason: Wu Hai has abundant coal resources. In 2012, it produced 38.6 million tons of coal, and placed 23<sup>rd</sup> among all cities in China<sup>1</sup>. Wu Hai is just one corner of Inner Mongolia. With many other cities producing similar or even more coal, Inner Mongolia ranked as the No. 1 coal producing province in China with about 1 billion tons of coal produced in 2012<sup>2</sup>, or over 25% of all national production. Figure 1 shows the distribution of coal in China geographically.

Figure 1 Distribution of Coal in China



Source: <https://www.stratfor.com/image/distribution-coal-china>

Coal mining is one of the pillars of industry for Inner Mongolia, and so unsurprisingly the economic development of the region and its cities follows the ups and downs of coal use in China. Figure 2 shows China’s coal production and prices from 1991 to 2012. While coal production in China has generally been increasing in the past 20-30 years, 1997-2000 was a period when coal production remained stagnant due to the economic crisis in Asia. During those years, demand for coal was substantially softened and prices crashed, leading to severe economic losses in the coal industry.

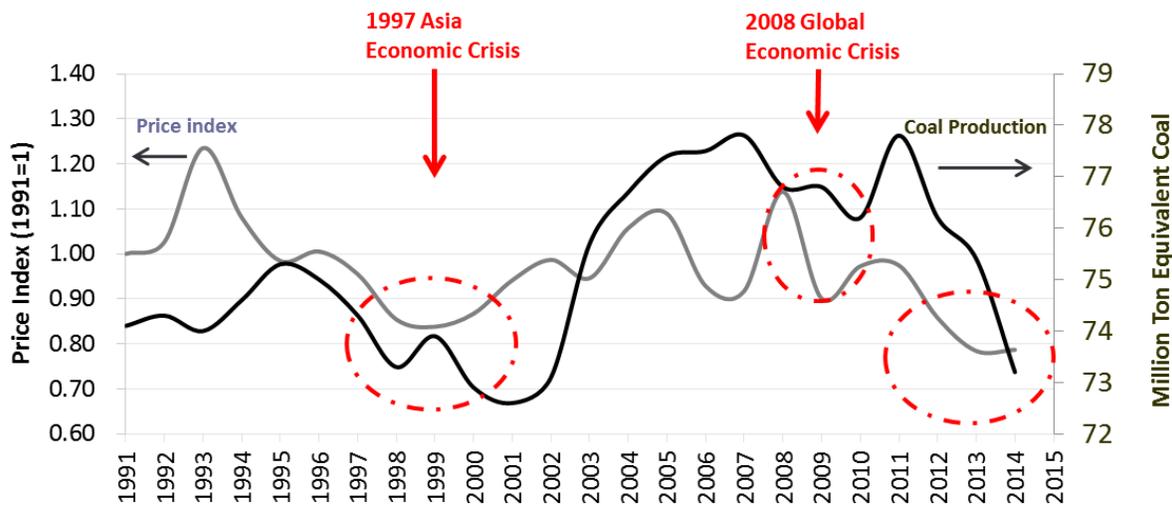
<sup>1</sup> <http://wenku.baidu.com/view/430e934aa76e58fafbb0034f.html?re=view>

<sup>2</sup> [http://www.360doc.com/content/13/1107/10/1723078\\_327348089.shtml](http://www.360doc.com/content/13/1107/10/1723078_327348089.shtml)

Just as Wu Hai is a microcosm of Inner Mongolia, my family is a microcosm of Inner Mongolia. I was in college between 1997 and 2000, which was when the education system in China had just changed and made college education no longer free. The annual tuition of around 2000 RMB, or about \$350, was a big burden for my family, as my father, like many others who worked for government-owned companies related to coal production or transportation, had not been paid for months at times.

Things started to change around 2001. The Chinese economy was on the path towards recovery. Government-owned companies started to become privatized. The real estate industry became hot, driving up tremendous demands for cement, steel, electricity, etc. all of which need coal as the energy input for production. Coal became a hot commodity in the extreme shortage of its supply. Piles of money awaited anyone who could get the “black gold” out of the ground. Almost everyone in Inner Mongolia became rich overnight. People bought houses, cars, luxury consumer products, etc. As indicated in Figure 3, GDP growth in Inner Mongolia was well above the national average. Especially in 2003-2005, its growth almost doubles that of the whole country. My dad, under peer pressure, achieved a lifelong dream when he bought a BYD car for himself. Twenty years back, that would have been the absolute symbol of upper-class wealth and social superiority.

**Figure 2 Historical Coal Production and Price Index in China**



Source: Chinese Statistical Yearbook (2005-2015)

Figure 3 Inner Mongolia and National GDP Growth Rate



Source: <http://www.economist.com/blogs/graphicdetail/2012/07/daily-chart-9>

However, it didn't last long. In 2013, the real estate industry began to cool down. The growth of China's macro economy also slowed down as China entered an era of the "new norm", as the Chinese government calls it<sup>3</sup>. In addition, air pollution problems have become severe in many major cities including Beijing and Shanghai. Burning coal is known as one major source for emitting carbon dioxide, nitrogen oxide, mercury, particulate matters (PM), and other hazardous pollutants that are related to the smog problem and/or climate change. In response to these problems, the Chinese government started to switch to cleaner alternatives, decreasing demand for coal.

Suddenly, it started to feel like time had traveled back 20 years ago in Inner Mongolia. Many enterprises have gone bankrupt. Many people have been laid off, and are only paid by government subsidies to support their basic life needs.

This is not an entirely new phenomenon in the sense that something similar happened during the economic crisis of 1997-2000. However, there is something new this time around. Due to the environmental concerns associated with burning coal, its demand for coal may decrease even if the macro economy continues to grow. It is apparent that Inner Mongolia can no longer rely on coal as the main pillar of economic development as it did in the past. It has to turn to something else to feed its 25 million people.

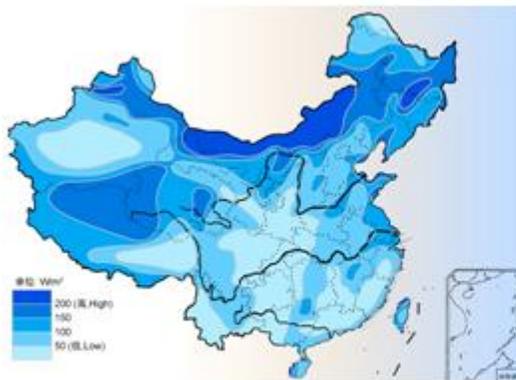
What is that something else? What is the future of Inner Mongolia? Does it mean that after providing the blood for the rapid economy development, Inner Mongolia is going to be abandoned by history?

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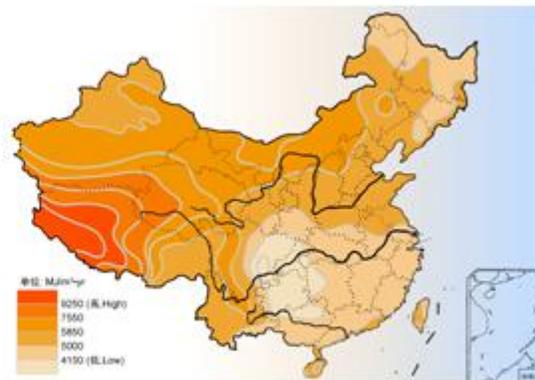
<sup>3</sup> The next slow period is 2008-2009 similarly due to the global financial crisis. However, since Chinese government managed to steer Chinese economy away from deep recession, this period was quickly passed and the growth in coal production was resumed.

Such an ending is undoubtedly miserable and depressing. Some may say that this is not unique and unavoidable in human history, and that it is the price to be paid as we progress toward a cleaner environment. However, the following two maps may provide a light glimmer of hope amid the darkness of desperation currently haunting Inner Mongolia.

The one on the left is a wind density distribution map for China. The deeper blue signifies more plentiful wind resource. Inner Mongolia is the place with the best wind resource in the country, accounting for 80% of the nation's wind resources<sup>4</sup>. The chart on the right shows similar information for solar resources. The deeper the yellow, the more abundant the solar resource. Though not quite as good as Tibet, Inner Mongolia is still among the regions with abundant solar resources. All of this is consistent with the geographical features of the region: with an average altitude of more than 1000 meters, Inner Mongolia has been a windy place; it has a temperate continental climate, with low precipitation and strong solar radiance year around.



中国大陆地10米高度年平均风功率密度分布图(90年代)



中国太阳能资源分布图 (MJ/m<sup>2</sup> · year)

Source: <http://cwera.cma.gov.cn/Website/index.php?ChannelID=39&NewsID=1434>

### **If one combines the blue and the yellow, Inner Mongolia can turn from a Sea of Black into a Sea of Green!**

In fact, this is what's been happening. Inner Mongolia has been leading the country's wind and solar power plant developments. Since 2007, the wind installed capacity has increased rapidly. In 2009 alone, more than 5 GW of wind capacity was added. By the end of 2015, the total installed wind capacity in Inner Mongolia has reached 31.5 GW<sup>5</sup>. Similarly, recent years have seen fast development of solar industries in Inner Mongolia. The total installed solar PV capacity is 4.9 GW<sup>6</sup> by the end of 2015. To put this into perspective: as of today, Texas, the state with largest wind installed capacity in the U.S. has 16 GW of wind, and California, the state with largest solar installed capacity in the US, has 3.7 GW.

<sup>4</sup> <http://202.119.108.161:93/modules/showContent.aspx?title=&Word=&DocGUID=8b131473017042fdb176105658b7d112>

<sup>5</sup> [http://www.nea.gov.cn/2016-02/02/c\\_135066586.htm](http://www.nea.gov.cn/2016-02/02/c_135066586.htm)

<sup>6</sup> [http://www.nea.gov.cn/2016-02/05/c\\_135076636.htm](http://www.nea.gov.cn/2016-02/05/c_135076636.htm)

However, many challenges remain for renewable development in Inner Mongolia. For example, the region has seen a high level of curtailment in renewable generation in recent years due to lower electric load growth and bottlenecks in export capability. To help solve this issue, State Grid has been constructing key Ultra High Voltage (UHV) transmission lines to export Inner Mongolia's power to eastern regions, addressing the air pollution problems in major cities. While this can help export more power and leads to more generation from renewables, there is more to be done to fully unlock Inner Mongolia's wind and solar resource potential.

It has now become a critical time for the Chinese government, both central and regional governments, to address these challenges. If done well, this not only helps address the short term problems of high unemployment and economic recession, but also sets Inner Mongolia up for a bright future so that its economy will be stronger in hedging the risks of heavy reliance on coal. Moreover, this strategy resonates beyond Inner Mongolia and China. At this critical moment when humanity is combating the climate change challenge and making a transition from fossil fuels to cleaner energy, it is inevitable that there will be winners and losers. For any successful policy and regulation, solving the problem for the losers is as important as developing the right incentives for the winners.