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Tech Talk - Coal Power and Air Pollution

Posted by Heading Out on February 4, 2013 - 2:38pm

Fifty years ago I began my undergraduate studies at the University of Leeds in the UK. It is not something I particularly dwell on, but the stories out of Beijing describing the air pollution in the Chinese capital this week brought back a memory. This story on CNN notes that visibility in Beijing has been cut to under 200 yards. Back in Leeds in December of 1962, the air quality had registered the highest levels of sulfur dioxide that had ever been recorded as air conditions generated smogs covering large parts of the country. What made it personal for me was that I lived about a mile from the University and had to walk there through the smog that covered the city. Despite it being daylight, there came a point where I could not see my hand with my arm outstreched (and I still vividly remember doing this). Crossing the Park to the University, there were cries in the mist as folk fell over some of the now invisible decorative iron edging along the walkways. From that time on, the air quality regulations took increasing effect and before long, the black buildings that I had walked past on my way through town were being cleaned and brought back to their original white condition, which they have retained in the years since.

Immediately after the Second World War, Britain needed the coal to power the reconstruction of the country, but during the time I was in college it was already clear that the days of unrestricted mining were over and that the transition to other fuels had already begun. It was not the air pollution in Leeds that was the driving force for the regulations, however, but more likely the presence of similar smogs in London and the South where those who governed the country lived. The major legislation began after the Great Smog of 1952. In a four-day period at the beginning of December, the combination of a fog, an inversion in the immediate atmosphere, and the increased use of coal fires to provide additional warmth generated a smog that is blamed for the immediate death of around 4,000 people and a strong influence on the consequent death of some 8,000 others.

I bring this up because the air pollution in both Beijing and in New Delhi is reaching levels where the government is beginning to move to help abate the immediate problem. In both capitals it is a combination of vehicle exhaust and power generation that is driving the problem, whereas back in the UK fifty and sixty years ago, vehicular exhaust was not nearly as much of a problem as burning coal. Yet I suspect that although these problems in Asia are not yet at the levels they reached in the UK, that they may be less tractable to solution.

Burning coal to generate power remains a relatively simple process, as does mining of the coal, for which a realistic estimate would suggest that there remains, for now, a plentiful sufficiency. (That latter point is, however, disputed by some). The EIA has recently pointed out that we are at a point where China will consume about half of the global supply of coal each year.

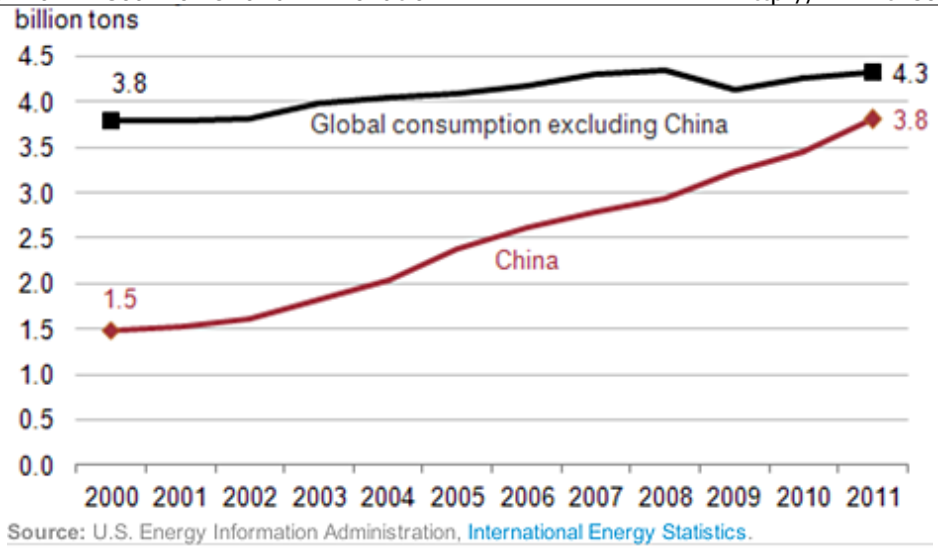

Figure 1. Chinese coal consumption relative to that of the rest of the world. (EIA)

At the rate of increase reported, it is likely that the two lines will cross before the end of this year. However, it should also be noted that India has been importing more thermal coal than China (a projected 118 million tons for 2012, in contrast with the 102 million tons imported by China). And as Mongolian coal becomes more available, so India may take over parts of the international supply that now flows to China from Australia, Indonesia and Africa.

The need for increasing levels of power to sustain the growth rates of India and China are most often discussed in terms of the oil and natural gas that these two countries are consuming, but it has been estimated that India has a shortage of around 10% between the level of demand and actual supply, leading to crippling blackouts such as that of last July.

It should be noted that the levels of air pollution from power generation can be controlled. The United States uses most of the roughly billion tons of coal a year that it produces for power consumption, but air quality has been successively cleaned to higher standards over the decades, so that smogs are now only a historic curiosity.

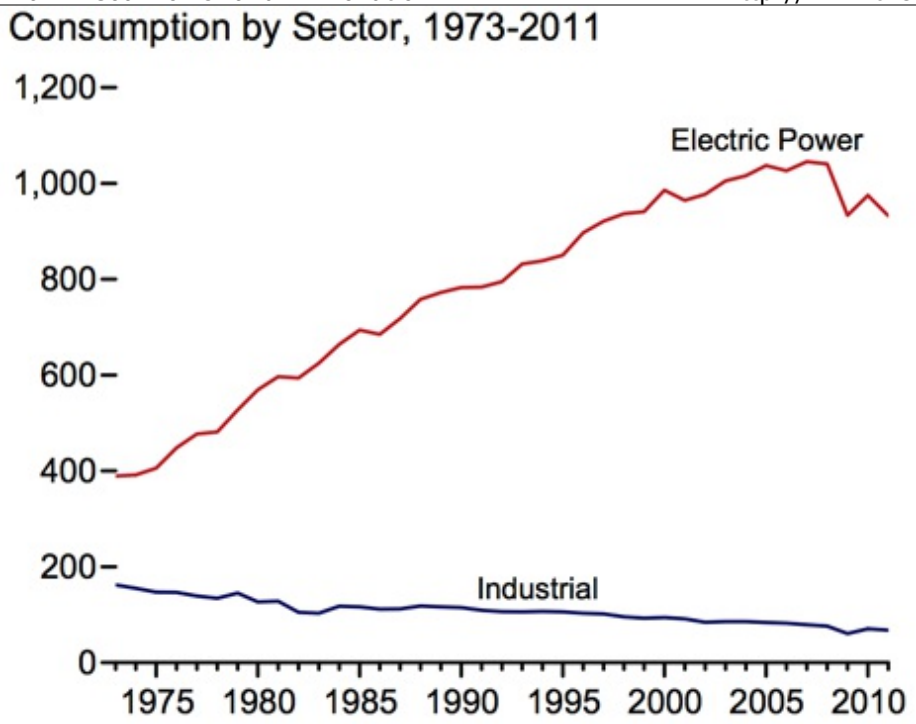

Figure 2. Coal consumption in the United States by end use. (EIA)

The efforts of the EPA, among others, have had a considerable impact on American air quality. This, for example, is the median air quality index for the District of Columbia over the past 30 years. (I am not sure where to get earlier data).

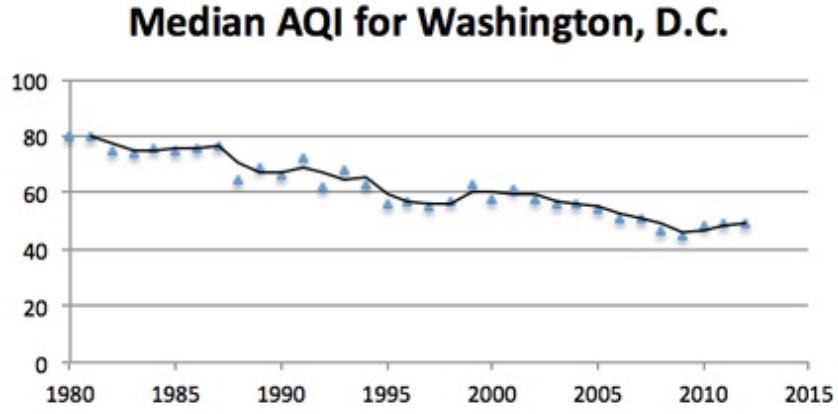

Figure 3. Median Air Quality Index for Washington D.C. (EPA)

It is thus demonstrably possible for China and India to clean up their air even as they increase their demand for coal. It should also be noted that over the past thirty years, the miles that Americans drive has also increased as I recently commented, and so, based on the above, the argument applies also to vehicular exhaust.

It is true that part of the imposed solution to date, in terms of the American coal used, has transferred demand to the lower sulfur coals of Wyoming rather than the higher calorific value but also higher sulfur contents of more Eastern states, but as regulations have changed the power plant requirements, so some of that earlier loss to Wyoming is being recovered.

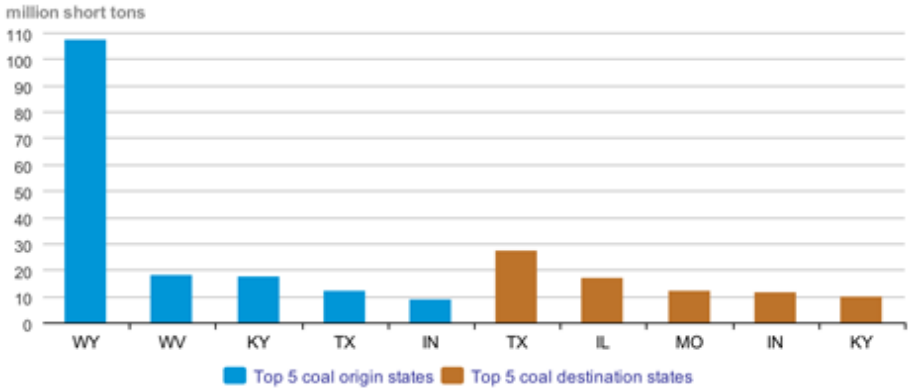

Figure 4. The top coal shipping and receiving states in the third quarter of 2012 (EIA)

Based on American experience, it is thus demonstrable that both China and India could clean up their air to American standards while still generating the power that they need through burning coal. Unfortunately, however, as the experience with mine accidents in China has shown, there are still too many operations too far from Beijing for central regulation to be fully enforced and complied with as yet.

Addendum

The Air Quality Index should be described. As the EPA Airnow site explains:

> EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health .Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country.

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*..air quality conditions are:*	*...as symbolized by this color:*
0-50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Figure 5. The gradation of the Air Quality Index. (EPA)