

# Setting the Record Straight on China: Energy and the Environment

**David G. Fridley**  
*Energy Analysis Department*  
*Lawrence Berkeley National Laboratory*  
*DGFridley@lbl.gov*

*Presentation to the*  
*National Association for Business Economics*  
*11 September 2000*

---

**Environmental Energy Technologies**

9/12/2000, p. 1

There is growing recognition of China's global importance in trade, economic growth, investment, military power, population growth, and climate protection—indeed, in many respects, China rivals or even exceeds the US in some measures in these areas. China is a major market consideration for US firms; it is the major element in the US trade deficit; and it is a major focus of US foreign policy concerns. But despite this growing awareness of China as a partner or rival in the world, there exists as well numerous misconceptions about the country as well. Today, I will be focusing on six of these misconceptions and misperceptions, with the intent of providing an introduction to important elements of China's energy, economic, and environmental situation in the discussion of each.

## Commonly heard phrases...

- “China will surpass the US in CO<sub>2</sub> emissions by 2020”
- “China has been among the fastest growing economies in the world”
- “China’s economy consumes energy inefficiently”
- “China’s subsidized energy prices give firms a competitive edge”
- “China self-reliance policy will keep it from being a major energy importer”
- “China’s cities are among the dirtiest in the world”

---

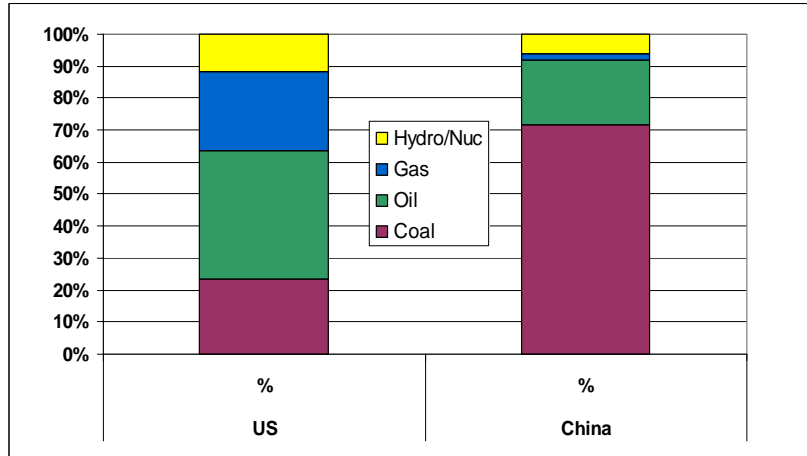
Environmental Energy Technologies

9/12/2000, p. 2

Here are six commonly heard phrases repeated in the media, business, and even academic journals. As with most cliches, there are elements of truth in each one. Some have been true in the past, but no longer are. Some may become true in the future. The speed of change in China in the last 20 years challenges observers to maintain an accurate picture of the country, and even the Chinese are sometimes unaware of the magnitude of the transformation going on about them.

Each of these statements relate in some way to fundamentals of China’s energy and economic situation. Let me start first by providing a comparison of the energy situation in the US and China as a context for the discussion of these phrases.

## How China and the US compare in primary energy consumption



### Environmental Energy Technologies

9/12/2000, p. 3

A major difference between the US and China is readily apparent from this chart. In primary energy terms, China is overwhelmingly dependent on coal. At about 70% of the total, coal vastly overwhelms China's consumption of oil, natural gas and hydro and nuclear power. In the US, where coal accounts for about 23% of energy consumption, the majority—about 80%—is used for power generation. In contrast, only about 45% of Chinese coal is consumed in power plants; the rest is burned directly in industrial boilers and other applications, or used for cooking and heating in households.

China is the 5<sup>th</sup> largest oil producer in the world, but in the space of just 15 years, it has gone from being one of Asia's largest exporters of oil to the second largest importer after Japan. As in the US, most oil is used for transportation and petrochemical applications, but these sectors are far less developed than in the US.

For many years, China flared or ignored its natural gas resources, and it still accounts for only about 2% of its consumption, compared to over 20% in the US. In recent years, the government has put increasing emphasis on expanding China's natural gas production, and is now considering direct imports of gas, both in the form of LNG and as pipeline gas, possibly from Russia or Central Asia.

## China vs US energy consumption

- Coal dominates in China; higher emissions of CO<sub>2</sub> per unit energy consumed than US
- Total China energy consumption of ~19 mmbdoe is just about US oil consumption alone
- China industry accounts for 65% of consumption, compared to ~1/3<sup>rd</sup> split of industry-transportation-res/comm in US
- Average energy growth 1990-99 3.4%/year in China, compared to 1.5% in US

---

Environmental Energy Technologies

9/12/2000, p. 4

These are several main points of contrast between the US and Chinese energy systems. China's reliance on coal increases the relative amount of CO<sub>2</sub> generated from energy consumption, as oil and natural gas, which dominate in the US, are much less carbon intensive. Nonetheless, with 4 times the US population, China's total consumption of all forms of energy is equivalent to just the US oil consumption alone. In per-capita terms, an average American consumes over 10 times more energy than the average Chinese.

In actual terms, the average Chinese consumes even less, as 65% of Chinese energy is consumed by industry compared to about one-third in the US. Residential energy use in China is about 15% of the total, and in transportation, the share is less than 10%. In total, China has fewer vehicles than Southern California alone, though in recent years the number has been growing rapidly.

As a rapidly developing economy, China's growth in energy consumption has also been correspondingly higher than that of the US. The highest rates of growth have been for oil and electricity, which might be expected in a modernizing economy.

“China will surpass the US in  
CO<sub>2</sub> emissions by 2020”

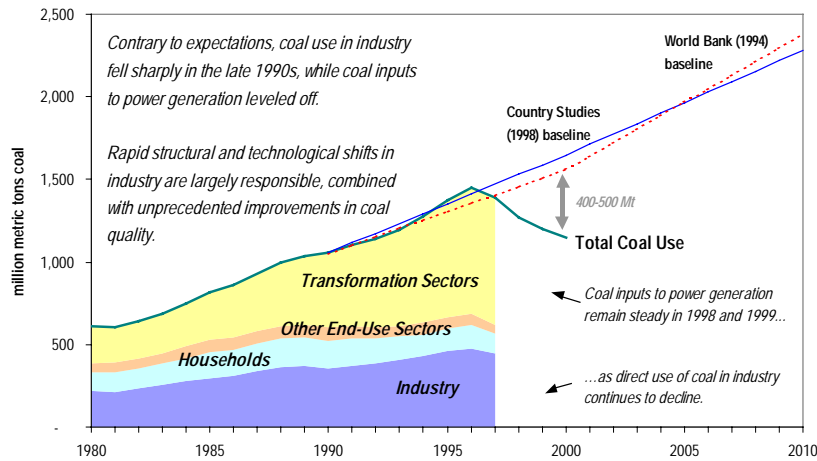
---

**Environmental Energy Technologies**

9/12/2000, p. 5

Here is the first phrase for us to look at. This statement often appears in context of the role of developing countries in climate change, and has been a working assumption of US climate change officials for some time. Let's see what the actual situation is.

## Assumption based on early World Bank forecast...



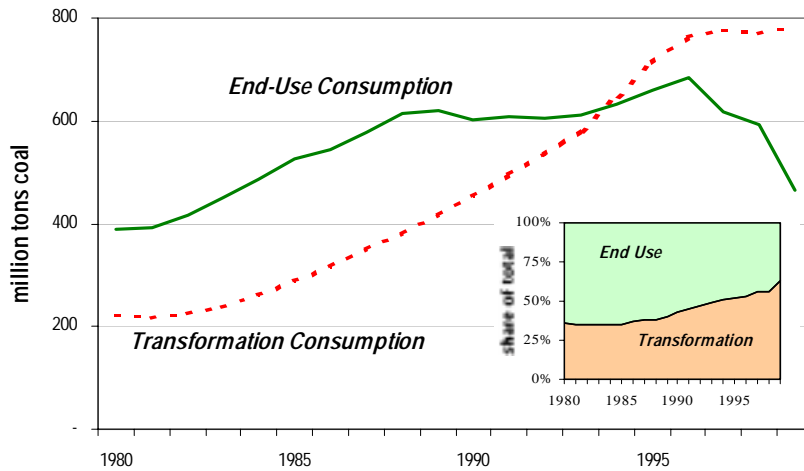
### Environmental Energy Technologies

9/12/2000, p. 6

This chart shows China's coal consumption from 1980 to 2000, with projections out to 2010 based on two major studies: the World Bank study on GHG emissions in 1993, and the Country Study of 1998, performed as part of the Framework Convention on Climate Change to establish an inventory of China's emissions and its "business as usual" projection. In contrast to the straight-line growth assumed in both studies, Chinese coal consumption has actually fallen dramatically since peaking in 1996, and now is some 400 to 500 million tonnes lower than what was forecast just a few years ago. This is equivalent to over half of total US coal production!

This sharp decline was unanticipated, and for the most part, is not generally recognized inside or outside of China. What is particularly ironic about this situation is that if China had indeed agreed to a Kyoto target along the lines of the developed countries, it would have already..or be close to..attaining those targets!

## Apparent decline most pronounced in end-use



1998-1999 figures estimated.

**Environmental Energy Technologies**

9/12/2000, p. 7

To understand this decline, it is useful to disaggregate consumption into transformation—those applications such as power generation that turn coal into another energy form—and end-use, in which coal is burned directly to generate heat for industrial or other processes. What is apparent here is that the decline is almost completely in the area of end-use—and since industry accounts for most coal end-use—something dramatic has happened to industry.

## What is going on?

- Predates the Asian crisis and exceeds GDP slowdown—primary domestic origin
- State-owned industry is failing; closure and reduced production
- Buyer's market for coal allows higher quality
- Residential switch from coal to gas
- Shutting of many small power producers
- Bad statistics

---

Environmental Energy Technologies

9/12/2000, p. 8

So what is going on? First, it's important to note that this decline in energy consumption is not "typical"; that is, it is not the result of an economic recession as was experienced in the rest of Asia in 1997 and 1998, and indeed, the decline predates the Asian crisis. A major element of the decline appears to be the implosion of China's old, inefficient and mismanaged state owned enterprises. Once the pillar of China's economy, state owned enterprises now produce only about a third of China's GDP, but consume nearly half its energy, and account for much of the "non performing assets" of China's banks, which were 'guided' to provide increasing amount of loans.

Another key element is the changing coal market itself. Once, like all energy forms, coal was in short supply and the state promoted the expansion of private and local mines to increase output. They were so effective in this that the market has been oversupplied for years, and the government found itself setting on over 200 million tonnes of coal in stockpiles. As a result, prices dropped, and buyers found that they could purchase higher quality coal—that is, coal with higher heat content—for the same price as the raw coal they purchased before. This change alone may account for as much as 30% of the drop in coal consumption.

Finally, there are longer terms trends that continue: the shift of households away from coal to electricity, natural gas and LPG, and, with the emergence of a surplus market in electricity, the closure of many small inefficient generating plants. Of course, bad statistics complicate all such analyses. In 1998, for example, China's National Bureau of Statistics could not account for some 75 million tonnes of coal in the system!

*Unlikely. Perhaps by 2040*

---

**Environmental Energy Technologies**

9/12/2000, p. 9

So, as much as this is a catchy phrase for politicians and environmental NGOs, it is not likely to come true by 2020. It is possible that China will reach this point some 20 years later, but there are many unknowns about what will transpire in the meantime in the US, in China, and in energy technology in the meantime.

“China has been among the  
fastest growing economies in  
the world”

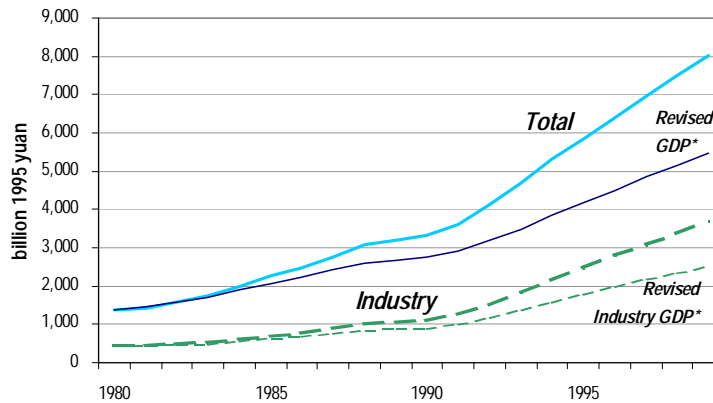
---

**Environmental Energy Technologies**

9/12/2000, p. 10

The second phrase relates to China’s much vaunted economic transformation in the last 20 years since serious reform started. Without question, there has possibly not been a similar episode of wealth creation in such a short time in the history of mankind, but it is important to understand as well that Chinese measures may not allow direct comparisons with other countries.

## China's GDP may not have grown as fast as reported in official statistics



\*Revised GDP figures are calculated based on time-series estimates that effectively reduce average annual growth in GDP by about two percentage points over 1980-1999. 1999 GDP is estimated.

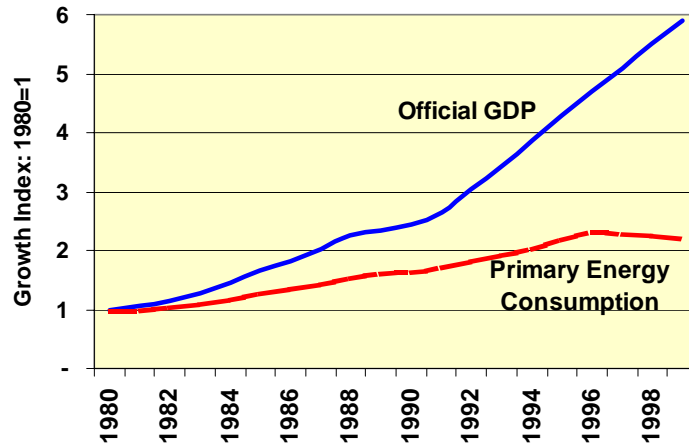
Source: SSB, 1998a and 1999; SCMP, 1999b and 1999f; *People's Daily*, 1999a; Maddison, 1997.

### Environmental Energy Technologies

9/12/2000, p. 11

Since 1980, China's GDP growth can be roughly divided into three periods: first, the period of agricultural, organization and pricing reform in the early 80s that led to a period of rapid growth, but resulted in a period of high inflation, chronic shortages, and social unrest by 1989-90, when China went through its first recession since reform began. Since the early 1990s, economic growth has been characterized by extensive expansion of production capacity, the rise of the non-state sector, a boom in foreign investment and foreign trade, and the emergence of oversupply. Over this period, official Chinese figures claim average growth of about 10% a year, but several in-depth studies of their economy present a slightly different picture—one in which average growth over this period, measured on a comparable basis, was actually some 2% a year on average lower. Nonetheless, at 8% per year, the results are impressive, but more on the order of what has been achieved in Japan, Korea, Taiwan, Thailand, and Singapore during comparable periods of development.

## Consumption declines even as GDP continues to grow



Environmental Energy Technologies

9/12/2000, p. 12

But, on an official or adjusted basis, the Chinese experience stands out in one major area—that energy consumption, which normally grows at the same if not higher rate as GDP in many developing countries, has grown at only half the rate of GDP growth on an official basis, and has even moved in the opposite direction since 1996, despite continued strong growth.

*Yes, but growth probably overstated by  
2-3% per year*

---

**Environmental Energy Technologies**

9/12/2000, p. 13

So, China has been among the fastest growing economies in the world, but in cases where the calculation matters, such as where GDP may appear in the numerator or denominator, keep in mind that a comparable figure may be 2-3% lower than what the Chinese declare.

# “China’s economy consumes energy inefficiently”

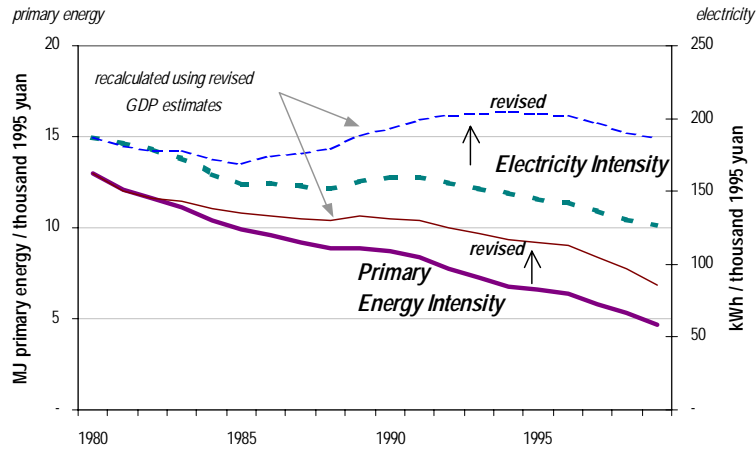
---

**Environmental Energy Technologies**

9/12/2000, p. 14

Arguing for “credible commitment” from developing countries in the area of climate change mitigation underscores the assumption that most future energy growth will come from these economies. At the same time, there is also a widespread assumption that energy is consumed less efficiently in these countries than in Europe, the US or Japan. China is considered no differently in this regard, and is often singled out as the biggest environmental “threat” because of its profligacy. What is actually going on?

## On official or revised basis, energy intensity has declined significantly since 1980

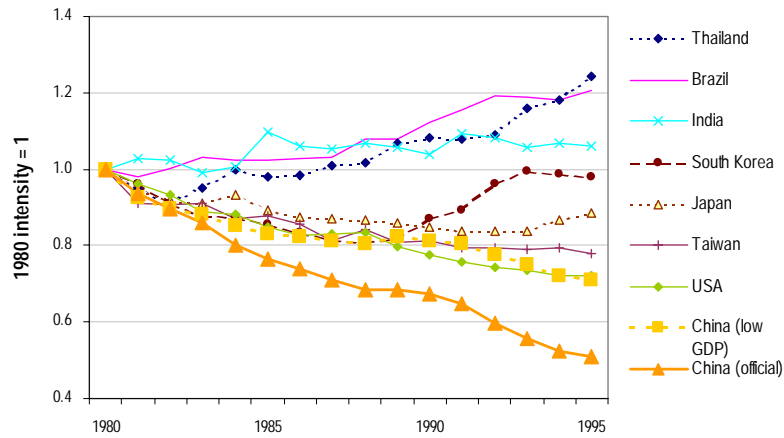


### Environmental Energy Technologies

9/12/2000, p. 15

As mentioned earlier, on either an official or revised basis, GDP has consistently grown significantly faster than overall energy consumption, and the overall energy intensity of the economy has declined significantly. As the next chart shows, this sets China apart from countries such as Thailand, Brazil and India, and more closely parallels the US experience.

## Revised energy intensity of GDP makes China seem more like other countries



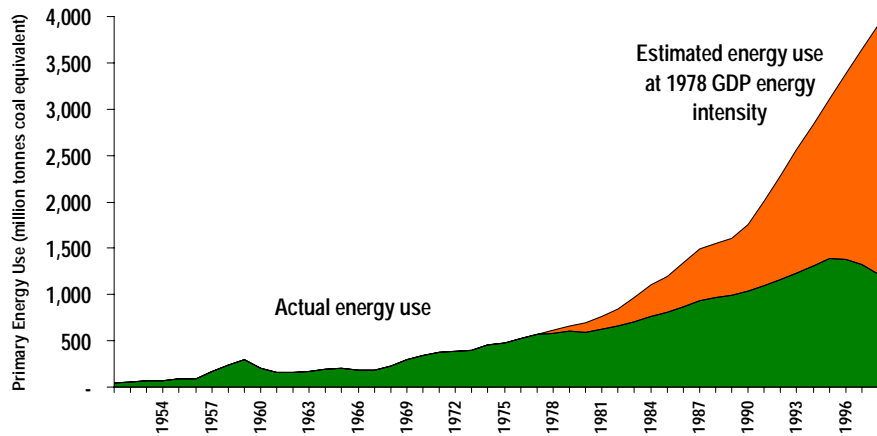
N.B. Indexes are based on energy intensities constructed with statistics on primary energy consumption and real GDP. Source: IEA, 1999; Figure 15.

### Environmental Energy Technologies

9/12/2000, p. 16

In this chart, on a relative basis, the China is shown to have closely matched the US in the rate of decline in energy intensity since 1980, based upon revised GDP figures. Absolute intensity, however, is still much higher—some 4 times that of the US, so there is still great potential for improvement.

## Without these gains, energy consumption in China would be over 4 billion tonnes ce



### Environmental Energy Technologies

9/12/2000, p. 17

The consequences of China not being an early promoter of energy efficiency—particularly in industry—are unfathomable. If energy use remained at the same intensity as in 1978, when the current reforms began, then current energy consumption would be equivalent to over 4 billion tonnes of coal. It is hard to imagine the environmental consequences of such high rates of energy growth, particularly as most of it would have been coal.

*Compared to the West, yes, but  
unparalleled achievements for a  
developing country*

---

**Environmental Energy Technologies**

9/12/2000, p. 18

Significant inefficiencies remain in China's economy, but its achievement should be acknowledged and encouraged. China, however, is only one of many developing countries that have complained that their gains in efficiencies haven't been recognized sufficiently in the current rounds of climate negotiations.

“China’s subsidized energy prices give firms a competitive edge”

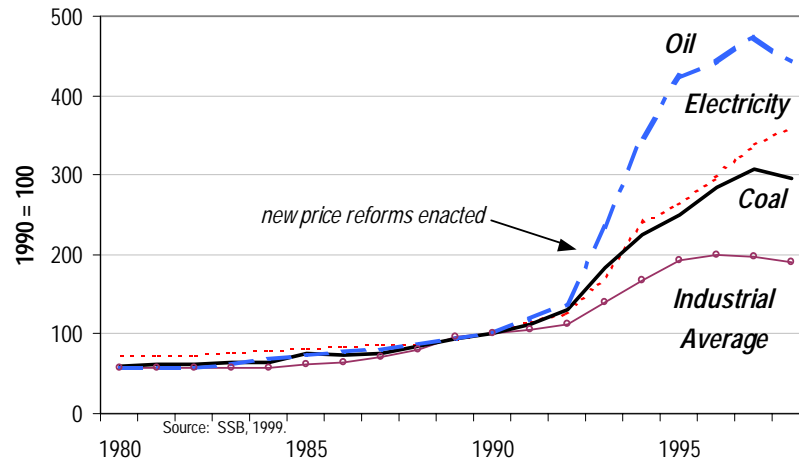
---

**Environmental Energy Technologies**

9/12/2000, p. 19

The next phrase is a comment heard often in tandem with the issue of China’s low labor costs. China’s labor costs are still low, though rising, but there has been a complete turnaround in energy prices.

## Energy prices have now all reached world levels and are mostly market-set



### Environmental Energy Technologies

9/12/2000, p. 20

After nearly 40 years of strict central price controls, China began relaxing controls in the early 1990s. The motivations varied, but all were aimed at returning the energy industries to profitability after years of hemorrhaging red ink. In typical Soviet style, the Chinese used energy prices as an implicit subsidy to industry, but as the economy expanded, the subsidies became unsustainable. Currently, aside from natural gas, which is now undergoing additional price reforms, energy prices are at or above world levels. In some places such as Guangzhou for example, residents are paying 11 cents/kWh, equivalent to what is charged in San Francisco!

*Not any longer, and even in times of low energy prices, low productivity probably offset the advantage.*

---

**Environmental Energy Technologies**

9/12/2000, p. 21

Labor and energy prices are key inputs to any manufacturing process, but ultimate competitiveness also depends on productivity, which remains fairly low. With regard to energy pricing, the current situation is a “level playing field”.

“China self-reliance policy  
will keep it from being a  
major energy importer”

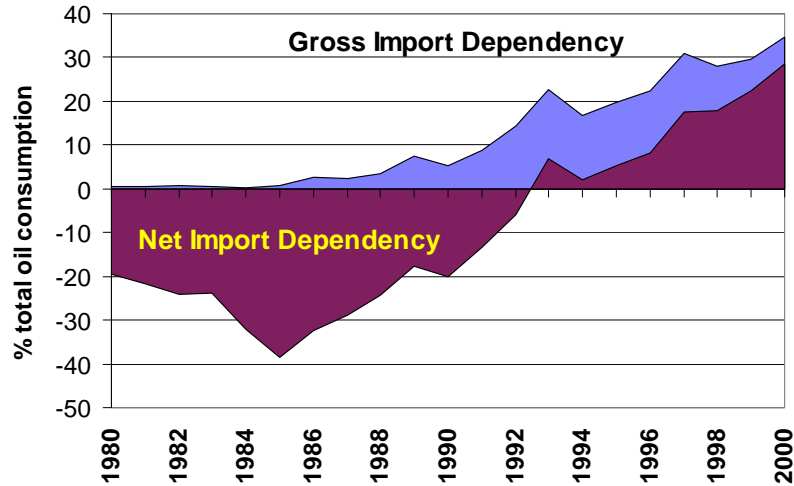
---

Environmental Energy Technologies

9/12/2000, p. 22

China, as many centrally planned economies, strongly espoused a policy of self-reliance, first in all economic spheres, then later most predominately in the energy sector. With bountiful natural resources and huge coal reserves, the policy was fairly easily maintained. The first cracks, however, appeared in 1986 when a debate arose over plummeting international oil prices and the wisdom of exporting crude oil (China was the largest exporter in Asia in 1986) versus consuming the oil domestically. Since then, the situation has shifted significantly.

## China is now nearly 1/3<sup>rd</sup> dependent on oil imports



Environmental Energy Technologies

9/12/2000, p. 23

As oil demand continued to soar in the late 1980s and early 1990s, and domestic production stagnated, China quickly became dependent on imports of foreign oil. It became a net oil importer for the first time in 1993, and a net crude importer in 1996. Reliance has since steadily grown, and this year, nearly 1/3<sup>rd</sup> of all the oil consumed in China will be imported. This situation has led to a complete reevaluation of the concept of self-reliance, and of energy security. An initial reaction was to invest billions of dollars overseas in oil fields in Venezuela, Kazakhstan and Sudan, in an attempt to secure control of foreign oil resources to bring back to China, but the realities of the international oil market quickly demonstrated the infeasibility of this approach.

*Debate still rages, but the market will override remaining central-planner reservations. Exigencies of growth have led to public statements basing 'energy security' on a healthy economy.*

---

**Environmental Energy Technologies**

9/12/2000, p. 24

An alternative concept has emerged, which parallels the developments in most other Asian countries during the 1980s, in which energy security is considered first and foremost a function of a healthy economy and healthy export sector generating the surpluses needed to pay for energy imports. Although this concept does not sit comfortably with traditional central planners remaining in Beijing, it is unlikely China has much alternative, as foreign dependency on oil, and soon, on natural gas, will be a key feature in their energy economy.

“China’s cities are among the dirtiest in the world”

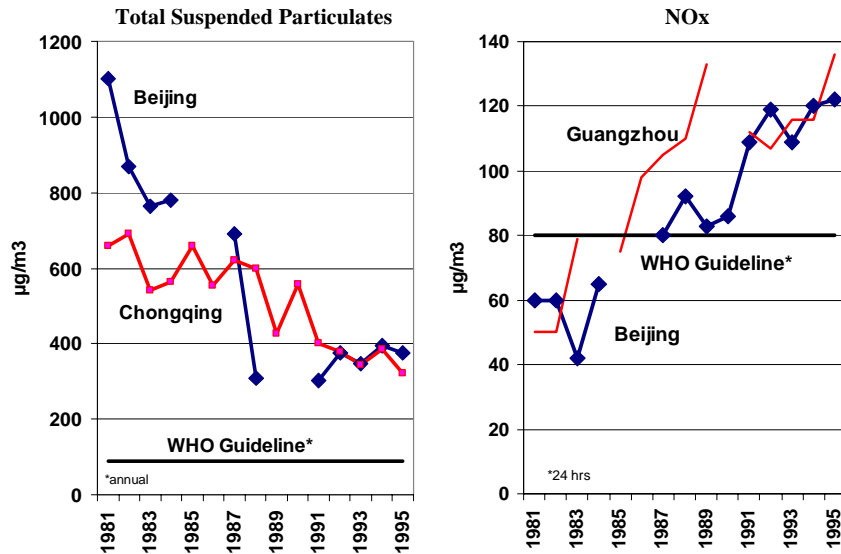
---

**Environmental Energy Technologies**

9/12/2000, p. 25

The filthy air and water of China’s cities are legend. It’s not uncommon to see the midday sun as pale as the moon in cities such as Beijing, and respiratory diseases are near epidemic in many locations. But there has been a change in the nature of pollution as the economy has modernized.

## Modern pollution replacing traditional pollution



Environmental Energy Technologies

Source: World Bank, 1997. New Ideas in Pollution Regulation

9/12/2000, p. 26

The most obvious type of pollution experienced in China is the pall of smoke created from hundreds and thousands of open combustion sources, such as factory smoke stacks, residential stoves and heaters, and district heating plants all using coal. Indeed, in 1981, the recorded level of suspended particulates from this smoke averaged over 1100 micrograms per cubic meter, or over 12 times the guideline recommended by the World Health Organization. Similarly, Chongqing has long been noted for its London-type smog that can keep the airport closed for days and has substantial health impacts on its residents. But after years of closing the dirtiest factories, consolidating district heating plants and substituting LPG, natural gas and electricity for coal used in homes, the government has managed to bring particulate pollution down significantly, although the average levels in most cities still remain far above WHO guidelines. As TSPs become more under control, a more ‘modern’ pollutant, nitrogen oxides, are quickly getting out of control. Emitted primarily from vehicles, this type of pollution was hardly known in the early 1980s, and the most vehicle-intensive cities at the time—Beijing and Guangzhou—both had levels up to half to a third of the WHO guideline, but are both now headed to double the WHO level. The same trend can be seen with sulfur dioxide, as electricity production expands rapidly and few power plants are equipped with desulfurization equipment. This has led to China’s growing acid rain problem.

*Yes. And the decline in TSP levels from reduced coal use will be replaced by growing problems of SO<sub>2</sub> and NO<sub>x</sub> from power generation and transportation.*

---

**Environmental Energy Technologies**

9/12/2000, p. 27

This actually is not a misperception or misconception. China does have among the most polluted cities in the world, and the shift away from coal--which has already begun--may solve some of the problems, but new problems are emerging which will provide greater challenges in China's environmental protection work.

Those are my remarks, and I hope that the review of these six issues helped to explain China's recent developments in energy, economy, and the environment.

Thank you.