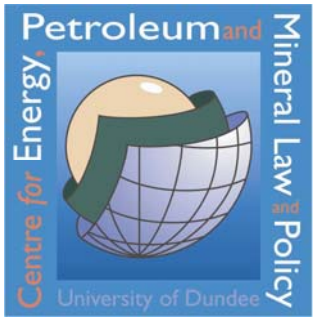

China's energy and environmental policies and their implications for OPEC

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Abstract

As China's economy continues to expand and modernise, its impact on world energy markets is set to continue growing, especially in the case of oil. The rapid growth of demand for oil, mainly for the transport sector, combined with the limited extent of remaining oil reserves, underpins this seemingly exorable rise in oil imports. China's government has realised that this pattern of energy consumption and of oil consumption is not sustainable and has embarked on a series of programmes to constrain the growth of energy demand and to reduce the environmental impact of energy use.

This paper provides a brief review of recent government policy initiatives in the wider field of energy conservation and identifies potential obstacles to effective implementation. It then evaluates China's domestic and international policies for oil production, consumption and sector investments and assesses the likely implications for OPEC.

Key words: China, energy, oil, gas, environmental impact, energy efficiency, energy conservation, government policy, transport sector, OPEC, national oil companies, pipelines

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Introduction

As China's economy continues to expand and modernise, its impact on world energy markets is set to continue growing, especially in the case of oil. The rapid growth of demand for oil, mainly for the transport sector, combined with the limited extent of remaining oil reserves, underpins this seemingly exorable rise in oil imports. China's government has realised that this pattern of energy consumption and of oil consumption is not sustainable and has embarked on a series of programmes to constrain the growth of energy demand and to reduce the environmental impact of energy use.

This paper provides a brief review of recent policy initiatives in the wider field of energy conservation and of the potential obstacles to effective implementation, before evaluating the domestic and international policies for oil and the likely implications for OPEC.

China's energy challenges and policies

Recent trends in China's demand for energy

Demand for energy in China has risen in a sustained manner since the early 1980s with the exception of the period of the Asian crisis from 1997-2000 (Fig.1). Over this twenty five-year period, three phases may be identified. The first ran from 1980 to 1996 when energy demand rose at an average rate of about 5% per year, slower than that of the rate of growth of the economy. The second phase spans the Asian crisis and a period of poor statistical data, from 197 t0 2001. During this period the rate of growth of China's economy did decline, as did the rate of growth of energy demand. However the official figures, on which Figure 1 is based, substantially underestimate the level of energy production and consumption during this period, on account of the poor quality of the statistical data over this time (Sinton, 2001).

The third phase, from 2002 to the present day has been marked by a substantial and sustained rise in both economic growth and energy use. Indeed the years 2003 and 2004 saw annual rises of primary energy consumption of 15%, which slowed to about 10% in 2005. China now accounts for some 15% of the world's primary commercial energy consumption, compared to the USA's 22%.

Setting this rise of energy demand in the context of economic growth, Figure 2 shows that for more than twenty years China succeeded in driving down its energy intensity at a rate of four to five percent each year (Sinton et al., 1998**;** Lin, 2006). In 2002, the country's energy intensity was about 35% of that in 1980. This was a remarkable

achievement, despite the fact that the level of energy intensity still remained high by international standards.

This downward trend was reversed in 2002 as a result of the government-induced boom in construction and heavy industry. The rapid growth of the economy combined with this rising energy intensity resulted in shortages of coal, electrical power and oil products. The nature of China's economic growth had become, quite evidently, unsustainable. It has become essential to change the way that energy is being used.

Recent energy efficiency and environmental policies

The soaring demand for energy in China during the years 2002 to 2004 has brought energy to the top of the government's agenda. The concern of the government was not just that the consumption of energy was growing along with the expansion of GDP; rather it was that the amount of energy used per unit of GDP growth has been increasing and that energy has continuing to be a major source of pollution.

In 2004 the central government announced that the sustainable use of energy was now a key priority for the whole nation and started to roll out a number of short and long term measures. The objectives of these measures include (Sinton et al., 2005):

- Constraining demand for fossil fuels;
- Encouraging the use of clean coal technology;
- Establishing economic incentives to save energy and ending price controls on energy products;
- Establishing and implementing stricter energy efficiency and environmental standards;
- Raising public awareness;
- Increasing support for research and development.

To drive forward these policy initiatives, to formulate specific policy instruments and to improve the coordination of energy policy, the central government established two new energy institutions in 2004: an *Energy Leading Group* which comprises the relevant top leaders of government within the State Council, and a *State Energy Office* which reports directly to the State Council. These are in addition to the Energy Bureau which lies within the National Development and Reform Commission and which has been responsible for the overall management of the energy sector and for drawing up major legislation relating to energy.

Challenges to effective policy implementation

The ability of China's central government to manage the nation's energy sector in an effective manner would appear to have declined over the last ten to twenty years (Andrews-Speed, 2004). With respect to the immediate priority of implementing energy conservation and environmental policies, the government faces three categories of challenge.

The first challenge the government faces is one of credibility. A review of government policy documents concerning energy reveals that energy conservation and energy efficiency have been 'top priorities' for China's energy sector for many years. The problem has been that the government and the energy industry have preferred to put their efforts and their money into the production of energy rather than in improving the way that energy is used (Lin, 2006). For this reason the top leadership has had to and will continue to have to put a great deal of effort and political weight behind this drive for efficiency, and this will have to be sustained for many years lest the improvements be reversed.

The second challenge derives from how the economy has changed since the 1980s. In the 1980s much of China's economy was still subject to 'The Plan'. Companies were owned by the state and were subject to direct state control. Energy production and energy consumption were planned. Companies would be assigned a quota of energy which they could not exceed. This control combined with direct administrative measures to improve efficiency, financial incentives to save energy, direct investment in industrial plant and processes and a large number of energy conservation technology centres underpinned the twenty years of success.

By the late 1990s the game had changed. Energy consumption was no longer planned, large numbers of industrial energy users were no longer state-owned, private citizens were buying cars and air-conditioners, and even the energy producing industries were starting to embrace some market mechanisms. Direct enforcement of energy efficiency by government was no longer possible. At the same time the level of investment by government and the attractiveness of the incentives for energy efficiency had declined (Andrews-Speed, 2004).

It is quite clear that the current drive to promote energy efficiency cannot rely on the old instruments and will have to take quite a new approach. Everybody agrees on what is needed - a combination of: clear regulations at national and sub-national levels which set and enforce standards for buildings, vehicles and energy-using appliances; clear labelling of appliances; a new approach to transport policy; clear economic signals for all energy users to find ways to save energy; information and technical support for energy users; and massive investment by all levels of government (Lin, 2006).

Set against this rather obvious list are a range of rather familiar requirements and potential obstacles. These form the third set of challenges. The requirements include the need for overall coherence across the country's energy policy, the need for clarity and consistency in the regulations and the need for well-resourced agencies to implement the policies. The key obstacles lie in the structures and systems of government and in the ability of vested interests to obstruct such initiatives. Further, the government's apparent unwillingness to raise consumer prices for energy, on the grounds of social justice, lies in direct conflict with the need to send clear pricing signals to all energy users.

So, what is the outlook for the government's strategy for energy efficiency and conservation? In some cities, the municipal governments have been quick to bring in and to enforce new regulations and standards. Shanghai, for example, in 2004 and 2005 issued new standards for buildings and lighting, established new energy

conservation companies and committees, set up new systems to monitor energy-intensive industries and launched new ways to inform the public. Such cities should be able to make significant progress in a short space of time. But it will take much longer for such initiatives to be successfully launched across the country.

Across much of China a number of reasons are almost certain to make enforcement of the new policies across the whole of the country more difficult than in the rich cities. These include a lack of resources, a lack of understanding of energy issues, the existence of more immediate demands on the local government, and the drive for local economic growth. And yet, the drive for energy efficiency will have little meaning unless it is indeed effective across the whole country. Thus the primary challenge for the central government is to find new ways to enforce policy, because, in the case of energy efficiency, failure is not an option.

China's domestic oil policies

Recent trends in China's oil production and consumption

Over the last 25 years the consumption of oil in China has risen at an average annual rate of about 6% (Fig. 3). But this has exceeded the rate of overall rise of energy demand, and so oil now accounts for about 23% of China's total energy consumption compared to 17% twenty years ago. At the same time China's domestic production of oil is slowly reaching a peak and increases at a rate of only 2% per year. As a result China has been a net oil importer since the early 1990s and the quantity of net import increases year by year. Though the year 2005 saw a significant decline in the rate of increase of oil imports, this had followed two years in which the consumption of oil had increased by 12% and oil imports by 30% each year. Already in the first five months of 2006 imports were up 18% over the same period last year.

These rapid perturbations in China's demand and import requirements cause ripples throughout the world oil markets, however what is clear is that the overall trend for oil demand and oil imports is upwards. Total demand for oil is likely to continue to rise at an annual rate of 4-6% or possibly more for as long as the economy keeps growing as it is. With only modest scope of production increases, net imports of oil could double or treble in the next ten years from 150 million tonnes per year or 3 million barrels per day in 2005 to more than 300 million tonnes per year or 6 million barrels per day (International Energy Agency, 2005; Energy Information Administration, 2006; Congressional Budget Office, 2006). China's dependence on imports would rise from a current level of 45% to 70% or more. This import requirement will be a drain on China's foreign exchange reserves, as well as stretch the capacity of the global shipping industry and the domestic ports. Further, such a massive increase of oil consumption will greatly add to the already high level of atmospheric pollution unless stringent environmental measures are taken at the same time.

The transport sector is becoming an increasingly important component of China's oil demand (Fig.4). The number of vehicles on China's roads increased nearly two-fold from 22 million in the year 2000 to 41 million in 2004 (Fig.5). Over the same period the quantity of freight traffic rose by 55% (Fig.6) and the amount of passenger traffic in all forms rose by 33% (Fig.7). Though road traffic may be the most visible form of

the increased use of oil in transportation, the most rapid recent increases have been in water transport in the case of freight and in air transport in the case of passengers. That being said, the statistics show sustained growth in both road and rail transport, for both freight and passengers

Recent domestic policies for oil

In 2004 the government announced a wide range of measures to address these concerns, along with the wider policy announcements related to energy conservation and energy efficiency. These measures were of three types:

- Restricting the use of oil outside the transport sector;
- A range of initiatives in the transport sector;
- Developing alternative transport fuels.

Though the transport underpins the long-term growth of demand for oil and the role of other fuels in the transport sector continues to decline (Fig.8), the surge in demand for oil in 2003 and 2004 was partly driven by the sudden need to generate electricity from oil as a consequence of the shortage of power available from the main grids. The shortage of conventional electricity capacity is currently being addressed through the rapid construction of coal-fired power stations, and so that element of demand has been substantially reduced, at least for the moment. The government is also acting to reduce the use of oil in petrochemicals (by substituting with gas made from coal) as well as in other industries which can more appropriately use electricity, coal or natural gas (NDRC, 2004a). However the use of oil products, including liquefied petroleum gas, in the residential and commercial sectors continues to grow and the government will find it difficult to constrain the use of oil in the highly inefficient agricultural sector (Sperling et al., 2005).

Within the transport sector, the government has a mix of policy initiatives (for example, NDRC 2004b). It has recently brought in high standards for fuel efficiency and emissions for new vehicles and continues to raise the regulated and subsidised prices for gasoline and diesel in an incremental manner in order to try to dampen demand. Contrary to expectations, price rises introduced for oil products in the spring of 2006 led to an increase of consumption as refiners chose to supply more to the market to take advantage of the price rise and to satisfy suppressed demand. The year 2006 has seen the introduction of differential excise taxes on vehicles depending on their fuel efficiency, as well as taxes on all oil products, not just gasoline and diesel.

All such measures which impose a higher cost of transportation are likely to have a negative impact on certain segments of Chinese society. The government is very aware of this and is proceeding cautiously, providing subsidies to certain sectors to compensate for the rises; these sectors include agriculture, fisheries, forestry, and public transport.

The government also plans to gradually promote the use of clean, efficient diesel, though this will require adaptations to the structures of existing oil refineries (State Council, 2006).

Where the government seems to have failed to make significant progress is in the design and implementation of policies to promote public transport rather than private transport. The opportunity to construct modern urban transport networks was there for the taking 10-15 years ago as China's cities were undergoing reconstruction. Instead, tens of thousands of kilometres of urban highways were built and the production and use of private cars was encouraged. Now the heart of most of the cities have been modernised, the introduction modern public transport networks will take more money and more time than had this challenge been addressed in a more timely manner. Major cities such as Beijing and Shanghai are expanding their underground metro systems and constructing light-rail networks.

Given that China's requirement for freight and passenger transportation is set to rise for as long as the economy continues expanding, the government is seeking alternative solutions to the ever-rising import requirement for oil. It is currently pursuing a range of options to develop alternative transport fuels, both liquid and non-liquid fuels. The most successful and promising of these are the biofuels, mainly ethanol, which has been promoted with great success since 2001 and now forms as much as 20% of total gasoline use. The sustained expansion of biofuels will require a coherent policy framework to address the potential conflict between using land to produce crops for food and for fuel.

A more long-term, ambitious and expensive project is to produce large quantities of oil from coal. This is still in the pilot stage, but will certainly be commercially viable if oil prices stay at today's levels. Optimists forecast that China could produce as much as 40 million tonnes per year of liquids from coal by 2020. The technology which converts natural gas to liquids is unlikely to be applied in China to any great extent because the process relies on having access to cheap supplies of natural gas, of which China has few.

Amongst the options for modern non-liquid fuels, natural gas is the only one (other than electricity) currently in use in China, but again the high cost of gas in China limits its application to large cities where the motivation is for a clean fuel for public transport. Work continues to electrify the railways and reduce the dependence on diesel. Though Toyota has started to produce its 'Prius' car in China, there is currently no policy for hybrid vehicles (gasoline and electricity) or for hydrogen vehicles.

Likely outcomes and implications for OPEC

Each of these initiatives faces significant obstacles if they are to be followed through to the extent that they have a real impact on demand. These obstacles include investment costs, social costs and regulatory capacity. Projects such as coal-to-liquids can be successfully implemented provided somebody, the government, the state banks or the companies, is prepared to invest and take the risk on future domestic oil prices. Fuel prices can be allowed to rise, and fuel can be taxed, if government is willing and able to address the social costs. Modern public transport networks can be built if the government pays. Oil use outside the transport sector can continue to be reduced provided electricity supply from the grid is adequate and reliable, and if natural gas supply continues to grow rapidly.

In some ways the consumption of energy in the transport sector is easier to regulate than other forms of energy consumption. The number of companies producing modern vehicles in modern factories in China is relatively small, and it will prove relatively easy to influence the fuel and emissions standards of these vehicles. But China's government has consistently proved less able to regulate the output of local factories, in a number of sectors whether it be steel, cement, coal or cars. Raising the standards of the vehicles and agricultural machinery produced by the large numbers of these local manufacturers will be a major regulatory challenge.

None of these wide ranging initiatives is likely to yield substantial gains in the next five years. Over ten years or more, a combination of measures to enhance efficiency and of steps to substitute oil with other fuels should start to make a significant impact on the rate of increase of China's oil demand and net oil import requirement. But such success will require the government to keep oil and transport near the top of its policy agenda, or else initiatives will fade and targets will slip.

It would be necessary to undertake a detailed evaluation in order a range of scenarios for the impact of these different initiatives on China's overall demand for crude oil. But it might not be unreasonable to expect that these policies might reduce the annual demand for crude oil by some 50 million tonnes by 2015. If total demand for oil in the absence of these policies is expected to rise by 80-100% from 330 million tonnes in 2005 to 600-670 million tonnes, then this reduction can be seen to be significant but not substantial. Greater reductions may be achieved, but these will required sustained policy pressure and investment from government. From 2020 onwards, more radical changes in fuel consumption patterns may well be possible.

If a number of these initiatives to constrain the growth of crude oil demand are successful, then China's demand for oil from the international markets will necessarily be significantly less than what it would otherwise have been. The potential impact on the call for OPEC oil will depend on other factors to be addressed in the next section. But what is certain is that the higher the level of international oil prices over the next ten years, the greater the probability that China (and other countries) will successfully implement measures to constrain demand for crude oil.

China's international oil policies

Patterns of oil imports and exports

As the gap between demand and domestic supply has grown, the volume of crude oil imports has grown at an increasing rate (Fig. 9). This reflects not only the rate of growth of the gap between supply and demand but also the Chinese government's preference for importing crude oil and refining it in domestic refineries. In contrast the growth of imports of oil products has been much slower. This preference is driven mainly by the desire of both the government and the Chinese oil companies to promote the growth of the domestic refining industry. A substantial proportion of these imports are governed by long-term supply arrangements with oil exporting states. These contracts are often part of a much wider package of economic and political measures which may include investment, trade, aid and diplomacy

(Andrews-Speed et al., 2002; Jaffe and Lewis, 2002; Leiberthal and Herberg, 2006; Zha, 2006).

The level of crude oil export has fallen dramatically in the past ten years as China's dependence on crude oil imports has increased. However the quantity of oil products exported has tended to rise at times of high oil prices as refiners seek profits on the international markets where prices have been significantly higher than regulated domestic prices over the last three years or more.

OPEC's share of China's crude oil imports has been highly variable (Fig. 10), and in the short-term the trend may be to decline. This results from three components of China's strategy. The first is to try to constrain its dependence on the Middle East for oil imports, and this can also been seen in the reduction of imports from non-OPEC Middle East Countries. The second is to import more oil from neighbouring countries, principally Russia and Kazakhstan. The third component relates to the limited capacity of China's refining industry to take the sour crude oils which many Middle East OPEC members produce. This has provided a strong incentive for China to import increasing quantities of sweet light crudes from West Africa (Fig. 10).

Overseas investment and pipelines

Two important components of China's international strategy for oil are the overseas investments being made by China's national oil companies (NOCs) and the construction of import pipelines.

China's NOCs have been going abroad to acquire stakes in oil fields since 1993. They started slowly and went almost unnoticed. By now one or more of them own assets in almost every major oil-producing region of the world. The total investment to date has been estimated at seven billion US dollars. In some countries, for example Sudan, they are welcomed as strategic partners. In others, such as the USA, they are repelled as representing a threat to strategic interests.

The drivers for the overseas investments come from two sources: the government and the NOCs themselves (Ma and Andrews-Speed, 2006). The government takes the view Chinese companies owning the production rights to oil reserves overseas will enhance national energy security. This is probably a flawed argument, for many other governments around the world have retreated from such strategies as the costs have become apparent and have preferred to rely on international markets backed by strategic oil stocks.

A second driver for government is the desire to promote its NOCs as national champions. This dovetails with the ambitions of the NOCs themselves to become major international oil companies. Remaining oil and gas reserves in China are limited. These companies can only grow in the long-term by going abroad. Conditions are currently relatively favourable: the high oil price gives them plenty of funds, if they want more money the Chinese banks are willing to lend, the NOCs have a dominant position in the domestic energy market, and they receive active political support from their government. These favourable conditions may not last for long,

and thus the companies have a window of opportunity to start building their international portfolios.

A third and final strand to government policy derives from the way in which the NOCs' activities may be used to support wider diplomatic and strategic goals around the world. In this context the Chinese government may seek to address, directly or indirectly, the needs of the host government.

Certain host governments may also need China's NOCs to participate in the development of their resources or may seek to use China's eagerness to secure oil supplies as a lever to fulfil their own political goals. Examples include: countries where the USA or Western governments forbid their companies to invest (e.g. Sudan); governments with a desire to break the 'monopoly' of western companies (e.g. Equatorial Guinea); and governments which want to regain control of resources (e.g. Kazakhstan).

In countries and regions immediately adjacent to China, the construction of oil pipelines is seen by the government as an effective way to enhance the security of oil and gas supply by reducing the country's reliance on international sea-lanes. A pipeline from Kazakhstan to western China with an initial capacity of 10 million tonnes per year was opened early in 2006. The planned capacity is 20 million tonnes per year by 2011 (Liao, 2006a). Further oil pipelines may be constructed from central Asia, both for oil and gas. Plans for a 20 million tonne per year oil pipeline from Russia to China continue to be delayed by controversy within Russia as well as by tension between China and Japan (Goldstein and Kozyrev, 2006; Liao, 2006b), however it is likely that such a pipeline will be completed by 2010. In the meantime more than 10 million tonnes per year of crude oil are being transported from Russia to China by rail.

A second type of pipeline has been discussed which is intended to reduce the risk or distance for tankers carrying oil from the Middle East. One idea is to construct a pipeline across the isthmus of southern Thailand in order to reduce the amount of oil flowing through the Straits of Malacca. The likelihood of this project progressing in the near future is reduced by the cost of working in such difficult terrain and the risks associated with domestic unrest in that region of Thailand. The second project would see a pipeline built from the Indian Ocean through Myanmar to south-west China. This would allow oil from the Middle East to avoid passing through the Straits of Malacca and avoid crossing the South China Sea. This second alternative does indeed offer more benefits but also involves political risks and potential high construction costs across difficult terrain.

Implications for OPEC

The proportion of China's crude oil imports from OPEC will depend on a number of factors, most important of which are:

- The capacity of China's refineries to take sour crude oil;
- The capacity to import oil from Russia and Central Asia by pipeline and rail;
- The political and economic relations between China and OPEC member states, particularly with respect to long-term arrangements, investments by Chinese

NOCs in the upstream sectors of OPEC members countries, and investments by OPEC member NOCs in China's downstream sector;
- The behaviour of Chinese NOCs themselves in OPEC and non-OPEC countries with respect to both overseas investments and imports of crude oil.

Conclusions: OPEC's China challenge

China's demand for liquid fuels is set to rise indefinitely. The government has launched a range of initiatives to use oil more efficiently and to develop substitutes for oil. The success of individual measures will depend on political will and economic cost, and on the government's ability to address a range of regulatory and social challenges. Predicting the aggregate impact of these initiatives is fraught with uncertainty, but the likelihood of success and the scale of the impact will be enhanced by high oil prices.

The proportion of China's oil imports to come from OPEC will depend on the willingness and ability of governments and NOCs from both China and individual OPEC member states to reach deals that address then needs of the respective parties.

OPEC's main China challenge has two components. The first is to understand the political economy of China's petroleum sector and the wider energy sector in order to estimate the probability of success and likely impact of domestic policy initiatives. The second is to develop relationships at central government; provincial government and company levels in order to develop joint approaches and initiatives, and to raise the level of trust in OPEC and its member states as oil suppliers and a partners. In this respect the first visit by a senior Chinese energy delegation to the OPEC Secretariat in Vienna, early in 2006, is an encouraging step forward.

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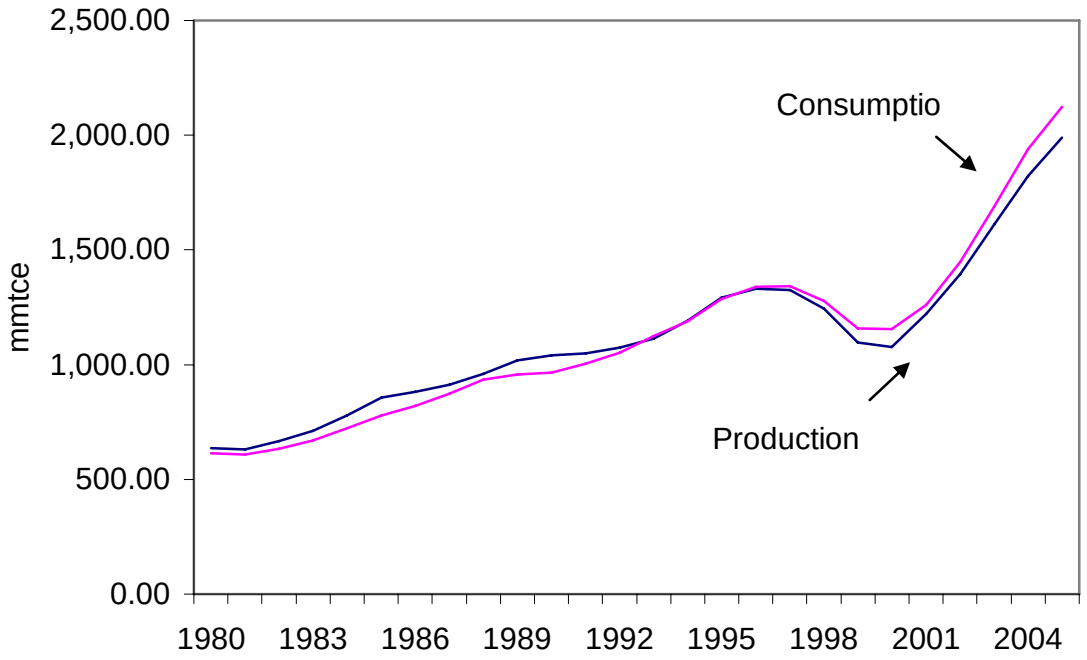

Figure 1. Energy production and consumption in China, 1980-2005, in million tonnes of coal equivalent per year. Sources: Lawrence Berkeley Laboratory, China Energy Databook 2004, for data up to 2003 for energy production and to 2002 for energy consumption; updated with the author's estimates based on various sources.

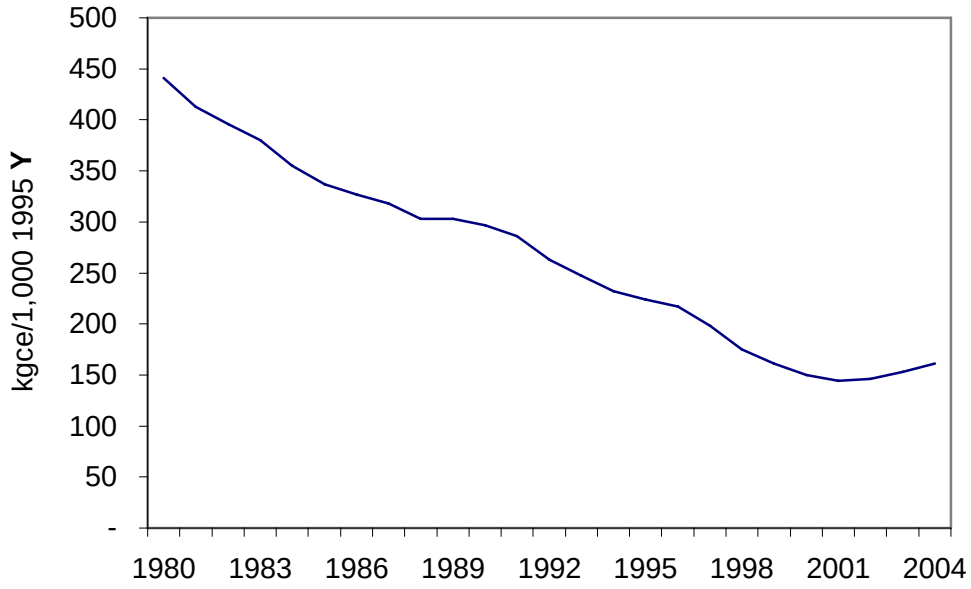

Figure 2. Energy intensity in China, 1980-2004, in kilogrammes of coal equivalent per 1995 Yuan renminbi. Sources: Lawrence Berkeley Laboratory, China Energy Databook 2004, for data up to 2002; updated with the author's estimates based on various sources.

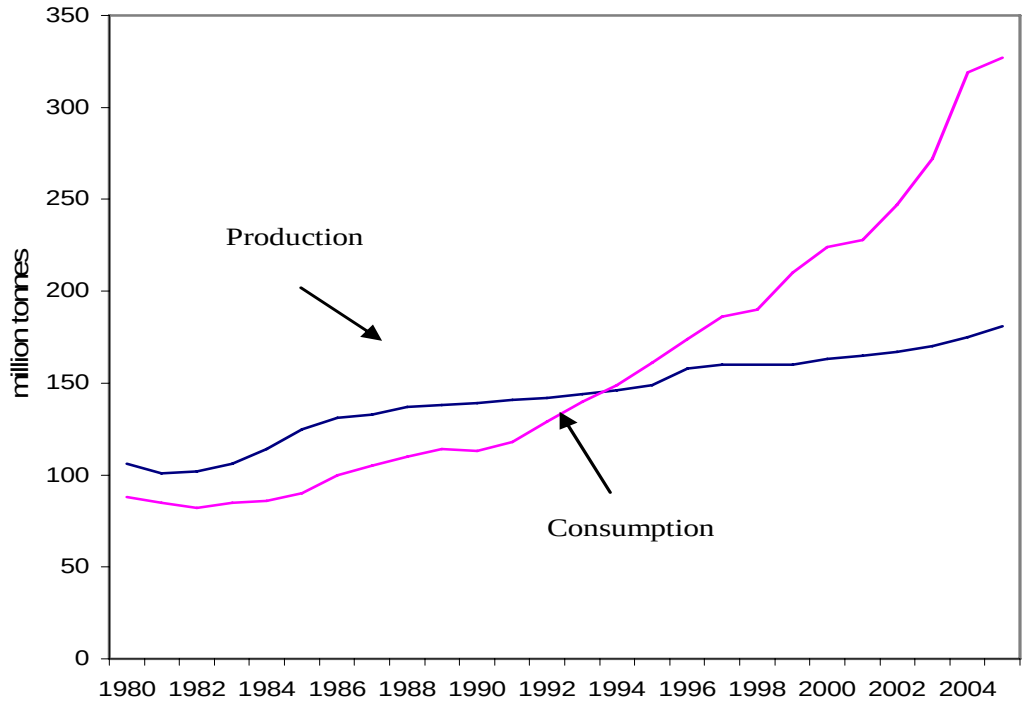

Figure 3. Oil production and consumption in China, 1980-2005, in millions of tonnes. Source: BP Statistical Review of World Energy, 2006.

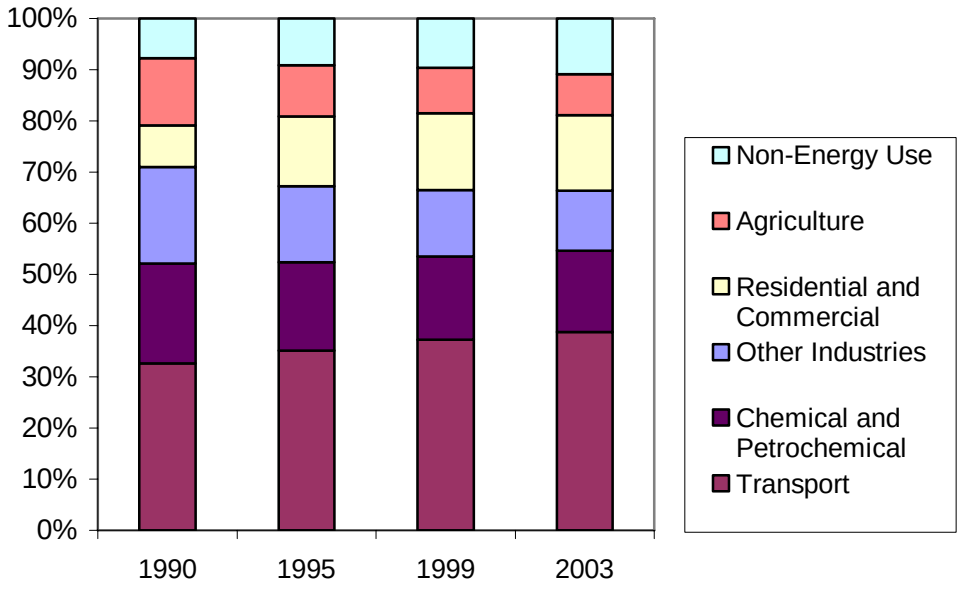

Figure 4. Final consumption of oil products in China by sector, selected years 1990-2003. Source: International Energy Agency statistics.

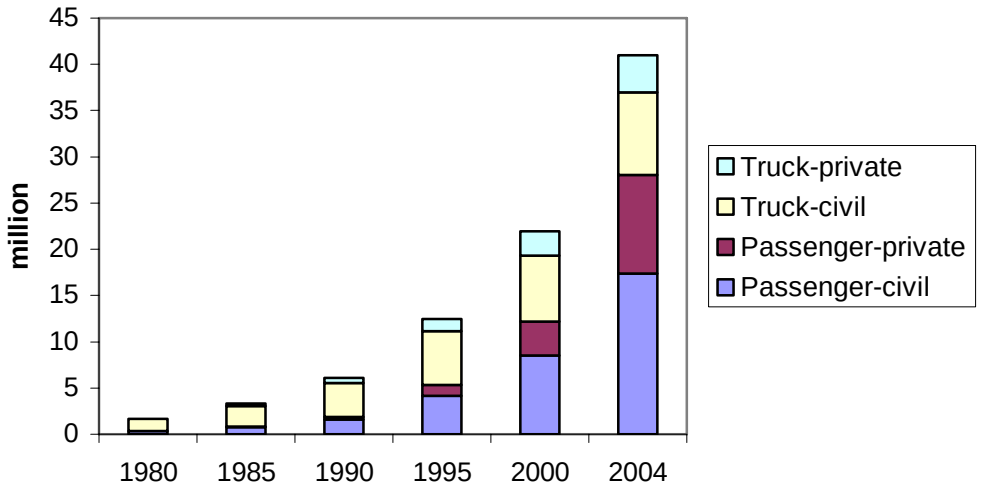

Figure 5. Road vehicle numbers and vehicle ownership in China for selected years 1980-2004. Source: China Statistical Yearbook, various years.

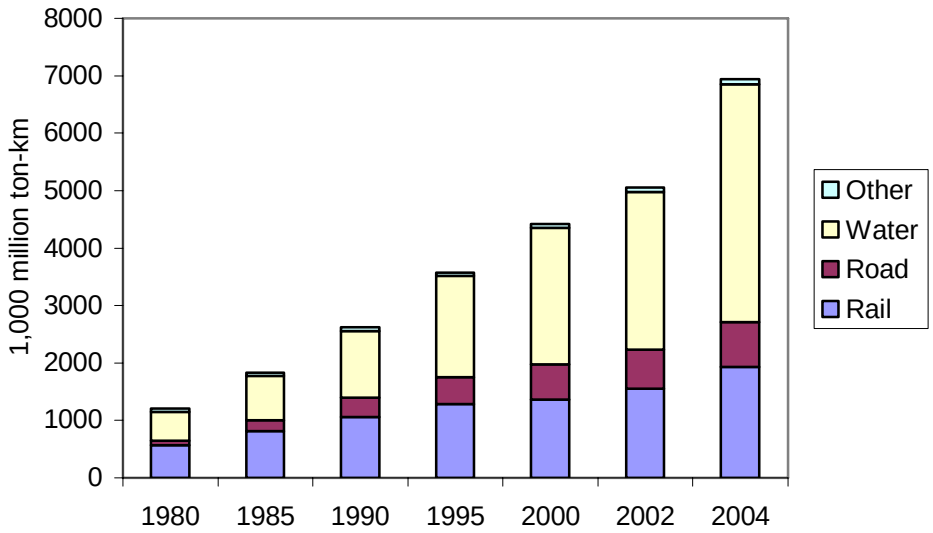

Figure 6: Freight transport in China for selected years, 1980-2004, in millions ton-kilometres. Source: China Statistical Yearbook, various years.

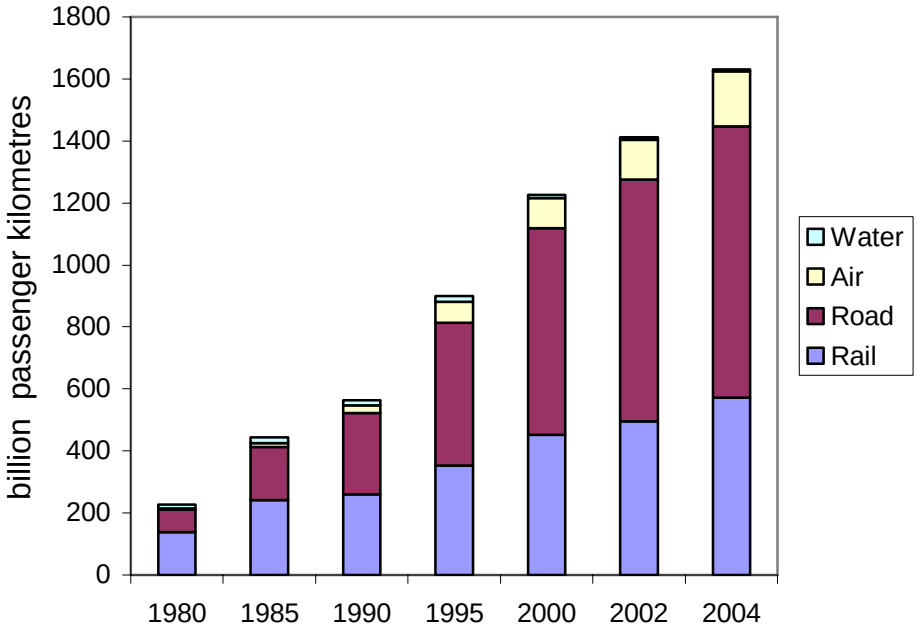

Figure 7. Passenger transport in China for selected years, 1980-2004, in billions of passenger kilometres. Source: China Statistical Yearbook, various years.

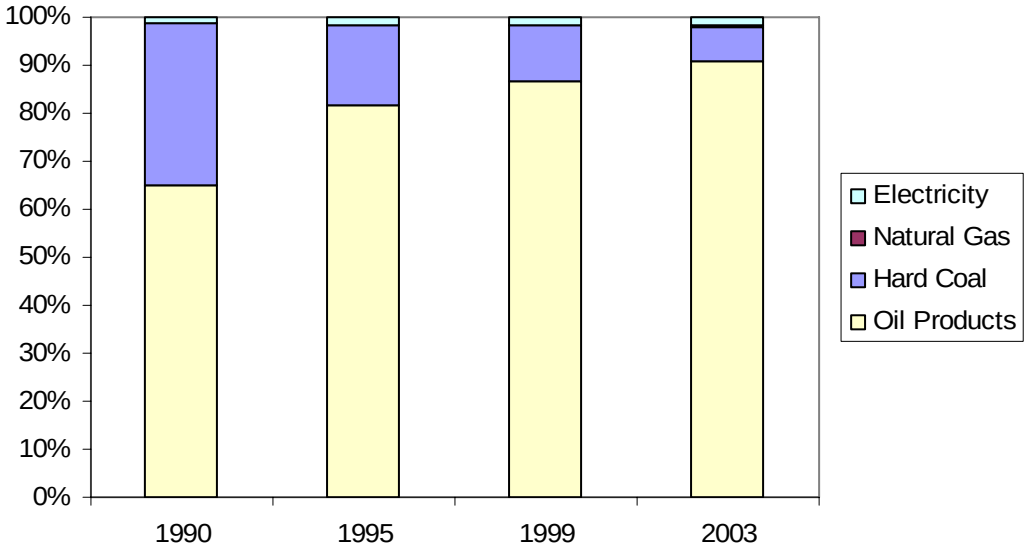

Figure 8: Final energy consumption by fuel type in the transport sector. Source: International Energy Agency statistics.

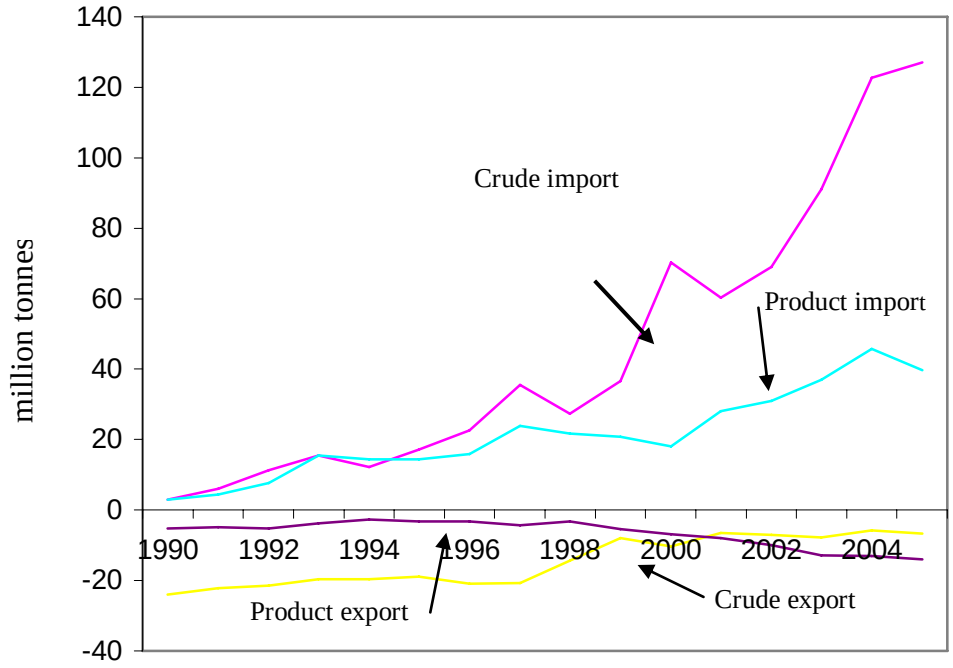

Figure 9. China's imports and exports of oil, 1990-2005, in millions of tonnes per year. Source: BP Statistical Review of World Energy, 2006.

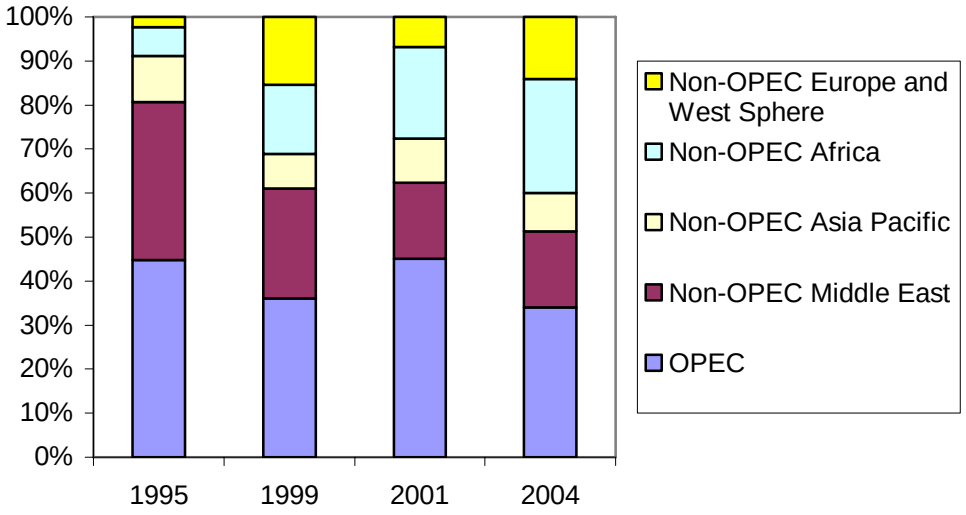

Figure 10: OPEC's share of China's crude oil imports for selected years, 1995-2004. Sources: State Bureau of Customs of China, cited in International Petroleum Economics, Vol. 13, No. 3 (2005), and in International Petroleum Economics, Vol. 9, No. 3 (2001).