June 14, 2007

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Before the

U.S.-China Economic and Security Review Commission
"China's Energy Consumption and Opportunities for U.S.-China Cooperation to Address the Effects of China's Energy Use"

Panel on *Chinese Energy Consumption Patterns and Trends: A Baseline Assessment*

Good morning and thank you to the commission for inviting me to participate on this panel and share my views on China's energy sector. By way of introduction, I come to you as a visiting fellow at the Colin Powell Center for Policy Studies and as director of the Energy Practice at a private sector advisory practice based in New York.

I have been asked to focus my remarks on coal consumption in China. But I'd like to begin by commenting briefly on some structural changes taking place in the Chinese economy that are shaping energy demand. I'll then turn to how China is meeting that demand today, how it is likely to going forward and what these trends mean for both China and the rest of the world.

What's Shaping China's Energy Demand

The past five years have seen a dramatic shift in the energy profile of Chinese economic growth. This shift has taken both market observers and government planners, whether in Washington, Brussels or Beijing, by surprise and has raised questions about the sustainability of China's development model. As China's economy moved from state-planned towards market-oriented in the 1980s and 1990s, the country reaped enormous energy efficiency gains. Management reform at state enterprises, greater competition, and liberalized energy prices created an awareness of energy costs and incentives to use energy more efficiently.

In addition, as households and firms were given more freedom in determining where to spend their time and money, China's economic growth model moved away from the energy-intensive heavy industry that defined the Mao era towards the labor-intensive light industry that's created the China we know today. As a result, between 1978 and 2001, China was able to expand the economy at 9% a year while keeping energy demand growth to less than half that rate. This meant that by the turn of the century, Chinese economic activity used only a third of the energy it otherwise would have if none of these reforms had taken place.

At the turn of the century both officials in Beijing and observers overseas assumed this track record would continue and that China would see additional improvements in energy intensity in the decades to come. Instead, over the past five years, China's energy trajectory has made a radical departure. The economy has continued to grow at better than 9%, but energy demand has increased by 13% per year on average since 2001, more than twice as fast as most analysts predicted. This upside surprise created energy shortages at home, tight oil and gas markets abroad, and has placed China front and center in the debate over international energy security and global climate change.

Yet while the impact of China's growing energy needs has garnered significant attention, there has been less focus on what is driving this demand and how it's shaped by China's role in the global economy. My colleague Daniel Rosen and I have attempted to shed some light on these questions in a recent report for the Peterson Institute for International Economics and the Center for Strategic and International Studies (http://www.iie.com/publications/papers/rosen0507.pdf).

We find that, contrary to what many observers assume, the recent surge in demand is driven not by the rise of the middle class consumer, but by the reemergence of heavy industry and a change in what China makes for itself and what it buys from the rest of the world. In other words, its not air conditioners and automobiles that make China 15% of global energy demand, but steel mills, cement kilns and aluminum smelters. We call this *investment-led energy demand*. Consumption-led demand (the autos, office lights and air conditioners) is China's *future* energy challenge.

Today, industry is responsible for 70% of China's energy consumption (in the US it's less than 25%). The iron and steel sector alone accounts for 16% of total energy demand, compared with 10% for all the households in the country combined. Aluminum production uses more energy than the commercial sector and chemical production more than all private transportation.

The fact that industry is responsible for the majority of China's energy demand means that China's energy footprint is shaped by its position in the global production chain and impacts the energy footprint of countries elsewhere in the world. At only 6% of global GDP, China today accounts for 35% of global steel production, up from 12% only a decade ago. China's share of global aluminum production has grown from 8% to 28% over the same period and China now accounts for nearly half of all cement and flat-glass produced world-wide. This reflects not only growing domestic demand, but also a change in China's trade position in many of these energy-intensive goods. In 2002, for example, China's steel imports exceeded exports by 450%. Last year, exports exceeded imports by 230% making China the world's largest steel exporter as well as producer.

In addition, much of the domestic consumption of these basic materials is to build the infrastructure that facilitates the lighter side of Chinese manufacturing: the roads, factories and ports that are needed to make toys, apparel, and electronics for export to the rest of the world. So whether in terms of steel exported directly, cement poured for a highway or petrochemicals used to make a Barbie doll, much of China's energy demand is used to satisfy consumption outside China's borders, not least here in the US. The question then, from a global energy and environmental standpoint, is how efficient is energy use in China compared to elsewhere in the world, and from what sources is it generated? As I have been asked to concentrate my comments on the supply-side of the energy equation, particularly in respect to coal, I will focus on the latter.

How China Meets its Energy Needs

China, like the US, is relatively rich in coal compared to other natural resources. According to recent estimates, China has the third largest proven reserves of coal in the world at 114.5 billion tones, or 13% of the global total.[1] Compare this with oil and gas for which China accounts for just 1% of global reserves. It is no surprise then that China relies on coal for 70% of its energy needs. In fact, China is by far the world's largest coal consumer. With demand growth averaging 12% annually over the past five years, China consumed 2.4 billion tons of coal in 2006, more than twice as much as the US and nearly 40% of the global total. Though coal prices, once tightly

[1] BP plc., *Statistical Review of World Energy 2006*.

controlled by the central government, have been almost entirely liberalized, it still remains the cheapest source of energy in most areas of the country.

Every year, more and more of this coal is delivered to the end-user in the form of electricity. Today coal-fired power generation accounts for 80% of the country's electricity production, with the remainder coming from hydro (15%), nuclear (2%), and a little wind, solar and natural gas. Total installed capacity in 2006 reached 622 GW (compared to 900 GW in the US) and is projected to double by 2020. Last year alone, China added over 100 GW of new capacity to the grid, more than the entire installed base of Africa, and is expected to add nearly as much again in 2007.

The options for moving the power sector away from coal are limited. Beijing has ambitious plans to expand hydro, wind, and nuclear power but these plans face both economic and political challenges. For hydro China would like to grow capacity from the current 120 GW to 300 GW by 2020. To reach this target, a new Three Gorges-sized dam would have to be built every year for the next 13. Even if this were possible, the productivity of the country's existing dams is declining as reservoir levels fall as the result of a warming climate and declining rainfall. For wind and nuclear power, the government has similarly ambitious hopes for capacity expansion. Between now and 2020, Beijing intends to add 30 GW of new reactors and 30 GW of new wind turbines to the grid. Even if these build-outs go according to plan, they will account for less than 6% of total installed capacity once they are complete.

That leaves thermal power to make up the difference, which will likely translate into at least 450 GW of additional capacity by 2020. And natural gas, which accounts for 26% of thermal power generation in the US, is largely off the table in China due to cost. Natural gas-fired power is most competitive in markets where demand is particularly high, and electricity more expensive, during certain periods of the day (known as "peak load"). These peaks are driven by residential and commercial users, who flip on their lights and air conditioners together at peak times. In China, where the majority of power demand comes from the industrial sector (which operates at a relatively steady rate 24-hours a day) the peaks are much smaller. This makes it difficult for natural gas to compete with coal as a feedstock.

The nature of demand in China's coastal provinces, however, is beginning to change as non-industrial users become a larger part of the picture. In addition, due to bottlenecks in the country's transportation network, the cost of delivered coal on the coast can run between $50 and $70 per metric ton (compared with $15 to $20 per ton at the mine mouth in the country's interior), making LNG more economically viable. Indeed, contracts have already been signed for three LNG receiving terminals, with several more currently under negotiation. Prospective gas-fired power plants, however, will have to compete for this LNG with petrochemical industry parks which need affordable gas to stay competitive with the Middle East and middle class residential consumers who are eager to find a cleaner fuel to heat their homes and cook their food.

In short, the growth of non-coal power sources in China will be an important development for the global turbine, nuclear equipment and LNG markets. It will not, however, do much to move China away from its reliance on coal, which will account for at least 400 GW of the 600 GW in new capacity China is slated to build between now and 2020.

At the same time, rising oil and gas prices have set off a search for ways to meet even more of China energy needs with coal by using it as a replacement for petroleum-derived transportation fuels and chemical feedstock. In the beginning, this charge was led by Beijing out of fear of the national security implications of China's growing dependence on imported oil. But with oil above

$60 dollars per barrel, the market doesn't need any encouragement, and a host of coal conversion projects are under development looking to produce everything from diesel to methanol to ethylene. Some analysts estimate that the production of coal-derived transportation fuels will reach 1.6 million barrels per day by 2020, which would require roughly 400 million tons of coal and 600 million tons of water each year to produce. Beijing's initial enthusiasm for these projects has waned, out of concerns over their impact on coal prices, water supply and the environment, and there are recent indications that policymakers may look to put the brakes on their future development.

Implications for China's Economic Growth

The commission has asked how China's reliance on coal shapes its energy demand profile today, and how that demand is likely to evolve going forward. To date, the country's abundant and relatively affordable coal reserves have been supportive of economic growth as a whole and energy demand growth in particular. If China had been forced to do with imported oil what it has done with domestic coal, the country's energy bill would have easily doubled and growth would have no doubt slowed considerably. But going forward, coal dependence presents more of a downside risk to growth as prices rise and the associated environmental costs come to bear.

The recent surge in heavy industry responsible for the country's burgeoning energy demand is made possible by a number of cost advantages that Chinese firms enjoy relative to their foreign competition. Most important are short construction times and approval processes, concessionary land prices and a capital system biased towards state-owned heavy industry that, in the absence of real interest rate competition for depositors, can provide cheap money to lenders.

Energy prices, in and of themselves, do not provide much of a cost advantage for Chinese firms. Domestic coal and electricity costs have largely converged with international levels, and in many cases Chinese companies pay higher prices than their peers in Russia, Australia or even the US. Where Chinese firms do have an advantage is in the environmental costs associated with producing and consuming that energy. Few Chinese power plants, and even fewer steel mills and cement kilns, control the pollutants emitted from the coal they burn. The cumulative effect of this is decreased agricultural yields, premature mortality and chronic respiratory problems. China's coastal residents are reaching an income level where their food and shelter needs are met and they are beginning to value less tangible goods like clean air and water. This rising middle class is putting pressure on the government to force industry to reduce the amount of pollution it emits, even if it comes at the expense of growth.

Incorporating environmental costs into already rising energy bills will surely hurt the competitiveness of some of China's heavy industry. This can either be a net positive, or a net negative for overall economic growth, depending on how the government manages the process. There has been a lot of discussion in the US recently about how to "rebalance" Chinese economic growth, away from investment towards consumption and away from industry towards services.[2] Worried about the negative impacts of the current investment-led heavy industry boom, from energy demand to environmental degradation to the exploding trade surplus, Beijing is eager to see such rebalancing take place.

But the steps the government has taken to date are insufficient to bring it about in an orderly manner and, in their timidity, risk causing a more abrupt adjustment down the road. What's

[2] Nicholas R. Lardy, "China: Rebalancing Economic Growth," (Washington: Peterson Institute for International Economics, 2007).

needed is a reform of the financial system that underpins the country's most energy intensive industry. By changing the way risk is assessed, allowing greater interest rate competition and extending formal lending to more of the private sector, Beijing would not only slow the explosive growth of heavy industry, but would improve the efficiency of the economy as a whole. In addition, households would get a better return on their savings and thus be able to spend more of their income on goods and services – boosting consumption. If, on the other hand, Beijing waits to act, the policy options available when the environment hits a crisis point will be much less positive for overall economic growth. Many in government realize this and seek to move beyond the traditional administrative approaches to reigning in industry and adopt more market-oriented measures. These steps are encouraging and should be supported.

Implications Abroad

In closing, I'd like to offer some brief comments on what China's current energy trajectory means for two issues that are front and center in the political discourse here in Washington: energy security and climate change.

First, energy security. Thanks to its rich coal resources, China has been able to use domestic supply to meet more than 90% of its energy needs throughout its history. This is changing. This year China will import more than half of the oil it consumes, will see the first full year of LNG imports and will become a net importer of coal for the first time ever. These developments, in and of themselves, do not pose a threat to global energy security. There is more than enough oil, coal and gas in the world to meet China's future energy needs at current prices, so long as the markets are able to accurately plan for that demand. China's impact on global oil markets in 2004 and 2005 had less to do with the absolute quantities China imported, and more to do with the failure of producers to adequately prepare for that increase in demand. But the US is also a significant source of market uncertainty with biofuels development, SPR fill, and consumer demand questions all challenging the ability of producers to plan supply. The US and China will continue to be the biggest variables in global oil markets going forward. Greater transparency, stronger cooperation and improved market signaling on behalf of the world's two largest consumers will improve energy security for everyone.

The US and China are also the two largest carbon dioxide emitters and the leading contributors to global climate change. Yet both the White House and prominent Senators have stated flatly that the US will not accept binding emissions reductions unless China agrees to do the same. And China maintains that, as a developing country with less than one fifth the per capita carbon emissions of the US, it should be held to a different standard. While it is true that the average Chinese citizen is poorer than his US counterpart, it is not the average Chinese citizen that is responsible for the country's carbon emissions. As stated above, the majority of China's energy demand, and thus carbon emissions, comes from industry. And much of that industry sells to households in the US who account for the majority of our carbon emissions. In that sense, the US and China are mirror culprits. In the US we have a consumer problem, from the gasoline in our cars to the electricity in our homes. In China it's a producer problem, whether from the steel mills, chemical manufacturers or aluminum smelters. If Beijing is unable to agree to the same kind of curbs on emissions expected of the OECD, Washington must not use it as an excuse for inaction. After all, China's producer problem may require different solutions than the consumer problem in the US. Beijing, meanwhile, must not cry crocodile tears for its low carbon citizens so that its state industrial giants can be exempt from change, particularly if that change would alleviate some competitiveness concerns in the US to get Washington to sign onto a climate agreement.