CONGRESSIONAL HEARING

Regarding

Opportunities and Challenges in the U.S.-China Economic Relationship

Statement of

Steven Chu
Director, Lawrence Berkeley National Laboratory

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Chairman Baucus, Ranking Member Grassley and distinguished members of the Committee, it is my pleasure to be here today to discuss U.S.-China energy issues. Few topics have the broad impact on America's and the world's future as this one, and I applaud you for calling this important hearing.

I am Steve Chu, Director of Lawrence Berkeley National Laboratory. Because of its direct bearing on this Hearing, I want to let you know that I am currently serving as Co-Chair of an InterAcademy Council study panel on "Transitioning to Sustainable Energy". The InterAcademy Council was created by the world's academies of sciences to bring together the best scientists and engineers worldwide to provide high quality advice to international governmental and non-governmental organizations. It is the charge of our committee to provide a roadmap to scientists and policymakers on moving toward adequately affordable, sustainable and clean energy supplies. My Co-Chair is Jose Goldemberg, formerly the Secretary of Science and Technology and the Secretary of the Environment for Brazil, and an expert in sustainable energy technologies who helped to shepherd Brazil's sugar cane-based energy phenomenon. The panel has given me a broad and varied view of the many energy challenges and opportunities facing our world – including those in China. Our final report should be completed soon and I will make sure that a copy is transmitted to the Committee once available.

China is now the world's second largest energy consumer, after the United States. Its emergence as a major player in the world energy scene is a result of its remarkable two decades of rapid economic growth, which has averaged approximately 10% per year. This tremendous growth has led to remarkable socio-economic shifts, many good for China and the world, many of which have created enormous challenges for China and the world. Clean energy is an issue with which the Chinese government and nations around the world must grapple collaboratively, with the understanding that progress in transitioning to a more sustainable energy future is the paramount task of the day.

As introduction, I would like to share a series of observations that clearly demonstrate both the challenges and the opportunities for the U.S.-China relationship on energy issues. My testimony will then go into a bit more detail on a few of these issues.

- China's and the United States' rapidly growing reliance on coal as the core energy source have substantially added to global emissions of CO_2 and the threat of yet greater climate change in the future.

- As with many countries around the world, China's desire to guarantee access to its future oil and natural gas supply could potentially lead to future conflict with the United States and the rest of the developed world. It has been suggested that China engages with "rogue" states to ensure access to these supplies. Alternatively, China may feel that the United States is trying to limit its access to a key resource. However, we both--as major importing countries--have similar

interests in the stability of supply, particularly in the stability of the Middle East, and should aim for cooperation instead of antagonism.

- In the Western United States, Sierra Nevada Mountain Range monitoring stations have measured and identified particulates from north China as part of the huge clouds of pollution that travel over the Pacific to the United States. California's mercury deposition increasingly comes from emissions from Chinese coal fired plants. The U.S. environmental technologies industry is well advanced and should assist China in identifying opportunities to help clean its air and water.

- China uses roughly 15% of total global energy while the US consumes approximately 25% of the total. Almost half of the world's CO_2 emissions are due to these two countries. While US energy efficiency, as measured by the energy consumed per GDP, is significantly better than China's, on a per person basis the US consumes about 8 times the energy as China. As China's economy rapidly advances and begins to approach the GDP per capita of the OECD countries, it is essential that China improve its energy efficiency, defined as the GDP divided by energy use.

- Can the world sustain the level of energy consumption and carbon emissions per person enjoyed by the US? *As far as our stewardship of the environment is concerned, the carbon emissions per person are a more relevant metric than the carbon emission per GDP.* US energy consumption and CO_2 emissions per person is about twice as high as Europe and Japan. Just as the US must significantly reduce its carbon footprint, China must strive to achieve higher energy efficiencies as its economy grows.

- Between 1980 to 2000, the economy of China quadrupled while its energy consumption only doubled, twice the improvement of the US. However, as free-market forces were unleashed, the energy demand began increasing and is now at one and a half times the rate of economic growth. The central government of China announced in 2006 an ambitious plan to decrease energy intensity by 20% by 2010, but it is already falling behind these goals. It is in the best interests of the US (and the rest of the world) to more aggressively help China achieve its goals. Why? In the next two decades, roughly half of the buildings in the world will be constructed in China. Between 300 million and 600 million Chinese will move into cities. During this massive construction, it is vital that the new cities be designed to maximize energy efficiency.

I believe that China's leaders understand their dilemma and their opportunity. For China, especially Chinese government officials, the energy issue is most often cast in terms of access to affordable energy as paramount to its economic future. Combating pollution and finding cleaner methods of powering its growth is a key to the health of its citizens.

China plays a central role in the world's increasing concerns over global climate change. The reduction of carbon emissions pledged by the European Union will be outstripped by the growth of energy demand and production in China. For example, China's addition of 90 GW of coal-fired power plants installed in 2006 alone is expected to emit over 500 million tons of CO_2 per year for their 40 year lifetimes. This compares to the entire European Union's Kyoto reduction commitment of 300 million tons of CO_2. Coal underpins the majority of China's economic growth, and consumption is now nearly 80% higher than in 2000. This growth has heavily taxed China's entire energy supply chain, from mines to processing to transport, and has sharply increased CO_2, sulfur dioxide and other polluting emissions. I should also note that the US is also in the process of building an unprecedented number of coal plant; over 120 plants are being planned.

As was previously mentioned, China had managed until 2000 to keep growth of energy consumption substantially below that of its economic growth. To repeat, between 1980 and 2000, China quadrupled the size of its GDP, while only doubling its energy consumption. This remarkable achievement is unknown among other countries of its size or level of development. On the basis of this success, the Chinese government's long-term development plan laid out in 2000 set a similar target for 2020—another quadrupling of the GDP, with only a doubling of energy consumption. Unfortunately, the experience of the past 5 years has completely stymied this ambitious plan. Energy consumption has been growing faster than the rate of economic growth and is already 75% higher than in 2000.

The aggressive 2006 response by China's leaders to reduce the energy intensity of the economy by 20% by 2010 has engaged the leadership of each province, who all signed a pledge in Beijing to achieve the target. In support of this pledge, the government has included success in increasing energy efficiency as one of the evaluation metrics for the provincial leaders. It has also announced a range of other policies to move in this direction, including efficiency gain requirements for China's top 1000 industrial enterprises, which collectively consume 33% of China's total energy consumption. If successful, this program would represent a substantial reduction in China's projected CO_2 emissions by about 1 billion metric tons. Already, at the recent G8 ministers meeting in Germany, China's environmental minister, Xie Zhenhua, included the 2010 reduction plan as part of China's upcoming national plan to combat climate change.

China's energy structure has been, and remains, dominated by coal. Coal provides over 90% of fossil-fueled power generation, and it is a key fuel to the steel and cement industries, now the largest in the world. It provides energy for cooking and heating in millions of homes. And increasingly, it is being looked to as a source of both chemicals and alternative fuels. In 2006, China mined and consumed nearly 2.4 billion metric tons of coal, more than twice the volume consumed in the United States. Just a few years ago China was a major exporter of coal, but since the beginning of 2007, has become a net coal importer.

China has few options to reduce the dominance of coal in its economy. Although natural gas supply has expanded rapidly in the past decade, domestic reserves are limited, and production is less than 10% of the volume produced in the United States. China has begun a program to import liquefied natural gas (LNG) to supplement its domestic supplies, but the recent sharp increases in world LNG prices and the costs of terminal construction have already curbed future expansion plans. Similarly, it has looked to neighboring countries—Russia and Kazakhstan, and Turkmenistan in Central Asia—for the possibility of pipeline imports of natural gas, but these projects have been hampered by uncertainties of resource availability and by unsettled issues of control by Russia. Domestically, high natural gas prices have stifled the expansion of natural gas use in the power sector, where now just 2% of total capacity is gas-fired. Although China hopes to quadruple the supply of natural gas to its economy by 2020, natural gas is unlikely to exceed 10% of the total energy mix, and natural gas can do little to offset expected growth in coal demand.

Another daunting barrier to improving China's energy reality is its rapidly growing petroleum consumption. Although it has displaced little, if any, coal use (which would be positive development from a carbon emissions perspective), China's use of oil is skyrocketing. As in the United States, oil forms the backbone of China's domestic transportation system, powering trains, ships, planes, trucks, cars as well as a vast number of agricultural tractors. In total, transportation use of oil accounts for only about 40% of total oil consumption, compared to over two-thirds in the United States. While China presently accounts for just 9% of world oil demand, it is responsible for 30% of world demand *growth* – much due to the growth of automobile consumption and use.

As with natural gas, China's demand for oil has outstripped its domestic supply. Once Asia's largest oil exporter, China became a net importer in 1993, and is now the second largest oil consumer—and third largest importer—in the world. China is home to one of the world's largest super-giant oil fields—Daqing—which produced over 1 million barrels per day for over a decade. It is now in production decline, and within a few years, perhaps as early as 2007, China will join the ranks of 60 other oil-producing countries whose national production has begun to decline. Future growth in consumption, therefore, will rely entirely on imports, and oil security is of central concern to China's leadership. Their policy response to the issue of oil security has been multifaceted, yet at times inconsistent and at cross-purposes.

China's national oil companies have looked increasingly overseas to establish resource and production bases to supplement weakening domestic supply, at times bringing them into conflict with the established operational modes of international oil companies and with policy goals of other countries, including the United States. China has established a Strategic Petroleum Reserve for the purpose of stabilizing the domestic market, but the lack of transparency on fill rates and timetables has at the same time unsettled international oil markets unsure of what incremental demand China's SPR will bring. China has opened its domestic oil wholesale and retail markets to a limited extent in accordance with WTO agreements, but continues to control the

price of gasoline and diesel to shield farmers, freight shippers, and other consumers from the full impact of high international crude prices. On the demand side, China has implemented strict automobile efficiency requirements on a per-car basis, yet has constructed the equivalent of the U.S. interstate highway system in little under a decade, and has let investment in its extensive rail system lag. The personal car—centerpiece of U.S. oil consumption—remains but a small fraction of the total vehicle stock in China but is already a major contributor to air pollution in cities such as Beijing and Shanghai.

Although the challenges are huge, China is committed to making progress and is implementing plans to do so. Some changes have been spurred by direct economic reasons and often do not address the issue in a climate friendly way. Other changes are made for political and policy reasons, such as to combat pollution and congestion, but are often negligible in their impact and efficacy for either global climate change or energy security.

On the economic side, high international oil prices have spurred development of domestically produced oil alternatives. Since 2001, China has expanded its grain ethanol production capacity to about 360 million gallons a year, providing 10% ethanol gasoline blends in 10 Chinese provinces and cities. In 2006, however, a surge in corn prices in the domestic market led to a moratorium—citing food security concerns—on the use of food-chain grains for ethanol production, and China is now looking to expand production of cassava and other starchy roots to substitute for grain. It has also declared intentions to plant an area the size of Delaware with jatropha and other oil-bearing plants to provide feedstock for the biodiesel industry.

Ironically, and unfortunately from a climate perspective, China is also looking to coal as an alternative to oil, and proposals for over 60 million tons of coal-to-liquids (CTL) capacity (about 1.2 million barrels per day) have been submitted for review. The consequence of this program, if carried out, would be dramatic. Nearly a quarter-billion tons of additional coal would have to be mined for fuel and feedstock, and substantial new water resources found to supply the plants. Also, no plans for carbon capture have been announced, despite the fact that CTL-derived vehicle fuels result in three times the CO2 emissions compared to petroleum-based fuels.

China is also looking at nuclear power as a means to reduce its dependence on foreign sources of energy. But, nuclear power remains a minor energy form in China. Currently, generation capacity totals 7.6 GW out of a total 622 GW nationwide, or just a little over 1% of the total. China has another 4.2 GW under construction, to be completed by 2012, and by 2020, China hopes to bring 40 GW total into operation, providing just 3 to 4% of electricity supply in that year. This very aggressive plan, requiring the commissioning of over 2 GW of new capacity every year to 2020, can do very little to offset the growth in coal use for power generation. In 2006 alone, China installed a total of 102 GW of new power generation capacity, of which 90 GW was coal-fired (mentioned earlier). In contrast, 2 GW of nuclear power capacity is expected to come online in 2007.

China's leaders and government bureaucracies have also looked to energy conservation and efficiency as a way to help address their energy challenges. China has strong efficiency programs in place for residential and commercial equipment, appliances, electronics, and lighting. Their program of minimum energy efficiency standards has been revamped and modernized since 1996, largely on the basis of the U.S. Department of Energy program, with broad support from the U.S. Similarly, China's energy efficiency labeling authority recently signed a Memorandum of Understanding with U.S. Energy Star to harmonize its own energy efficiency specifications with those in use in the United States. In contrast to the United States, however, the residential and commercial sectors account for only a small proportion of China's energy consumption: the industrial sector dominates, accounting for over 60% of all energy use. In this sector, efficiency programs are weak or non-existent, with only a few pilot programs developed with international assistance underway. The need for such programs is urgent, as progress towards the achievement of the 2010 reduction target will depend heavily on efficiency gains in the industrial sector.

In developing these new programs, China traditionally first looks abroad to survey successful programs in other countries, adapting as needed to suit the conditions in China. Technology is generally not the challenge: what is needed is a package of measures to encourage adoption of new technology, information dissemination of results and experience, financial or tax incentives, technical assistance in auditing and planning, backed up by leadership support at higher policy levels. These are areas in which the U.S. has extensive experience and could provide assistance to China for achieving its energy reduction goals.

China's reliance on coal also makes it urgent to accelerate research and development on techniques for carbon management, including capture and sequestration. As the United States and China are the two largest coal-consuming countries in the world, and the two largest CO2 emitters in the world, a partnership in this area could make progress towards offsetting the impact of the expected increased use of coal in both countries. Further progress on climate change mitigation also depends on the engagement of the United States and China.

Finally, China's size and rapid growth means that developments in every energy field—oil, coal, natural gas, nuclear power—will have global impacts. It is important, therefore, that the engagement with China on energy issues be strengthened and expanded, both bilaterally and multilaterally. Although the International Energy Agency has already established regular dialog with China on oil and other issues, full Chinese participation in the mechanisms of the International Energy Agency—particularly with respect to Strategic Oil Reserves management—may be appropriate. China's rapid rise into top global economic leadership may also suggest that full participation in global dialogs such as that of the G8 are warranted. Without engaging the developed world fully and at all levels of the energy issue, significant and long-lasting progress will not be realized.