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THE CHALLENGE OF SUSTAINABLE DEVELOPMENT IN ASIA

REMARKS BY DR. JEFFREY D. SACHS

Beijing, China

March 8, 2007

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Jeffrey Sachs:

Thank you very much for coming together on this wonderful day to discuss the world economy. I'll try doubly hard not to be boring because you're all standing! Having to stand through a boring speech would be a double burden; so I hope that this will be worthwhile for you and I thank you very much for taking the time and having the patience to stand and listen.

I would like to talk about the world economy and China from the perspective of sustainable development, meaning both the economic and environmental challenges intertwined. While macroeconomics, savings and investment, currency, trade etc. are all very important issues, when we look at the medium and long term challenges of China over the next 25, 50, or 100 years, it is clear that environmental challenges will be as important as any other that we face. Yet we have not done a good job in understanding or responding to these growing pressures on all of our economies.

I have been to Tsinghua many times in recent years always with a similar message: I am very optimistic about the medium term economic growth of China. I am a big believer in the basic proposition that the forces of economic convergence are now very powerful and unlikely to be derailed. From a standard view of the growth process, developing countries have the chance to narrow the income gap with developed countries. In fact, the evidence suggests that a country with roughly half the income level of the highest income countries should experience economic growth at a rate of about 1.4 percentage points faster than the rich countries. Countries that are half as rich as that middle level should experience growth at an annual rate of roughly 2.8 percentage points faster than the richest countries, and so on so on. In short, the statistical evidence suggests that the bigger the income gap, the faster the growth. What we are going to experience in the coming decades is a considerable rise of aggregate income and a considerable shift in where that income is produced in the world. We are therefore facing a very strong rise in the share of world income that will be produced in Asia, and an overall level of economic growth that could, if unimpeded by environmental challenges, raise world income as much as 6 times between the year 2000 and the year 2050. China's growth rate in per capita terms can robustly be at 6 percent per year. It has been even faster in recent years, and it will likely continue at this rate as the gap narrows. India's growth rate will be even a little bit faster, and is accelerating right now. The implication of this optimistic scenario is that the basic pattern for the world economy includes convergence leading to a sharp rise of the share of income produced in Asia to more than 50 percent of the world economy by mid-century. Conversely, what is happening in the so called western countries is a remarkable drop of the proportion of the world economy to about 20 percent actually. This is partly because the population of the western countries as a share of the world is shrinking, and partly because the non-western countries are catching up in income.

In terms of population, the shares and the shifts are not so dramatic according to current forecasts. Traditionally, Asia has comprised about two thirds of the world's population, and then has fallen to, and stayed roughly at, about 60 percent today. The big change of demography is actually the shrinkage of Europe's population, as growth has gone to 0 and then negative, and the sharp rise of Africa's population, rising from about 7 percent of the world's population in 1970 to about 20 percent of the world's population by 2050. This is quite a remarkable shift, which I will not

discuss further today, except to say that in Africa, because the fertility rates remain so high, the population in many countries is doubling every generation. The overall forecast is that the total population of Africa for the whole continent will more than double between now and 2050, from about 800 million to about 1.7 billion, and this will obviously lead to profound changes in the world economy and world society.

The rough calculation is that the population is projected to rise roughly 50 percent from about 6.6 billion today, to about 9 billion by the middle of this century, and per capita income is projected to rise roughly by a factor of 4 between now and 2050, assuming the convergence process continues as it is going now. This would mean that the aggregate world output would rise by about 6 times, between now and 2050, from roughly 50 trillion dollars today to roughly 300 trillion dollars by the year 2050.

The basic point of all of this is that on standard economic terms, if not constrained by political disaster or ecological limitations, the world economy has enormous aggregate growth built in right now as the poorer countries catch up with the richer countries.

The bigger question, however, when discussing this economic catch up, is whether the global environment, ecology and resource base can actually accommodate this growth. My view is that it is perhaps the biggest question that we face, bigger than the standard questions that we ask about growth dynamics. The underlying mechanisms of saving, investment and technological improvement are rather well understood, but the ecological limits are not. For a long time mainstream American economics has neglected these issues, so we do not have a serious answer to them. The ecologists say such growth is impossible and the economists say it is no problem. The truth is somewhere in the middle, but we do not know where that middle is. It is therefore important to discuss this issue at length.

The ecological problem is that at the present, it is clear that we are not on an environmentally sustainable path. If we do nothing more than use energy the way we do, but allow for massive growth (use automobiles the way we do but have China go from 30 million vehicles to 300 or 500 million vehicles, use power the way we do but add maybe 3 times the electricity production between now and 2050) we will find ourselves up against an unsolvable problem. There will not be enough environmental space for us on the current path, even if all we do is use existing technologies. I would like to briefly elaborate with some critical examples.

One important thing to realize is that we are NOT running out of mineral resources. It is not going to be a shortage of oil, iron ore or copper that will stop this process of economic growth. The bigger constraints are on the biological limits of the planet, rather than the mineral limits; and those biological limits are being pushed very, very hard right now. It is crucial that we understand this if we are going to try to continue with the rapid convergence and with some kind of physical sustainability. A famous ecologist at Stanford University, Peter Vitousek, asked the question: how big is the human impact on various parts of the ecological system? What he found was that it's already enormous, even without a six times increase of output. Human beings are already appropriating about 50 percent of the total net photosynthetic potential of the planet for

human use. This seems unbelievable but it is true---we are using half of the photosynthesis potential for ourselves! We are doing so mainly in three ways: first to grow food for ourselves, second as pastureland for animals that we eat, and third for use of physical area for non-agricultural purposes (pavement etc.). The point is it would be impossible to double the land area used for additional food production, because we simply do not have enough to double again. If we are going to increase our food production, we are going to have to be cleverer about how we do it.

A second crucial issue to note is that humans have taken over the natural nitrogen cycle. We have done so by using fossil fuels to produce nitrogen based fertilizer. We now put in more nitrates into the earth than the natural nitrogen cycle does through bacteria and lightning, and this is killing many ecosystems through eutrophication (putting nutrients into the water supplies of major river systems which create big blooms of algae which in turn kill the fish and the other marine life).

Additionally, humans have a direct impact on species abundance. First, we have altered where species live on the planet by carrying them from one place to another, where they become “invasive” and derange the ecosystem. Second, humans are now causing massive extinctions of animals by destroying habitats and by over-hunting and over-fishing.

Before I go on to focus on the issues of climate change and water, I’d like to emphasize that all of the realities I just detailed exist right now, before the expected six time increase of economic activity. Although we do not give very much attention to the issue, we are pushing right against the boundaries of all of the ecosystems—the land, the water, the climate, the species abundance. It is clear that the only way to accomplish a six fold increase of GNP in an ecologically fragile planet is through substituting physical and human capital for natural capital so that we can use fewer natural resources per unit of output.

Now I would like to take some time to elaborate on the issues of climate change and water. Let me first turn to climate change, an issue which is very quickly rising to the top of the global agenda. A few days ago I went to Berlin, the current host city of the G-8 summit, and then to Tokyo, next year’s host city. In both capitals, all of the discussion about the summit started with the climate change issue, which is a signal of how rapidly this is moving to the top of the political agenda. China is going to play a crucial role, perhaps the most important role in this issue in the years ahead. So we really need to begin discussing climate change in a lot more detail; and the discussion needs to include how growth issues and the climate issues are deeply connected.

I am sure that everybody is familiar with the basic proposition that human beings have taken over the carbon cycle and we are now changing the carbon dioxide concentration in the atmosphere. Under human influence, the molecules of carbon dioxide in the atmosphere, which were stable for tens of thousands of years at about two hundred eighty parts per million, have now risen by 30 percent since the beginning of the industrial revolution, to about 390 parts per million today. This is mainly from burning fossil fuels, but it is also from cutting down and burning forests to make room for food production and for pasture land. While the most important of the greenhouse gases is carbon dioxide, there are two other main greenhouse gases: methane and nitrous oxide.

The nitrous oxide comes in large part from fertilizer use and the methane comes mainly from rice growing and livestock breeding, or agricultural use in general. All of these emissions are intensifying, and because of convergence taking place in the world, it is the developing countries that will soon become the largest emitters of the greenhouse gases.

The result of these emissions, as we all know, is that the earth has warmed by about .8 degrees centigrade since the start of the Industrial Revolution. The warming is greater the higher the latitude and it is least near the equator. The increase in temperature at the high latitudes causes a cyclical reaction in which snow melts, resulting in less reflection of ultraviolet, which in turn causes the earth to absorb more heat. Indeed, even if we halted all greenhouse gas emissions today, there would still be another half degree centigrade or more of continued warming, just based on what has already been emitted. Climate change effects will still double, simply due to the fact that the earth has not yet warmed up fully in response to the greenhouse gases. The main reason for this is that it takes time for the oceans to warm up due to thermal inertia. They are still warming up, catching up with the warming that has already taken place on the land.

Of course, we have not stopped putting greenhouse gases into the atmosphere and the amount that we are putting into the atmosphere is accelerating, not decelerating so far. Thus things are going to go faster. Indeed, according to the most recent estimates of the International Energy Agency, China will overtake the United States in carbon dioxide emissions by the year 2010. China will soon be the largest emitter of energy-based carbon based dioxide. Clearly it will not be the largest emitter per person, as its per capita rates will still be roughly one fourth the levels of the US, but in aggregate, it will indeed be the largest.

It is evident that the current trajectory of energy use, if it increases along with economic activity, and given the availability of the fossil fuels that we have, would very likely push us into very dangerous territory. Quantitatively we can say the following: before the Industrial Revolution, the concentration of carbon dioxide in the atmosphere was 280 parts per million. Now we are at 390 parts per million. This means a rising at a rate of about two to two and a half parts per million each year, and that rate of increase is going up because the world economy is becoming bigger. A 'business as usual' path would probably lead us to about a doubling of the carbon dioxide by 2050, to about 560 parts per million, and it could be 7 or 800 or 900 parts per million by the end of the 21st century. If we reached a level of 560 parts per million of carbon dioxide in the air by 2050, estimates suggest that the temperature increase would be about 3 degrees centigrade compared to the pre-industrial baseline. Most ecologists and climatologists think that the consequences of this temperature increase for the planet would be very severe.

Some people have said that this problem could solve itself if we run out of fossil fuels; but that is not going to happen. In any case, that would not happen soon enough to avoid great environmental damage. The effects of the global warming are already serious. An important report issued by the United Kingdom late last year, the Stern Review on Climate Change, surveyed these effects quite comprehensively. The report shows that climate change affects many sectors. It affects food, water availability, ecosystems and extreme weather events (like the huge typhoons that hit China this year, or the big hurricanes that hit the United States in 2005). Of course the higher the temperature

increase, the more serious the problems become. We are already seeing major impacts, for instance in Africa on reduced food production; and we are already seeing the coral reefs around the world being destroyed, perhaps irreversibly damaged. If we get to a 2 degrees centigrade increase, which is very likely on the current trajectory, there could be even more significant declines in food yields, very serious changes of water availability and very large species die offs. Moreover, according to my colleagues, 2 degrees centigrade would give a very high likelihood of eventual disintegration of the Greenland and the Antarctica ice sheets, based on the long history of the climate record.

Clearly, if we are to achieve sustainable growth, we must head off this treacherous path. The question is essentially whether a combination of three kinds of actions would allow us to stabilize the greenhouse gases, including carbon dioxide, at a safe level: first through more energy efficiency, second through non-carbon fuels (nuclear, wind, solar, geothermal energy), and third, through the technology of carbon capture and sequestration (the technology where as coal is burned at a power plant, the emitted carbon dioxide is chemically removed from the exhaust, and piped underground, for geologic safe disposal). In order to head off this crisis, we would have to do some combination of the three of those actions.

Currently, we are not doing any of the three. China and the United States have both announced more energy efficient policies, but neither have followed through. Moreover, renewables still remain a small fraction of our energy source, and because we will run out of some of the cleaner sources of energy, we are probably going to use more coal, not less, in the 21st century. We cannot, for example, use more hydroelectric power as we have already built pretty much all the dams we can without creating big ecological disasters. While China is still trying to build more, there will still not be enough to satisfy a big portion of the demand for increased electricity. Also, if China puts a lot of dams on the Mei Kong River, for example, perhaps more energy can be produced, but the consequences for Cambodia and for Laos and for Vietnam would be extremely negative.

One of the biggest issues we face is whether it will be possible to use the coal in an environmentally safe manner, which is a big technological and economic issue. The hope for carbon capture and sequestration technology is very real, but it is important to realize that China is in the process of a massive increase in building of coal based electricity now, without any preparation for carbon capture and sequestration. One estimate is that in the last three years, China has added 200 billion watts of power from coal based power plants, not one of which is equipped with the capacity to capture and dispose of the carbon dioxide.

In my view, the important thing is to take two steps now. First China, India, the United States, and Europe must undergo a major effort to test clean coal technologies with a lot more urgency than currently. We must see if technology really does give us the chance to use the coal resources safely. But as far as I know, there is not one single power plant under construction in China that is even attempting this. The second thing that is going to be needed is for the US, China, India and Europe to finally agree on a strategy for limiting greenhouse gas emissions, given that the Kyoto Protocol is not comprehensive and expires in the year 2012. There must be a worldwide agreement for after

the Kyoto Protocol's expiration. The negotiations on this will start in December 2007 in Indonesia, and it is going to be an extremely important time for China and the US in particular to agree. As the two largest emitters of greenhouse gases, we are going to have to come to an agreement on how our countries will work together to find a solution that attempts, at least, to allow economic growth to continue, but introduces technologies that are much safer than the ones being used right now.

Now I would like to turn to the second issue that I'll discuss in depth: the water crisis. This is another ecological issue that, like climate, could really derail long term economic development. The water crisis could create terrible crises for food production, for example, as well as for industry and household use. Significant parts of the world that are already under tremendous water stress-- we happen to be meeting in one of them today, because the roughly 300 million people who live in this area in the North China plain are all in a region of serious water crisis. The western United States is the same, as are all of the dry areas just north and south of the Sahara and into the Middle East and into the dry lands of Central Asia. A large part of India is also subject to quite extreme water stress.

We are already taking over about half of the water runoff in habitable areas of the planet by putting up dams, irrigation projects, and other obstructions for industrial and household use. The Yellow River, and many others, no longer reaches the ocean. The Rio Grande, which means 'big river' in Spanish, is a tiny little river now since the water is all used for agriculture in the very dry areas of the US Southwest and the north of Mexico. There is almost no water there anymore; indeed many rivers around the world have basically disappeared as a result of human use. There is simply no way that we could double the irrigation on the planet again. The potential runoff just does not exist anymore.

One of the ways that the dry areas are compensating for their relative lack of water now is by tapping the underground aquifers. For example, Beijing lives on underground water to an important extent, and much of India, especially Northern India, does so as well. A lot of the increased food production of the last 30 years has come from farmers putting their own bore wells in Northern China and in North India. This underground water use has risen spectacularly, to the extent that the rate of underground water use from these aquifers is much faster than the recharge rate of the water through natural rainfall. What is happening is that we are draining the aquifers, and the water tables are falling very sharply. India is the country most at risk. My colleague did a map of the groundwater use in India and spent some time in the Punjab, which is called the bread basket of India as it produces India's grain. The water table has declined by more than 150 meters! When my colleague spoke with government officials this past summer about their plans, seeing that the water may only last another 20 years or so and that it's already extremely expensive to pull out, the government's answer was they have no plans. Essentially, the water is just being taken out without any response or policy, and I would say this is true in a lot of China as well.

Exacerbating the problem is the fact that climate change is going to have a very significant effect on the water crisis, for two reasons. The first is that the precipitation patterns will change, and it

is likely that the current dry areas will become even drier. Second, the warming of the land areas is leading to a massive change of the river flow patterns, especially in the Himalayas, which are the source of the water for the Yellow River, the Yangtze River, the Mei Kong, the Ganges River, the Brama Putra River—all the major rivers of Asia. Running through Pakistan, India, Bangladesh, Southeast Asia, and China, all of these rivers originate in the highlands areas or the Tibetan plateau. The warming of the Tibetan Plateau is already changing the river flow significantly: the glaciers are melting, and the snow that comes each year melts sooner, causing the rivers to run a month earlier than before. As a result, when the water is needed in the summer, it no longer exists because the river has reached its maximum flow in the early spring. Now, in India, tens of millions of workers are forced to migrate because traditional areas for farming no longer have enough water to farm. This is clearly a major economic and social challenge as well as an ecological challenge.

I am not going to say much about the solutions for water because much less is known about this issue than about climate change. In my view this is perhaps the biggest unknown and I believe this is now the area where we need urgent worldwide studies, with China and India as very high priorities.

So what's my conclusion from all of this? I think we can be fairly confident that powerful convergent growth processes will continue because of the natural market dynamics of technological advance and capital accumulation. What we do not know is whether that economic growth is really compatible with the environmental constraints on the planet. My prediction is that environmental economics, which is up until now considered a fringe issue, and not taken seriously by policy makers, is going to be the core subject of discussion in the decades ahead. This issue is very important and remains very much unsolved. Our policymakers have not liked to talk about this too much up until now, but I am afraid that we are all going to have to learn to be ecologists in the years ahead. Thank you very much.

XIAO Geng:

Thank you, Jeff, for a very inspiring and insightful lecture on the state of the world's ecology and economy. We also have three commentators today, two of them I know are very familiar with this subject. Privately, Mr. Yi Gang talked with me many times about the issue and Wang Gang also did a lot of work in this area so we should have an interesting discussion.

CHINESE SPEAKER 1 (in Chinese)

CHINESE SPEAKER 2 (in Chinese)

CHINESE SPEAKER 3 (in Chinese)

QUESTION AND ANSWER SESSION (questions in Chinese)

Jeffrey Sachs:

Thank you, thank you very much again, also for your patience. Wonderful comments from all of you. Once we enter the discussion of what to do about this problem, we are going to face a very big question about whose responsibilities these are and how to pay. Let me again stress one basic

point: from a purely arithmetic perspective, just from the total amount of carbon dioxide relative to the atmosphere, all the major countries are going to have to limit their emissions if we are going to avoid dangerous levels. And this is quite unfair, because China's level of emission per person is much lower. Unfortunately, the air does not care about that. The air does not really care about anything except how much carbon dioxide is emitted. Who pays for that is another matter, because the question will be threefold.

First, what level should we aim for to avoid danger? Most scientists think that we should try to aim for somewhere between 450 and 500 parts per million of carbon dioxide. The second question is: in which places in the world should that carbon dioxide emission reduction take place? This question brings up a basic point which is: once you put the capital in place, whether in the form of buildings, power plants or automobiles, it is very hard to reduce the emissions. However, if you are making new investments, then your choices are somewhat easier. It is hard to retrofit an old plant or an old factory, but much easier to fit a new one. In this sense, the lowest cost solution from a world point of view will be actually in the faster growing countries that are adding new capacity rather than in the old advanced countries that have a stable capacity. As a result, the cheaper solutions, from a global cost point of view, will be emissions controls in the new factories of China and other expanding countries, rather than in the old factories in Europe and the US.

The third question is who should pay? Should China pay for that even though its emissions per person are lower? Should the United States pay for it even if it's taking place in China? There is clearly an international sharing agreement that needs to be negotiated.

We are going to need strong controls on all new investments in the world. New power plants, new automobiles, new buildings are going to have to be more carbon efficient, either using non carbon energy or capturing the carbon and sequestering the emissions. In order to pay for that, the rich countries are going to have to help the relatively poorer countries. The good and bad news for China is that it is very quickly becoming a "not so poor" country.

Actual negotiations will begin in December. I think it's important for the economists here to work out what a valid negotiating position is for the government. What's a fair negotiating position? What's an efficient negotiating position? How much would it cost?

We must reach an agreement by 2010 at the latest if we are to have a post Kyoto agreement which starts January 1, 2013. So the time is short and there is a good demand for economists' work right now to do important studies in preparation for the negotiations. We really should work very hard so that the US and China, India and the European Union, can all reach some kind of agreement on what we are going to do, and how we are going to share the costs. We do not have that much time to do it.