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CHINA'S BALANCING ACT: ECONOMIC GROWTH, CLIMATE CHANGE AND THE ENVIRONMENT

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Introduction:

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Panel One: China's Energy and Economic Outlook

Moderator:

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Panelists:

JEFFREY D. SACHS
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WANG YIMING
Executive Vice President, Academy of Macroeconomic Research

GAO SHIXIAN
Chief of Division of Energy Economics, Energy Research Institute

Panel Two: Earth, Wind and Fire: China Tackles Climate Change

Moderator:

JEFFREY A. BADER
Director, John L. Thornton China Center

Panelists:

XIMING CAI
Professor, University of Illinois, Columbia Water Center

WING THYE WOO
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P R O C E E D I N G S

MS. BRAINARD: (in progress) -- nexus of issue and how China balances these competing priorities is obviously critical -- not just for China, but because of China's growing importance also for the planet. As everybody in this room knows, in the last two decades, China has outperformed every previous growth record and in the last 10 years alone, tripled its GDP and really brought a record number of people out of poverty. But, of course, with traditional growth paths that China has followed and that the industrial countries followed before it, along with that growth has also come a large environmental cost.

And today, as we all know, China has recently taken on the dubious status of being the world's largest emitter of greenhouse gases. As we start to think about these things, these are challenges that we in the United States face and will continue to face moving forward, and it is enormously in our interest here in the United States to work collaboratively with China as it grapples with many of the same challenges. We saw perhaps the most graphic example of this -- or at least for many people around the world who hadn't really thought much about it -- the Beijing Olympics was a moment in time where people sort of realized that just to clear the air for the Olympics cost by some estimates over $10 billion. And I think that was a kind of wake-up call.

And as we know air pollution is a serious issue, not just for environmental reasons, but for health reasons, and so it is something that every developing country grapples with. On climate change, the issues are also very thorny. Not only are there the questions of economic tradeoffs, but also the questions of how burdens should be shared -- questions of equity, discussions about the historical biggest contributors to emissions -- the United States obviously -- relative to tomorrow's biggest emitters, which by all accounts are going to be the emerging economies, chief among them, China.

And so as we all grapple with the planetary emergency of dealing with climate change, what's the right way for us to share the burden? What's the way for us to best collaborate on technologies that are going to chart a new development path, a new growth path that is less carbon and pollution intensive? We've got a very eminent delegation from China's NDRC who is looking at these issues very much from a technical perspective and who our scholars here at Brookings are having the benefit of being able to examine some of these issues along with the Earth Institute at Columbia and so this is really the public side of that dialog.

It's led on our side at Brookings by Dr. Wing Thye Woo, who is going to be on the first panel, and on the Earth Institute side by Jeff Sachs, who I think is going to switch with Wing and be on the second

panel, led by my colleague Jeff Bader, who heads the China Center -- the John Thornton China Center here at Brookings. On this panel, we are going to have first Dr. Wang Yiming, who is Vice President of the Academy of Macroeconomic Research of the National Development and Reform Commission, whose research focuses on development strategy and planning, macroeconomic policy and regional economic policy -- and we're going to start with his remarks and then have a few minutes from him on these issues as they are being viewed and discussed and debated at the top levels of the Chinese government.

Then we'll turn to Wing Thye Woo, who is a Senior Fellow here at Brookings, to talk about these issues from a perspective of a scholar from outside who is studying them. And then we will finally also switch the panel slightly more just to make -- really we're just going to switch between the second and third panel -- to have Dr. Xu Hauqing (phonetic spelling), who is a Research Professor and Director of the Center for Energy, Environment and Climate Change Research at the Energy Research Institute of the NDRC. So he will speak third.

So why don't we start with you, Dr. Wang, and then why don't you come on up to the podium and then we'll go down the line. Thank you very much.

DR. YIMING: Good afternoon, everybody. And I feel very honored to have this opportunity here this afternoon to have this exchange with you, and my topic today will be the short-term and mid-term outlook on China's economic and development and its impact and energy. After 30 years of opening up and reform, China has experienced a very rapid growth on its economy with a yearly annual growth rate of double digits -- especially in the last five years.

And here's the number that -- this is a graph that shows that growth rate and our GDP, as of last year, per capita has reached 2,500 U.S. dollars. The factors or the reasons behind this rapid growth many fold, but mainly they are because we have a high savings rate. We have high investment rate and we're able to control the growth of our population and because we have a pretty stable macroeconomic development. And therefore -- and also most importantly, in the past few years, with the reform in China, we have also raised the productivity -- productivity of our country. And in terms of investment input, we have increased that by 60 percent, and our GFP has increased by 40 percent.

But there have been changes in the last six months because our economic growth has partly been affected by the slowing down of the global economy, especially by the slowing down of the U.S. economy, which has a great impact on the export market of China and in the last

quarter, we have seen that (inaudible) page rate of our export has declined. Our GDP for the first six months of the year was ten point -- the growth rate was 10.4, which compared (inaudible) was a dropped 2.5 percent.

Inflation rate has also gone up. In the first six months, our CPI has gone up by nine percent -- 7.9 percent -- which is an increase of 4.7 percent compared to the same period last year. So if we consider the last five years to be a period of growth, then in the next two years -- even in the next four years -- we would enter into what we call an adjustment or transition period, and after that we're going to begin to see a slow down of our economy. And if you look at this graph, you can see that in the past we -- there are many factors that causes the slow down that's going to begin in the next couple years. That is because we are going to see a decline in foreign demands and not unlike -- in the last three years, we had depended upon net import, which accounts for 20 percent of our GDP growth.

And in the next few years, we are going to see a decline in that and you can see from this graph also that for the first quarters and second quarters, for the first time we have seen a negative number rather than a positive figure. In the last five years, we see a very rapid growth.

In the next few years, we are going to see an increase in inflation rate and decrease in our growth rate.

Now how long is this adjustment or transitional period is going to last? My prediction is that it's going to last for another two to three years, if not three to four years. And this is all dependent on the change of the global economy in the same period. We have experienced our best possible growth in the last five years and so because we are so intertwined with the U.S. economy and the global economy, we believe that the global economy is also going to experience the same adjustment period as we are going to.

The other matter that we are most worried or concerned about is whether there is going to be a deluge of capital outflow in the next few years. This is because -- if you look at this graph, you can see all the different colors utilized FDI (inaudible), that capital inflow and trade balance in the foreign reserves. We are very concerned that FDI is going to decrease and, because now the housing market and the stock markets in China are also experiencing some kind of fluctuations, and so our biggest concern now is whether in the next few years we are going to see capital outflow.

In the future, we are expecting to see a high inflation rate or inflation is going to go up. According to the data, we can see that and our

PPI has exceeded ten percent, which shows that there is a significant drop. However, we still think that this will -- we are still going to see inflation going up in China. And we also look at other data, for example, investment.

Our nominal investment is still going up and the real investment values has gone down and in the future we're going to see that this trend will continue. As far export is concerned, whether it's nominal or the real export rates -- they are both going down. And also the numbers for the projects under construction or projects newly started, you can see that numbers are low. For urban income per capita, you can see that it has -- it did grow very fast for a period of time, but now it has also plateaued.

In terms of trade or enterprises, we have seen a large gap between the import costs and also export prices. This is because of the appreciation of (inaudible) and also because we have imported a large volume of raw materials as well as energy -- as well as energy sources -- and because these are high priced commodities and our exports mainly consist of manufactured goods, so there is significant gap for us to make up. The other potential problem or crisis that we may face can be traced back to what's happening in the United States now.

We have seen that a lot of investment banks on Wall Street have encountered problems and that can potentially also cause a trigger a financial crisis in China primarily because our housing market is also very unstable. Prices of houses in China have dropped and we have also a lot of default lendings in China that we are dealing with. And so if the (inaudible) can stabilize and we are expecting to see a lot of capital going outside of the country, and that can potentially trigger a very serious financial crisis in China. Look at the graph -- the picture on the left, you see the green line.

That would be the trading volume of housing in China. And then on the right is the stock market graph. And you can see that it has gone down -- slowly declined after October last year and we have now dropped down to under 2,000 point, which also is another concern that we have. And so as far as policy is concerned, we have two challenges that we need to balance and first of all, we want this rapid growth -- economic growth in China -- to continue, but at the same time, we need to take measures to control the inflation rate and this is something that we are trying to balance.

We also are loosing up our money and our recently the Central Bank of China has dropped the interest rate slightly and the commercial banks have also followed suit. We are also taking active

measures to prevent what happened in 1997 from repeating itself. At the time, I think a lot of the problems was caused by our huge amount of investment in our infrastructure. However, currently we are looking at the cause of these problems in China.

We think that we have a danger of overspending in the public sectors -- especially for schools and health and so forth. As far as mid-term projection is concerned, I think that in the next few years the Chinese economy will continue to progress at a stable rate. Of course, we are facing the pressure from the transformation of our economic systems and therefore in the next few years, I expect the growth will continue.

However, this is because our savings rate and our investment rates domestically is still very high. For example, savings last year for China has still exceeded 40 percent. And also we are still in the middle of our industrial transformation and therefore spending is still high. For example, there is still an increase in home purchases and vehicle purchases. Therefore, we're expecting that the investment will continue also to grow for the urbanization purposes. And in the next few years my projection is that the Chinese economy will continue to grow at the rate of nine percent or higher.

Now, our mid-term challenges. We are facing the aging of our population. Our labor cost has gone up. We have very scarce

resources in land for very few -- very little arable land and that means that cost is going to go up in terms of labor and because our rapid growth, we also have to pay a cost for environment. And because of all that, I expect that our productivity will go down in the next few years. And also asset prices -- for example, houses and other real estate assets -- the prices have gone down, which means that there is a potential danger of a financial crisis as well. Consumption has gone down and this is something that we need to do something about so that we can push it up again. Thank you.

MS. BRAINARD: Okay, I think we're going to do a slight rewalk to the former alignment, but we're going to give Jeff a minute to catch is breath. Does that sound good?

MR. SACHS: That sounds good.

MS. BRAINARD: Okay. So, whoever wants to come up next, we're still -- Wang, you want to come up next and then we'll go over to Jeff and --

MR. WING: If you look in the program, Jeff Sachs is speaking now. I don't look like him, but being in broad agreement with his recent book, Commonwealth, I would sound quite a bit like him. So the quandary for those of you who are here is because of Jeff Sachs' participation, your quandary is whether you should believe what you are

seeing or believe what you are hearing. I think we live in exciting times. The collapse are about our dangerous times.

The collapse of the U.S. financial markets is widening. The failure of AIG will accelerate the financial contagion to the rest of the world. It is not just the U.S. Central Bank adding liquidity to the system, but there will need to be the liquidity by other countries as well. And this idea of that we either hang together or we hang separately certainly applies to the long term problem of global warming, because one thing we do know is that the United States, which has always -- which has been in opposition to the Kyoto Treaty -- has now changed its position and I think partly it's because the United States is no longer the world's biggest emitter of CO_2 and -- let's see.

Let us see how good has been our -- what the future says according to a study that was done in 2003, which is that the developing countries, the -- incongruously enough -- the green line would soon have CO_2 emissions that greatly exceed that of the developed countries. That is an estimate done in around 2002. One thing we should know is that our ability to forecast what is happening in the case of China, we have always underestimated the amount of CO_2 that China would emit. The lower down graph -- hard to see, but since I tell you to believe what you hear rather than what you see -- the lower part of the graph shows the

projections of what CO_2 emissions in China would have been in the future, done in 2002.

The amazing thing is that the highest anticipated emission in the study that was done in 2002, is lower than what actually happened. In fact, the new estimates done in 2007 has the lowest emission path substantially higher than the highest emission path that was projected in 2002. And when we look at this -- why? It's because the growth of China has been much more sustained than anticipated. And the other thing is, because the high price of oil, the use of coal has been greater than anticipated.

And when you think about China's growth, you would see that it comes from understanding what the other developed countries have done in the past. So, they have done what the others have done accordingly -- convergence to a capitalist economy -- and growth follows. The unfortunate aspect is that that strategy suffers from the fallacy of composition. A Taiwan could pollute as much as it wants, and the next typhoon that comes would blow it all off shore and dissipate it completely. But a large country like China -- if it follows the same energy intensive path -- growth path -- of other countries, that would surely bring about calamitous climate change. And this is not just adjustment to China. India is coming right up from behind.

So the idea of working together on control of CO_2 is certainly of paramount concern. So what should be the ways of handling of it? Oops. Oh, translator (inaudible). I'm glad that I am less inscrutable than I look -- not needing a translator. When you think of the amount of carbon dioxide in the air, it is clearly determined by the amount of production. And we can break production down into three parts. One is production per capita.

Another way of saying production per capita is income per capita. The second one is total number of people -- population. And the third is amount of CO_2 produced by each unit produced. Clearly you think that we want to control the amount of CO_2 by decreasing production per capita is immoral when you consider how poor many of the world countries are. So that's not the solution.

The other solution is to control population growth. That, China has certainly made big contributions with the one child per family policy, and a policy that they should work -- well, now that the Bush policy on population growth is most likely obsolete in a couple of months, the United States and China should work together in the national forum to promote a better policy on world global population growth. But the real win-win part of it would come from decreasing the amount of CO_2 emitted

for each unit of production. In other words, the savior is technological in nature -- a large part of it.

And that would require -- if you believe in the idea of that two heads are better than one, there is no better way than to form a synergistic relationship between China and the U.S. in technological collaboration. Specifically, China is building one power plant a week -- and an increasingly number of them are coal rather than oil. And clearly given (inaudible) energy sources we have, coal is a natural resource that is abundant enough to carry us into the next century. The key is to burn coal cleanly.

And since China is building a power plant a week, it is the natural place for scaling up and experimentation. And this is where I think the first step in collaboration should be. And this, by the way, is what the SED is promoting -- the Strategic Economic Dialog between the United States and China. And how should it be done? Whatever new technology that is developed would be easily appropriated by the rest of the world. This calls for a global financing model. The European Union and the United States and upper middle income countries should in the short run bear most of the costs of financing of this international collaboration in using coal cleanly.

And besides that there, of course, needs to be collaboration on the renewables -- wind power, solar power -- of which that would be the only way that we can bring about convergence of global living standard in a non-conflictual manner. Otherwise, what could happen is that convergence of living standard comes because while China is growing up, but creating the climate change that brings about a fall in the income level of developed countries. That would not be the kind of convergence that would be -- that would not be an outcome that we would want to even think about. So, in the question of the environment -- just like the way that we will find in the rest of the topics that we talk about -- for example, not only is international collaboration important largely because the effects of it go across borders -- let me end by jumping ahead of what our next panelist would say -- the question of water shortage in China.

That has a big international dimension because it means drawing more from the map, the shrinking glaciers of Tibet and that would certainly require international collaboration, too. So it's about greenhouse gases, about water management in the long run and the short run about global liquidity management. So, I think that the SED provided the foundation -- a good foundation -- to build on. And I think -- I hope that the next administration of the United States will move faster on that front. Thank you.

SPEAKER: Good afternoon, ladies and gentlemen, and I am very honored to have this opportunity of a brief view of the emission of major pollutants and CO_2 in China and its related strategy. I'd like to talk about this from six aspects. And first is I'd like to address the national -- overall national circumstance of China and the first issue is our huge population which accounts for 21 percent of the global total.

In terms of economic development, China is at a relatively low level. The GDP per capita in China is only a quarter of the world average. And we also have a 23 million population that are living under poverty. And also in terms of energy consumption per capita, we're still at a relatively low level and currently is 1.3 (inaudible), which is a quarter of the OECD average standard. And when we talk about climate change and we have to face our own domestic environmental challenges, the first is -- the most important issue is the control of the emission of SO_2 and the chart that shows you here and there is an increase of 28 percent since year 2000.

This chart shows you comparison between the United States and China in terms of CO_2 emission. The historical accumulation -- we talk about historical accumulation -- China is still at a low level. In terms of our future economic development, we are facing a number of major challenges. The first one is our high employment pressure. And during --

well, we did some statistical work for the past seven to eight years, and on an average annual basis there is 10 million population from the urban areas that needs to find work. And also there is migration of 10 million population from the rural area to urban areas to seek employment.

And so the second challenge is the high coal dominated energy structure and this has -- this accounts for the -- this has as a per capita emission much higher than that of the world standard which is like 20 percent higher than world standard -- per unit, per energy emission. We also face a reality that is the rapid increase of the CO_2 emission at the same time the relative low per capita CO_2 emission level.

And so these are the four major driving forces behind our development. The first is urban growth and population growth. The second is economic development and the third is consumption and (inaudible). And the fourth is our technology innovation. In terms of population, I'd like to mention we stay with our policy which is to stabilize our population growth. And our prediction is that our population will stabilize between 2030 to 2040. And urbanization is probably the primary factor in terms of our CO_2 emission as well as the growth of urban population.

And, but our fundamental policy remains the same -- that is to develop our economy as well as to alleviate poverty. This is our

ultimate goal for 2050, but how to get there and we have different understandings, opinions in terms of the different stages that are involved in the process. So we export a lot of manufactured goods on a yearly basis and these manufactured (inaudible) consume a lot of energy and that accounts for 14 to 24 percent of our total emission.

In terms of consumption, we are committed to build conservation-oriented society and we expect that by 2020 our consumption pattern will reach crucial transition moment and there are three major factors. One is the automobile ownership and housing. And the third one will be -- these are major factors that will influence our energy consumption. In terms of technological innovation and progress, we understand that we have to pay attention to two major aspects. One is the locking effect of technology, and the second is the technology transfer in the future. And this will play a major role in the control of emission in the future.

We have different understandings based on the different scenarios that we speculate on. From this scenario, we expect that China's energy consumption demand will increase to about 5,000 MTZE by 2030 and reach 6,500 MTZE by 2050. So consequently our CO_2 emission by 2050 is expected to be higher than that of the 2005 by 150 percent. So from IEA Research, it shows that by year 2030 and all the

global energy related CO_2 emission will increase 50 percent over that of 2005 and a large part of that is from China. So if without strong and effective policy and measures and by 2050 China's CO_2 emission from both consumption and combustion will be 80 percent higher than that of the 2005.

And, but our goals and our objectives are very steadfast and clear. That is to control CO_2 emission during the eleventh five-year plan and we hope that the growth of greenhouse gas emission between 2030 to 2040 will stop. So we hope that by the year 2050 that the per capita CO_2 emission in China will be below six tons. And, okay, these are some of our strategic objectives. We hope that by year 2050, the emission of SO_2 and nitrogen to oxide will be brought under control within the environmental capacity. So the SO_2 emission will be reduced to (inaudible) million ton and nitrogen to oxide to 11 million tons by 2050. Based on research, we hope that by year 2030 we can achieve the zero growth of CO_2 emission. Of course, this is a tremendous challenge to us.

Probably people will remember that this past April, President Bush proposed that United States hoped to achieve zero growth of CO_2 emission by 2025. So if we compare this to the growth of the United States, we probably need to make some adjustment. We hope that by 2050, we can achieve zero growth of CO_2 emission. And we also, based

on our research, we propose to have lower (inaudible) effort to reduce carbon intensity for economy in terms of GDP by 80 percent below the level of 2005 by the year of 2050. And also understand, climate change is a long term issue facing developing countries such as China. But we also need to have a sense of urgency and understand its grave significance.

In terms of developing model, we have to put conservation as a priority in order to build, in order to have a no carbon society or no carbon economy. We also need to optimize our energy structure in order to build a no carbon energy system. And also we are committed to technology cooperation, technology innovation as well as technology transfer.

We believe all this will be very conducive to our ultimate goal of emission reduction. Also we need to do a lot of -- the system innovation. For example, we need to do more research on market mechanism in control of the emission and these are aspects we need to further work on. And we understand the U.S. Congress and U.S. Government are also very concerned about carbon (inaudible) and we are the same -- especially during our eleventh five year plan. These are remarks. Thank you very much.

MS. BRAINARD: That's great. Well, we have heard from Dr. Wang about China's shorter term and medium term challenges in

terms of managing its economic trajectory. We've heard from Dr. Woo and Dr. (inaudible) about how that translates into emissions and the enormous, enormous challenges that China has ahead. Our final speaker is Dr. Jeff Sachs, who is Director of the Earth Institute, Special Advisor to U.N. Secretary General, and also author of the most recently best selling, Commonwealth, which you get if you haven't already. And hopefully you're going to bring it all together and also tell us this is achievable.

MR. SACHS: Good. Thank you very much. Thank you for organizing this important session and I'm delighted so many friends and scholars from China are here to brainstorm together with us on these issues. Clearly, we're making rapid progress in defining the challenges. I think the discussion today exemplifies the fact that we're having a kind of discussion that would not have occurred even three or four years ago. So the discussion is progressing. The solutions are not progressing yet.

In terms of translating ideas from seminars and national institutes and laboratories into practice, I think we've made no headway in recent years and China's situation is dramatic and getting worse. The emissions are -- as Wing showed -- of carbon alone, rising faster than was anticipated. The environmental damage in China -- in the water, the air -- and consequences for human safety are very clear and very serious and very worrisome. So I think, in general, on so many issues in the world the

gap between what we're saying and what we're actually doing is profound and probably widening. These days we're on a trajectory, however, of reduced emissions because our economy is collapsing.

Now this is the hard way to achieve stability. (Inaudible) already -- when he talked about the dangers of pushing against ecological limits -- was very clear that ecological limits in the end would be respected. That's almost the definition of limits or caring capacity. The question is whether it comes in a very hard way or whether it comes satisfying the criteria of economic wellbeing, which we're aiming for. That has not been achieved. The starting point is that the world as a whole -- in significant part because of China's success, but certainly not only because of China -- is pushing against very important and generally neglected ecological limits.

And, in fact, I would say that the ethos, or ideology, in this country as the number one pusher against limits, was that these limits aren't important or that they're easily adjusted to. But the world as a whole is up against multiple stressors and we haven't even gotten started yet. In the sense that the amount of pent up economic development that remains in the system -- with China's catching up, with India's development, with economic development and technological diffusion

elsewhere -- means a tremendous increase in the stressors if we continue to use pretty much current technologies for the amplification of economies.

China has not demonstrated much technological innovation in resource saving, for example, or in environmental protection along its current trajectory. China is mostly catching up in current resource intensive technologies. It's using automobiles the normal way. It's building cities that have sprawl. It is a very energy intensive economy not only because of the industrial mix, but because China is following a trajectory like the United States and Europe in terms of overall choice of industry, consumer development, methods of urbanization, methods of farming and so on, which is a very high input kind of production strategy.

This is not to say that China is choosing wrongly, or that there is something particularly pernicious about this from China's development strategy. But it is to say that we're not solving any of the problems of the growing resource stress that we face. A lot of our confusion in our own discussions on these issues came from the fact that we put a lot of focus on control of specific kinds of pollutants in the past and argued that as countries got richer, the pollution came under control.

And that has generally been true with particulate pollution or the worst kinds of effluence into waterways. So sulfur -- and also for particular specific kinds of air pollutants like sulfur oxides in the United

States or Europe where smokestack scrubbers or effluent controls at major factories could make a very big difference. But that vision, which is part of our normal thinking on these issues, captured by the idea of the environmental Kuznets curve -- which says it gets bad, but then it gets better as you get richer, so not to worry -- is basically a misunderstanding, because it focuses on a few things for which that inverted "u" is true and it ignores that actually, deeply more important things for which that inverted "u" is not true.

The things for which it's not true are the stresses on ecosystems -- both local, national and global. It stresses on water, habitat, biodiversity, climate change. There's no evidence whatsoever of an environmental Kuznets curve in vast areas of environmental degradation. Partly that's technological and partly it's a sociopolitical and bargaining phenomenon. But there's no reason to believe that there's any kind of automaticity to a turning down of carbon dioxide or a decrease in water use or a protection of habitat or a relaxation of pressures on endangered species. Those things can be achieved, but they don't display a nice inverted "u" like particulates over American cities do in the last 40 or 50 years.

At a global scale, we see therefore profound stresses on habitat, including massive continuing tropical deforestation -- both for

logging and for food production. We see massive stressors on carbon dioxide and climate change as well as carbon dioxide and ocean acidification. We have major local regional and international stressors on nitrogen use related to farming systems, because of the massive inputs of nitrogen -- China being one of the heaviest users of chemical fertilizers per hector of any country in the world.

And that nitrogen derangement leads to massive water pollution, changes of ecosystems and destruction of estuaries to a shocking and growing extent now counted to be about 130 hypoxic estuaries around the world or parts of estuaries that have reached a eutrophication followed by hypoxia due to the runoff of nitrogen from the rivers, from the farms into the rivers, and the rivers into the estuaries and the ocean. Biodiversity is collapsing in major parts of the world -- rich country and poor country. And my argument would be that all of this is going to increase tremendously on our current trajectory, that we've already reached a level of literal unsustainability in that if you map out the current trajectories at current levels of impact, the amounts of destruction reach harrowing levels.

I didn't mention water in general is another one of those major categories. We are depleting or degrading resources already at our current level so fast that we couldn't continue to do this. So we won't. It

will stop -- either the hard way or through a change of the ways that we pursue economic life. Remember that the world economy is about $70 trillion right now -- maybe now it's about 68 trillion, going down fast -- in GNP, of which the rich countries are roughly 40 and the developing countries, or the rest of the world I should say, roughly average around four and the world's mean is about 10. And China is close now to the world mean -- all in purchasing power adjusted prices. This means that if the rich countries were to stop growing -- which we seem to be good at now -- and the rest were to catch up, there would be a four-fold increase of production.

My argument is simply that this would be impossible to contemplate under the current technologies. Now, China has a huge influence and stake in all of those major areas and it's a huge contributor to the problems -- both internally and internationally and to a growing extent. China's ecological footprint goes far beyond China naturally. The carbon emissions is Exhibit A that we've been talking about, but so too -- and this isn't blame, this is how the world economy works, and China is only catching up. So in per capita terms, it's nowhere doing the damage that the U.S. and Europe are doing.

But, China's reach extends to the soy bean production on the deforestation fringe of the Amazon, for example. So it's a major force

in Amazonian deforestation. China's demand for exotic species is a major force for mega fauna extinctions around the world or threats of extinction, because there are a lot of traditional demands -- exotic demands -- which are, lead to a tremendous amount of bush hunting and poaching of exotic species. China's demand for tropical logging is contributing massively to deforestation throughout southeast Asia.

I was recently in Borneo watching one giant truck after another with logs that big being carried out of Borneo, and it was literally one truck after another and a very significant part of those are on their way to China right now. So the reach is big and China is growing very, very fast and still not close to the per capita terms of the United States -- but you'll get there. It seems like we'll go in both directions and we'll probably meet somewhere soon and all of this will mean vastly greater stress. What we also experienced was the fact that we probably have reached -- now, I should say this properly, but -- we're already pushing against limits to the rate of global growth right now of certainly oil supplies, perhaps oil and food supplies, and the reason that commodities prices have come down is a little bit of a breaking of the bubble, but much more is the slowing of the world economy.

When the world economy was growing at five percent per year, which it was in most recent years -- or nearly five percent -- we were

hitting limits on oil and I believe we're going to continue to hit those limits because there isn't a lot of easy oil to be found. And this city is number one mythmaker for the poor, beleaguered American people who are told about all that off-shore oil and all that wonderful oil in Alaska's nature refuges -- if we can just get rid of the moose and some other things and those pesky polar bears and so on. The fact of the matter is that all of that off-shore oil in the United States, plus the Alaskan reserves, comes to perhaps 20 billion barrels, which would be -- at current levels of production -- about seven months of one year, one global year's use. So there's very little there.

This is completely traditional misdirection of the American people. But, what I'm saying is that the idea that we're somehow going to surmount both the resource availability and the ecological limits and continue to have a rapid growth of the world economy, strikes me as completely unrealistic. So, I believe that we are hitting limits that are serious -- not just financial market crisis. That will create a significant recession in the U.S., but I think the rest of the world will continue to grow actually quite quickly.

And in some ways, America's slow down will mean easing of the oil limits, so more oil consumption in China and India and other parts of the world which will pick up the slack. And so I don't think that we're in

any way seriously addressing these problems right now. Now for China, briefly, all of these issues are highly complex. But I don't think that the forecast that we've seen are yet really grounded by more than a little bit of wishful thinking and probably unrealistic -- unrealistically, nonambitious targets.

It probably won't be good enough to aim for six tons per capita by 2050 -- although that might be hard to reach on current technologies. But that's not a kind of limit that makes any sense on an average for the world. For the world, that would mean something like 54 billion tons per year of carbon emissions compared to the current level of about 35 billion tons per year. So that would be -- and that was the mitigation strategies. So that's not a mitigation strategy. That is -- if you plug that into a global climate scenario, a big problem. Not a successful mitigation strategy. So -- and it -- but I agree that it would -- just to require that would require a turning down of the business as usual.

The business as usual strategy struck me as overoptimistic in the sense of too little energy demand put in because China is on the verge -- if it continues to have the success that we hope -- of the world's greatest automobile boom -- ever. Unimaginable -- the scale of China's automobile boom, because China's motor vehicles right now number something like probably 50 million cars, trucks and buses. And in the

United States it's nearly 300 million. And China's population, of course, is more than four times the U.S. So the pent up demand for automobiles in China is phenomenal.

We could imagine a 15 million vehicle per year market easily in five years. Or 10 years, we could imagine selling 20 million vehicles per year -- because why not? Especially if they're going to start being stamped out at $2,500 and if India's not going to do it, China will do it. And so the demand for this stuff -- with all of your clever technology and engineering -- is out of control in the sense. So I think those scenarios are not realistic.

The business as usual is much steeper because the economy after all has been doubling in per capita terms roughly every eight years. And doubling in -- or maybe nine years -- and doubling in absolute terms every seven years roughly. And energy has been going on pretty much along that pace and you could see it even accelerating now because of the obvious areas like automobiles and electricity use that will just skyrocket with urbanization. So I think that these challenges are not easy at all and this is not a special challenge for China. China just happens to be coming late in the day to the wonders of wrecking the environment.

We got there first and filled up a lot of the atmosphere first and created a lot of technologies that are -- have the side effects that don't work for nine billion people on the planet, and therefore the technologies need to change. Quickly -- I don't know -- I've lost complete track. I don't know what my time is or not, but let me say a few things about water, energy and urbanization. Water is a major issue everywhere in the world and in China it's obviously a profoundly complex and important issue. Why? China is dry in the north for one thing, and yet it has half a billion people that are living in relatively dry areas. The strategy has been to mine the ground water in very populous areas. That ground water depletion is a short-term depletion.

By that I mean another 10 or 20 years subsidence and loss of ground water is proceeding at an incredible rate. Climate change is likely to make this worse. The disappearance of Himalayan glaciers, the change of timing of snow melt in the Himalayan heads of the major rivers, perhaps drop of absolute precipitation levels in north China -- though that's a little bit harder to know -- means that there are a collection of powerful forces at play that are very, very difficult. One of China's strategies is three major river linking systems from south to north. Probably the ecological consequences of that are extraordinarily risky if it's really to

move massive amounts of water for hundreds of millions of people to the north -- which is the plan.

One thing we know right now is that the risks for southeast Asia of damming on the Mekong and diversion of other major river systems that flow from Yunnan and from south China into southeast Asia could be calamitous for countries that depend the Irrawaddy and the Mekong and Salween and other river systems. So water goes far beyond pollution. Pollution is probably doing the number one harm right now, but the water issue is going to be massive.

The energy issue -- I've already said and I'll take five more minutes, so you can make me feel guilty for five minutes or just keep the sign down for five minutes. The water issue -- and I apologize. The water issue -- the energy issue is worse than it looks because China's growth is very heavily energy dependent and because coal is your number one resource -- energy resource -- and because there's not a lot of cheap oil out there in the world anywhere. And so I think that this is a profoundly difficult problem. It's not just industrial mix.

There's a question of tapping into new energy sources. There's not a lot of hydro left to do without big ecological costs. A big question is whether solar in the Gobi and in the -- in Gonsu and inner-Mongolia and other very sunny places could play a very big role. That's

one option for 30 year time horizon, or 40 year time horizon. I believe in that. The other is nuclear obviously, which can play a role. But this is a very, very big and unsolved problem. And then I would add the urbanization challenge of adding another half a billion people into cities, which is unprecedented in human history what's happening right now.

And China will add hundreds of new cities and, of its existing cities of 100 that are of a million people or more, they'll also increase significantly in size. I don't think China's urban planning is yet addressing the ecological consequences of this adequately. My impression is you're building a hundred Los Angeles', because China's model right now is sprawl. Typically it's concentric rings of sprawl. So keep on adding ring roads. And that's true in many of the big cities of China, so everybody is in traffic now. And, of course, there is urban transit and metros and so forth, but I don't think that there's been deep enough reflection on how to economize on transport needs, transport time and urban lifestyles because we've learned, I think, that this kind of urban development of big sprawl is bad for our health and bad for the environment and very expensive. And so I do think that there's a big mistake that needs to be addressed. Three quick points -- technology, as everybody noted, is crucial because the current technological mix does not give answers to these problems. So simply scaling up what we're doing right now -- which

is what the solo growth model is all about -- that doesn't work. So technological change -- the kinds of transport, the use of solar, carbon capturing sequestration -- these are really important.

Everybody believes China needs carbon capturing sequestration, but there's not yet one operational project. There are two that I know of that are in the works, but you don't want to bet 1.3 billion people on a project that hasn't even been done one time yet. And so I would say to accelerate that tremendously because the current pace is very inadequate. This is yet another area where the Bush Administration completely wasted our time, because we should have had multiple projects underway with China and paid for them. But we didn't do that.

Technology cooperation is good, but it may turn out to be the most sensitive of all of the issues because we do need private incentives to develop a lot of technology -- though I also believe we need a major public financed effort and how you share private technologies is not an easy matter and it has to be given a lot more thought than it has been. What it probably means is public funding to pay for private royalties on transfers of technology. General Electric is not just going to give away its technologies. Its business is developing those technologies.

On the other hand, those technologies do need to be transferred and so we need a financing mechanism, I believe, to close that

gap and that should be where the U.S. Government actually pays the royalties for technology transfer. But we don't do this kind of thing in the world -- almost in any case. And so these categories that we know to be important -- that's where I started. The conversation is very good. The practice is nonexistent, so far.

And it will take a little bit of rationality, which we've not had in Government for a long time in this city -- it will take a little bit of rationality to sort out how to do these things. Systems mechanism was raised. We will not have a global tradable permit system -- nor should we. It's kind of a mess -- the whole approach -- in my opinion. We don't have time -- I don't have time at the moment to say so, but we have to think about how we can actually create a mechanism for cooperation. I do believe technology standards will provide a better mechanism for cooperation than tradable permits or harmonized pricing.

So I would look towards a Japanese-style best technology practice standard worldwide as a kind of way to cooperate between China and the U.S., rather than believing that we'll work -- be together within a tradable permit system. The final thing I wanted to say is that all of these issues require quantified analysis at a time horizon of a half a century, which is a very tough thing to do, because in the end, arithmetic really matters here. How far are you trying to achieve?

What levels are internationally compatible with global objectives is ecological and economic arithmetic which has not really been done yet in the U.S. or in China or in India or in other countries. The planning horizon for serious planning tends to be five to ten years, if you're lucky, and no planning if you're unlucky. We're kind of in the no planning mode these past years and we need to get into the planning mode, but we're going to need a time horizon that we're very unused to doing and that's why I think academics, at least, should be moving to scenario building at a 40 or 50 year time horizon quantified multi-region in order to be able to assess this and I'm happy that Brookings is going to be working with us at the Earth Institute and the Chinese government to be pushing that forward. Thanks.

MS. BRAINARD: Well, we've got a lot on the table and only a little while left in this panel, but we'll be able to take some of these question forward and put them to the speakers in Jeff's panel as well -- Jeff Bader's panel. What I wanted to do is make a quick question -- joining Jeff Sachs' last remarks -- and asking our Chinese colleagues to respond to them and then I'd like to open up to the audience for some questions.

As you look, Dr. Wang and Dr. Xu, at this area of potential technological collaboration, how do you see it in terms of are there areas

where China and the U.S. has particularly strong both interests and capabilities and what is that financing model that would get some of these research projects off the ground at the scale that is needed, which has not taken place to date?

SPEAKER: These are just -- this is my personal view. I think that in terms of emission reduction, there are two areas where our two countries can collaborate. First of all, I think that since we have two very big coal consuming countries, we should put our efforts in the clean technologies. And the second part where -- area where I think we can collaborate, is to increase our cooperation on renewable energy. Then the second area -- when I talk about the second area where we could collaborate, I talk about renewable energy and one example would be a hydrogen technology. And then another area where I think we can collaborate is the separation of CO_2 or what we call the CGS technology and I think -- in this area I think it becomes more pressing for China because of our current situation.

For our cooperation model, I think that we have to pay attention or our focus should be on the funding of this cooperation. And I think that we should actually open this area more to the private sector, especially the R&D department. For example, we can expand our platform so that major corporations or enterprises, such as coal

companies or electricity companies, can all participate in our research and development.

MS. BRAINARD: Why don't I open it up to the audience and just I'd ask that -- first of all, wait for the microphone and second that you will identify yourself. That'd be great. We've got one way in the back there. Thanks.

MR. EBINGER: Charles Ebinger, Director of the Energy Security Initiative here at Brookings. In several of the presentations, there were remarks -- general remarks about we need to kind of rationalize the commercial aspects of energy and water. But I'd like to know what that really means in terms of energy pricing reform in China -- for both energy and water -- because quite clearly the sooner you move to real time pricing, has a major impact on your projections 10 and 20 years down the road, whereas if you wait right now and slowly implement real time pricing over the next say five to ten years, you will not have nearly the dramatic effect on consumption you might otherwise.

SPEAKER: China has opened up and conducted reform in many other areas -- especially in areas that did not include resources. Because when you talk about resources, you also talk about the land, you also talk about the earth and this is an area which is still relatively new to us. And so this is our next step that we are going to conduct. For

example, crude oil. We know that a refined oil in China is subsidized by the Chinese government and our pricing of the crude oil right now is only about 95 percent of the world market's price and therefore we are now facing a very large pressure in terms of reclamation or reform. Our problem is now that we are -- at the same time we are trying to conduct this reform, we are also facing with high rate of inflation.

In early July this year, we had already adjusted our price once and so far we readjusted our pricing twice and still we cannot bring it to balance the demand of the market. So our next step may be -- that is if we -- judging from what happened in the last four months (inaudible) has actually slowed and therefore are hoping that if inflation rate can be kept under control, then it gives us a chance to drop the prices of the energy resources even more and after that we'll be able to readjust our price of water. However, we think that we have to start with crude oil and also electricity price.

MS. BRAINARD: Let's take -- let's see. There's one here and one back there. Let's just take two questions and then we'll go to the panelists and then we'll switch to the next panel.

MR. LOVELL: Malcolm Lovell, George Washington University. Jeffrey Sachs and several others have mentioned nuclear energy, but just in passing. And it seems to me that nuclear energy is the

solution here. Japan relies on it. France relies on it. There are developments that need to be made, but why aren't we talking more about nuclear energy as a regular -- a way to resolve this issue?

MS. BRAINARD: Okay, let's take one more. Oh, sorry. Go ahead.

SPEAKER: Actually, we have considered nuclear energy and it is actually our next -- well something that we are going to make it one of our key projects in the near future. In fact, if you go to China, you'll see there we already have a lot of nuclear powered generation stations and therefore our goal is to be able to provide, through nuclear energy, 60 million kilowatts of energy and we are going to do it in two stages and we came to achieve five percent of the total energy consumption and then the next step will actually be 10 percent.

SPEAKER: Nuclear energy is actually one of the major projects in China and the Chinese government actually has encouraged its development. In 2007, we only had the energy provided by nuclear energy is only about 10 million kilowatts. However, last year we had launched a big scale initiative that we hoped that by the year 2020 we'll be able to achieve 40 million kilowatts. However, judging from the current progress, we can almost be certain that by the year 2020 that, in fact, we're going to exceed that number. We are actually going to achieve 60

million kilowatts. And therefore, according to our research -- our research shows that by the year 2050, nuclear energy actually will be one of the major energy sources in China and we will actually be able to achieve the result of 3.5 trillion kilowatts by the year 2050.

MS. BRAINARD: Why don't we take this one last question here and then we're going to go right directly to the next panel.

MS. LEGGETT: Thank you. I'm Jane Leggett from the Congressional Research Service. And I want to follow up on the first question which was about getting the prices right in economies and China had been a leader among countries a few years ago in moving forward with green accounting, which is to start developing, understanding the value of your natural resources and changes in environmental services and considering that in how you're accounting for economic growth and development in a broader spectrum. But, my -- has China backed away from that process? I think that -- and I'm wondering if so, why? And if you have not backed away from green accounting, can you tell us what we could look forward to from you?

SPEAKER: Actually the green GDP was only a feasibility study as far as research is concerned for that period of time in China. In fact, we were not officially funded by the state to actually carry through this program and in the process of our research, we had actually encountered

quite a number of issues and therefore if we are not able to bring our pressing reform to a mature state, then accounting of it would be very difficult and challenging.

MS. BRAINARD: Well, let me do the following. We're going to just ask everybody to stay seated so that we can bring up the next panel, which is going to go much deeper into these issues. I will say, having listened to this panel now, let us simply hope that just as China exceeded every expectation in the past 10 years in terms of eradicating poverty in large parts of its population and growing faster than any other country in history, let's hope that China surpasses all of our expectations in terms of developing a new path that is really quite different than the one that we pioneered and that we are both working in a much more cooperative way going forward because I think both of our futures hinge quite centrally on it. Thank you very much.

MR. BADER: Okay, everyone. If you could take your seats so we can get the program going again. Good afternoon, everybody, and I appreciate your staying for our second panel. I'm Jeffrey Bader, Director of the John L. Thornton China Center here at Brookings. A very stimulating first session. The second panel will cover some of the same subjects, but some different subjects. I'll simply introduce the speakers and we'll take it from there. Our first speaker is Dr. Gao Shixian. He is the

Assistant Director General and Director of the Center for Energy Economics and Development Strategy of the Energy Research Institution of the National Development and Reform Commission. He will discuss alternative energy systems available in China and renewable energy.

The second speaker will be Dr. Cai Ximing, a Professor at the University of Illinois at Urbana, Champagne. He will speak about China's water crisis and potential policy actions in response. And our third speaker is Professor Li Yuanyuan, the Vice President of the General Institute of Water Resources and Hydropower Planning and Design at the Chinese Ministry of Water Resources. He will speak about -- also about the water crisis and potential solutions in China. So we'll have two presentations on alternative energy and one on water. So, Dr. Gao, if you could begin.

DR. XU HUAQING: Thank you, Chairman. Ladies and gentlemen, good afternoon. It is a pleasure to be here to exchange prospects and policies for China's energy development. There are three aspects in my talk today. The first is the status call of energy development, and the second is outlook for China's energy industry, and the third is about policy for China's energy development. As we mentioned before, that China is a big -- the country was a big population. And a large percentage of the population is rural and also there is big

disparity between urban and rural energy consumption. And the chart on the left shows a big difference between the western part of China and the eastern part of China in terms of energy consumption. And the chart on the right shows a big difference between urban and rural energy consumption.

China is the second largest energy production country in the world and last year China had reached the energy production of 23 billion MTZE. And coal accounts for 70 percent of the total energy production. And also, as we mentioned, coal is a primary source in our energy structure. In terms of energy consumption, last year 2007, we have reached 2,600 MTZE and 70 percent of which is from coal. But in terms of per capita energy consumption, China is still at very low level. And last year the per capita energy consumption in China accounts for 80 percent of the world average, where in terms of the consumption of gas and natural gas and that's even lower than the world average. And the primary source of our energy is produced domestically.

In the year of 2007, about 10.7 percent of our energy comes from external sources. And our oil import -- the volume of our oil import accounts for 8.2 percent of the global total. And however, U.S. accounts for 25.3 percent of the total oil input globally. Some of you probably have read reports on the increase of oil gas globally and some of them would

consider it's because of the energy -- because of oil import increase of China. But I think if you look at the figure, it only accounts for eight percent of the global oil import total and it's almost impossible to fluctuate the global oil price.

This chart shows the overall energy circumstance energy resources in China. If you look at the total volume of resources, it is quite rich. Compared to many other resource rich countries, we're still at a relatively low level. And now I'd like to talk about some of the energy consumption forecasting. Because of the following reasons, I think the energy demand in the future is going to continue to increase. Our first factor is the GDP. It is supposed to increase at a certain speed.

We predict that between year 2005 and 2050, our GDP gross is around six percent annually. Another factor is the growing population. If we look at this 45-year time span and it's about 0.2 percent increase annually in terms of population growth. Another factor is the increasing speed of urbanization. So by year 2050, about 80 percent of the population will be urban population. It will match the current percentage of urban population of the OECD countries. Accordingly, consumption patterns would change and evolve as well. So based on all these prior years factors I mentioned and for this 45-year span, we predict

that the energy demand will increase at a rate of 3.72, 4.2 percent annually.

So by year 2050, the per capita energy consumption in China will be pretty much equivalent to the standard of OECD in 2007 -- OECD countries in 2007. And it will be 48 percent of the American -- of the U.S. per capita energy consumption of 2007. And we expect to see the continued optimization of the energy consumption structure. And we expect to see the percentage of coal in our energy consumption drop from 70 percent to 44 percent. And the percentage of natural gas and hydraulic power as well as nuclear power, we expect this to grow. The second part -- I'd like to talk about our energy policy in China.

The first factor is we have to guarantee the energy supply security of China. First of all, we have to secure a continued supply of energy without interruption. We expected to achieve this energy supply securities through diversification in the supply and diversification in our import. At the same time we expected to work on our efficiency and to improve efficiency in order to reduce our overall consumption. And another aspect would be the optimization of the energy structure. Two points in this aspect.

The first point is we need to increase the percentage of the hydraulic power and nuclear power and natural gas and also the

renewable energy -- increase the percentage of these sources in our energy consumption structure. And also we need to improve our clean coal use, or work on our clean coal technology to improve our end user structure. The third aspect is, of course, energy conservation and energy efficiency improvement. First, of course, is an adjustment of the energy and economic structure in China.

And the second point is to improve energy efficiency through technology innovation. And the third point is to approach from a management perspective to improve management and governance. And Chinese government has proposed a strategic goal of increased energy efficiency by 20 percent during eleventh five-year plan. During the past 30 years, our energy conservation rate has been kept at four percent. From our research, based on -- our forecast is for the next 45 years and our energy flexibility index is still at a low level. Of course, the first aspect would be environmental protections. That is to reduce the environmental pollution in the energy development and energy utilization. Mr. (inaudible) has already elaborated on this.

The final aspect would be enhanced international cooperation in the energy sector. And it is in the energy and economic globalization and this time we need to strength our regional as well as international cooperation to ensure energy security, such as the

cooperation we have now between U.S. and China and currently we are drafting plans for cooperation. These are my remarks. Thank you.

DR. CAI XIMING: Ladies and gentlemen, first I want to acknowledge my co-presenter, Professor Mania Lo from Columbia University. I'm going to discuss with you about changing water management in changing China -- so you might hear too many changes during this (inaudible). So I'm going to talk about -- so these changes include the change in engineering practices, policy and the national strategy. So during the past 60 years, engineering development has taken a dominant role in water management in China and it has supported the (inaudible) of the economy in China. So, right now, by 1997, China has the largest number of reservoirs and dams in the world. And the total storage, as you can see by the number -- how large is that? That's about eight Yellow Rivers, about one and a half Mississippi Rivers.

And also we -- China has irrigated agriculture is a very important component of the agriculture. Forty percent of the agriculture land is irrigated. And that produced about 70 percent of the total food in China. You see here -- one is the largest dam -- Three Gorge Dam and also south-north water transfer project. So basically north China has -- north China uses only one-fifth of the water to support about half of the population and to irrigate about one-third of the land and produces about

half of the GDP in China. So this comparison shows a very clear reason about why this south-north transfer water project is necessary and it has a very important role to adjust the south-north water imbalance. Then the question here is can the engineering dominated water management practice be continued and should this be continued? This is not a new question.

So back to many -- several years ago, the Ministry of Water Resources proposed to change from engineering oriented water management to resources oriented water management. And this is to take water -- to take water as a broader view as a more distinct human nature and human nature resources. So that could be related to many questions. Has the engineering development approached the resources our ability limit or the limit of ecological preservation? So in some basins, we have reservoir storage or (inaudible) capacity which is over the total renewable water. And also -- particularly in north China -- many basins, many basins in north China the environment has been very seriously affected. And from a financial perspective, will the marginal costs be too high for additional engineering development? And also from economic perspective, will the environmental damage be over the economic gain?

And another -- another change in engineering aspect is -- is that the small and distributive projects has been playing a more and more

important role in water resources management. So water harvesting is garden scale matters to gather, accumulate and use water, use simple structure. And these kind of projects have been -- have contributed a lot to power, to reduction in China. And water (inaudible) restoration -- particularly for small scale water (inaudible) restoration -- that practice is basically is changing the landscape, the environment and also the agriculture practices.

Now for the -- so those small scale distributive projects, they might be more environmentally friendly, financially flexible and affordable and also socially acceptable. So one of the challenges is at some regions in the future the centralized -- larger-scale centralized project and the small scale distributive projects -- they might be combined together to form a complementary relationship for sustainable water resources management. So, so far agriculture is the major water user in China. So, although the numbers varies from different sources, but it's definitely over 70 percent of the total water consumption.

So, right now, just as many other developing countries with economic development, water is transferring from agriculture to non-agriculture sector. But in China, this transfer is not as smooth as we expect. So, there are so many -- there are some conflicts which are worthwhile to, worthwhile of some attention. On one hand, farmers lost

water. But they don't get appropriate compensation. But in the same time, cities and the industry, they are still thirsty. They need more water. Farmers are wasting water -- are wasting water -- but they could not -- they don't have the ability to save water because of the infrastructure and also because they could not pay the additional investment.

And on the other hand, farmers may not be willing to save water because water is too cheap. So, just as many other engineering and engineering practices and policy, they usually follow the -- they usually go along with the institutional change. So the western scholars, they are very curious about why the Chinese scholars uses water rights and water markets so many -- so much in China. But the Chinese government and also the research community, they are pretty serious. They have -- they have studied some, studied many experiments and some of them are very successful and very quick.

But obviously, China still does not have consistent water right system or consistent mechanism and a lot of successful stories, they are basically ad hoc, case by case -- case by case situations. And this actually related to -- in the foreseeable future, nobody will doubt the government will still -- the administration will still take a leading role in water management and the economic (inaudible) will be -- will supplement to the government, to the administration. But this is actually related to a

very broad question -- the government versus market. It is consistent, complementary or conflicting. So this is actually a question beyond water resources management. And water resources -- water resources management in China usually follows -- has been following the national strategy.

Back to many years ago, human power over nature used to be a kind of a slogan. But today we realize -- the Chinese people realize -- we have to have another strategy, which is human nature harmony. This is so important because the environmental change. In China, water stress has caused a lot -- huge economic damage. There is no doubt. But personally, I really believe, environmental really -- environmental has (inaudible) a large sacrifice from water stress and the inadequate demand on water uses. So in the future, it looks like to put environmental protection has the same role as the economic development will be quite important for China.

So let me -- I don't really mean to talk about it so much. Alright. Okay. So finally I just want to emphasize some of the messages I already talked about in my presentation. The first is to have a wider view on water as a distinct human and ecological resources. So water is both a human resource and also an ecological resource. So currently, obviously, the water value has not been fully realized -- has not been fully

appreciated in China. But that's -- that's really not easy. So farmers -- agriculture water saving is a major thing, but a farm -- in order to help farmers to be able to save water, to be willing to save water, the whole society will take some responsibility. Not just the farmer. And obviously we have some -- we might have some contradictions in the marriage of administration and the market. This is not a -- it's also a problem in many other countries.

And we just talked about the implementation of current GDP. But I really want to emphasize here is to make environment -- particularly water related environment -- as an active agent -- to have someone to represent the environment. And, of course, climate change and viability is a big issue. So based on some of our preliminary study, an average case -- if we just look at an average case, it looks like we will not -- China will not have big problem. But we also realize there are so many low frequency (inaudible). There are so many extreme (inaudible) in both south and north China, which I think about -- well, the thing about, once the north -- the south-north transfer project is implemented, then if there are some very frequent drought or (inaudible) in south China, what could we do?

And finally (inaudible) -- self (inaudible) of the basic water need for weight growth. The basic water demand is really the minimal

amount of water which could allow people to survive -- particularly for under (inaudible). So right now China is developing harmonious society -- harmonious society. I personally believe the basic water (inaudible) for on the record (inaudible) is a fundamental index. So I still have three more minutes? Three. Okay. So I just want to speak a little bit of Chinese particularly in my last two slides. (Additional remarks in Chinese. Not translated.)

MR. BADER: Let's give the interpreter a chance.

DR. CAI XIMING: Alright. Sorry. (Remarks in Chinese. Not translated.) Thank you.

MR. BADER: Let's give the interpreter -- (inaudible). Okay.

LI YUANYUAN: Good afternoon, ladies and gentlemen. It's been an honor here to discuss water issues in China with you. I would like to divide my presentation into four components. First is some basic features of water resources in China. As you know, China totally have about 2,800 billion cubic meters of water available. But compared with land resource and population, is whatever (inaudible) -- the water is quite limited and so the per capita average of water resources is only about one-fourth of the world average. And the water also is unevenly distributed in (inaudible). It's a decrease from the southeast to the

northwest. And also it's unevenly distributed in the seasons and different hydrological years.

So this brings a lot of difficulty for the water use. If we divided China into three components -- one is the south, one is what I call the north and one is the northwest. The area is almost equal -- about 30 percent. But water situations and production is quite different. In the southern China, the water is coming about 80 percent and the GDP is about 50 percent. And in the north of China, water is only about 40 percent and the production is about half of the country. This is a natural condition of the water.

If we look at what has changed during the past, let's say, 20 years, we found the particular water situation has been more and more serious because of two reasons. One is the climate change. And another is because increase of human activity intensities to the land surface, to the ecosystems, to the environmentals. If you take north China as the example -- let's say (inaudible). During the past 20 years, precipitation has reduced about 10 percent if you compare with 20 years ago. The surface water is reduced about 40 percent and the ground water reduced about 25 percent. Why is this happening? Because -- one is the reduce of the rainfalls.

Another because is change of the mechanism of water resource formulations. Because of the most stress spent on the land resources, so you can find what might be happen on the same rainfall condition, the water results generated is smaller than before. So that's impacted the (inaudible) activity (inaudible). Second is current stages of the water resource development. If we say China was mainly -- dominated part of China was strongly influenced by mountain climate and therefore we need large capacity to regulate natural flows to supply the -- to smooth supply to meet demand. But if you compare with the regulation capacity of China, it's about -- if we divided the storage, the current storage by the runoff -- annual runoff -- it's about only 20 percent.

And the U.S. is already about 33 percent. So actually the capacity of the water development facility is still not enough for China and the current water use is about 500 billion cubic meters a year. It's almost equivalent to the U.S. That is a per capita water use is only about less than 500 cubic meters per person. And which is about a 68 percent was spent on agricultures. Other was for domestic and industries. Another major issues of water -- first there is a shortage of the water. As we saw before -- partly because of nature, partly because of the stress on the water -- so we can say about 60 percent of total area of China was

stressed by water shortage problems, which impacted a large number of the populations and productions.

According to our estimate, the annual water shortage is about 40 to 50 billion cubic meters a year -- so in terms off stream water supplies. And which create huge economic losses is estimated about 30 billion U.S. dollars or something like that. And if we look at the wet side of the water issues, we can divide China into three components. One is red color in the -- mostly in the eastern side -- mainly the planning areas -- actually the flood planning areas, which mainly on a downstream of the big river systems. But this area is mainly -- the land surface actually is below the normal water level. So actually this area -- although the towns, populations, GDP was concentrated on this area, but this area actually was suffering from a great deal of flood risks because the flood mitigation system is still have a lot of weak points. And it's a big dominating part of in the yellow color. I'm sorry, it's always change. It's what I call mainly the mountainous area where is the flood and the rainfall is coming from.

In these areas, there are about 400 million people living there and with poor conditions. So they are also suffering from the flood risks from streams and small rivers. And for others, we don't have a big issue. So you can see from this chart -- from this diagram, you can see how China's population and GDP was suffering from the flood risks. It's

also a big issue in China. And then in terms of flood disasters and economic losses, we can -- so from historical record, this is a flood disaster (inaudible) in the time horizon from the first of the century of the B.C.

And here you can see the disaster was increasing according -- along with increase of population, increase of intensity of land use and (inaudible) things. But again, I think we have seen the 20th century. And the pollutions. Pollutions -- naturally speaking, about 25 percent of surface water and 60 percent of ground water is not actually in good conditions. But also because of the increase of pollutant loads. It also has created a lot of problem of the pollutions in the rivers. Like this is about 40 percent of the surface was polluted now to some extent. And then is ecological situations, because naturally about 40 percent of China was categoried as semi-arid and arid areas. And in there they have about four percent of the population and three percent of GDP and only five percent of total water. Because of high pressure put on the land and the water, so they are a lot of the cause of lot of degradation of the ecological systems. And particularly this -- oh, sorry.

From this chart you can see -- this is actually the water -- what they call the water resource development ratio for different rivers in China. And you can see a lot of the rivers with development ratio much

more than 40 percent is north China rivers -- like (inaudible), Yellow and (inaudible) rivers. All these are -- actually what this means. It means these rivers already runs beyond their current capacity of the water. So you take a lot of water from -- by peoples, so you're only left a small water in the river system for the ecological, for the environmental use. So this cause -- what they call an ecological degradations. According to estimated water shortage and what they call (inaudible), ecological water shortage is about 60 billion cubic meters a year in north China river systems. So it's a big job in the future to restore these river systems. And also ground water exploitation like Professor (inaudible) mentioned before.

The annual actually -- the annual overexploitation of ground water is something about 20 to 30 billion cubic meters. It is also known if we want to solve the environmental problem, you also needed to restore these. So it's also huge, big issues of China. And, of course, because of the shortage of ecological flows that cause reduction of the lake surface and reduction of the wet land. And if you look at the futures and this is the past trend of the population GDP and these kinds of things.

In the future, (inaudible) will keep going on and I think a lot of my colleagues have mentioned the future forecasting of populations and these kind of -- so I will skip that. But if we look at what -- pictures. What will be in the future. If the continues use current development patterns.

So the water demand will go into about -- from 600 billion cubic meters, to about 80 billion cubic meters. But this is far beyond what your current capacity and environmental acceptance. So we have to reduce this demand to certain levels. So what level is acceptable -- and according to the availability of the water supply, according to the requirement of the environmental flows. So we have an estimate -- the maximum water supply capacity is only about 700 billion cubic meters.

So in the future, (inaudible) got to get this demand from eight billion down to about 700 to meet the future balance. So this is future forecasting. Number four is strategy and policies. So I think some of our colleagues have mentioned the overall strategy is to change the human oriented -- to change the development concept to become a human oriented development strategy, to change the economic development patterns to balance the human and nature and also to ensure the national water securities. So what are we do is to improve the economic equality, the major policies and to improve the water efficiencies, to protect the water resources and to provide a safe drinking water supply and also to enhance flood mitigation capacity as well as to prepare water resource deployment. Because, as we mentioned, water even is distributed in China particularly very strongly -- so we needed to raise deployment of water resources according to the natural need and according to the

human need. And also to improve the water management. I think I've got to stop here and thank you very much.

MR. BADER: Thank you very much, Mr. Gao. Thank you Professor Cai. Thank you Professor Li. We have a few minutes for questions. If you'll just raise your hand, identify yourself and your affiliation and tell us who your question is directed to. The gentleman on the left side here.

MR. BERG: Thank you. My name is Bob Berg. I'm with the World Federation of United Nations Associations. When you think of the governance of -- for sustainability -- it puts some parts of government concerned with resources in a difficult position, because it requires so much the cooperation of many other parts of government. So I wonder whether you could tell us what lessons you've learned so far of how to influence the Agriculture Department, the education people, other parts -- the industrial ministries -- other parts of government for good behavior in the use of water.

MR. BADER: Would that question be perhaps for Professor Li?

LI YUANYUAN: If I may try to answer that, although it's a quite difficult question because as you know in China, although we still encourage what I call a (inaudible) water resource management. And

actually the water responsibility was actually allocated to different departments and some department are responsible for just a couple of things, like here in the U.S. -- you also don't have what I call a Ministry of Water Resources or integrated agencies dealing with water.

Sometimes it's really quite difficult to have the different departments sitting together and have the (inaudible) policies. But we try to set up a kind of mechanism first in the central government. We set up like -- in case by case -- like in terms of pollution controls, in terms of the water saving. We tried to set up a kind of working mechanism between different ministries. And sometimes together we (inaudible) to hold the different ministry together to set up the integrated plans and policies. But we do more increase -- more in the rural basing levels to have what I call the integrated management (inaudible).

So I think from two years ago, we started to design the reform -- what I call the rural basin authorities which was try to set up what I call a commission which involved different government department and ministries and the provincial government to set up a commission then transfer the current what I call the river basin commission, as a executing office for this commission. Then try to incorporate these policy and these kinds of things. And more practical level and I would say down to the local levels to a provincial and professional level, is that time is for the local

government much easier to hold all the departments together. So we try several ways to more integrate water resource management.

DR. XIMING CAI: One more point to your -- I teach water resources management, so I want to just emphasize the education because you mentioned that. I think water saving is an issue of management -- government management and also an issue of economic (inaudible). And we should also take it as an issue of (inaudible). So I think that's particularly important in north China, where water is so limited. If you use more, other people will use less. Thanks.

MR. BADER: The woman on the left. Okay.

MS. BABBIT: Hi. My name is Hattie Babbit. I'm with World Resources Institute. And you all have given a very candid analysis of the situation in China today with respect to water resources and the difficulty in managing the ecosystem services associated with water. I wonder if you could go into some more detail about the kinds of thinking and the kinds of planning you've been doing with regard to climate change.

Much of the water in the now water rich south comes from the Himalayas which will inevitably produce less water and I wonder what -- if you could go into some detail about the planning that China is doing with regard to the impacts of climate change.

LI YUANYUAN: Maybe I'll just --

DR. XIMING CAI: We can answer this together.

LI YUANYUAN: In terms of tackling with water issues, particularly facing the climate change and the impacts of water -- so what are we do is to -- first is try to set up what I call the -- to better develop a facility and to set up a basic water security bases -- like why we bring the water from south to north to China (inaudible). Actually the first object to is to recover the ecosystem. So we have this set up the policies. When the water was coming from the south to north, and the overexploitation of the ground water have to be stopped.

The over use of the local surface water have to be returned to the flow itself. The over use -- the over use of the water from the agriculture -- because some of the industry and domestic was taken from the agriculture -- you have to get back to these agriculture. So first it is still needed to better promote your water system, to ensure the basic water security.

Number two is to we also set up the policies is to ask the different individual cities to -- what I call it -- to prepare what I called it a (inaudible) water source for the particular emergencies use and also during the dry season uses. I think you can --

DR. XIMING CAI: Alright. One issue is the growth pattern change. So we have conducted -- as I mentioned in my presentation -- we

have conducted some preliminary analysis using actually 17 GCMs recommended by (inaudible). So if we just conduct a first (inaudible) analysis, actually we found some positive things in north China and our irrigation requirement were basically declined -- for some crops in north China. But we found some service problem with Xi Jiang, that's Pearl River -- Xi Jiang River basin -- and also the mid stream and the upstream of the (inaudible) and the (inaudible) of the Yangtze River and we found the irrigation requirement might increase significantly and particularly in Xi Jiang River basin. A lot of rice is planted in that area.

But it looks like the change in climate will be more favorable to spring weight, so maybe -- that means maybe they have to switch to -- from, I mean, from rice to spring weight in some way. So this is just like, as I said, it's a general analysis. But on the other hand, we also -- we have conducted some analysis on the (inaudible) variability -- particularly for south China. So based on what China had in the past years -- there were some consecutive growth -- we just wonder if that kind of no frequency (inaudible), extreme (inaudible) might have higher frequency in the future. So this question is so important because it's actually kind of relating to the south-north water transfer project.

So we kind of assume we would have a stable resource to transfer from south to north. But if drought, if we have more frequent

drought in south, then does this mean we need to have additional storage to regulate the (inaudible) year variability. Fortunately we have Three Gorge. Maybe Three Gorge Dam could help us on that, but I'm not sure that's enough. This is -- as a research question -- I think anyway we need to conduct more detailed research, but we are just started thinking that way.

MR. BADER: Woman on the right.

SPEAKER: Basically I have two questions and I'm directing my questions to Mr. Gao. The first question is basically about an oil energy security and what are your long term plans? And the second question is on the cooperation -- whether there exists any cooperation and what kind of cooperation you have between the energy authorities in China and the IEA or other international cooperation?

SPEAKER: Strategic oil reserves and commercial oil reserves in China? Do you have any strategy plans on that?

SPEAKER: In this area, the Chinese government has taken on many different measures and what you mentioned about the strategic oil reserve is one of the many measures that we have taken. In fact, we have just recently completed our stage one project of our strategic oil reserve. This is actually part of the -- in addition to that, I mentioned about four projects that we are conducting and that is also part of the

strategy. And we are now in the stage -- for our stage two and stage three projects, we are now in the process of selecting the proper locations or sites for this research. Actually in May this year, the Assistant Secretary of State of the United States Government visited -- in charge of oil and energy resources -- and visited Beijing and we had discussions with him in this area. Mr. Sullivan.

For China to have a membership in IEA, I think we have a prerequisite and that would be that we are going to go according to the charter of IEA which is that a member of the IEA has to be a member of OECD. So how could that be possible for us in the current state because one of my colleagues has already told you that our current GDP per capita in China is 500 U.S. dollars and OECD in average is $10,000. Despite the fact that we're still not an IEA member, there is no lack of frequent cooperations between China and this organization.

First of all, China is an observer in the IEA and that means that we participate in many of its activities. And also if you look at the activities or programs of IEA, you can see that historically China has been considered as a target study group of IEA.

MR. BADER: I think we have time for one more question. Down in the front here.

MR. MITCHELL: Thank you. Gary Mitchell from the Mitchell Report. I want to come at what has been predominantly a sort of engineering/scientific policy discussion about water and resources in general from a different point of view and I'm -- so I'm not sure (a) who to direct this question to, and (b) whether it's even appropriate -- but let me pose it if I may. One of the ways to -- we might characterize what you and panelists, even in the first panel, are talking about is the need to develop an environmental ethic in China. And last week we -- Dr. Bader moderated a panel of religious leaders from China -- Buddhists, Taoists, Muslim, Protestants, Catholics. And as I've listened to you today, one of the questions that has come up for me is whether there is a role for religious organizations and other non-state actors or institutions to play in helping China develop what -- for the purposes of this conversation -- I would describe as an environmental ethic and greater environmental awareness.

MR. BADER: Any volunteers?

LI YUANYUAN: Well, I'm not really the expert. I'll try to say something I know regarding to the people's participation in terms of resource development and management. As you know, in China a lot of the natural resources actually was stored in the -- was founded in some remote areas and some special regions like inner Mongolia and

(inaudible) -- these kind of areas. So the past practice is most of these natural resources was because it was handled by the central government. So that means less concern for the local cities and so religious groups. But nowadays the policy was dramatically changes.

As you know, particularly like petroleum development and coal mining development, there are -- what I call -- the special what I call the resources charges. Our engineers -- these resource charges mainly what I call something like central government taxing, but now is about eight percent or more than that percent. I didn't remember. I was (inaudible) on the local areas to particularly helps local peoples including local government and the local cities including religion peoples and different ethnic group peoples. This is the one thing I can say.

And the number two is we do have some kind of special group of the peoples like there are very few ethnic groups like living in the mountains or living in the river side or some special religion peoples. And I remember if we say 18, 20 years ago, or 30 years ago, when you're dealing with infrastructure development like dams, reservoirs or coal mining or those kind of things. Usually it's easy to move these people out of these site. But nowadays you cannot move these people unless they get (inaudible), unless they get sufficient compensated (inaudible). This is number two I want to say.

Number three is in terms of planning and policy making procedures now in China, actually we encourage what I call it people's participation. So actually -- during the planning and policy formulation stage, actually we do have some what I call the public hearing or those kinds of things to invite the ethnic group or the people involved to have their voice, to listen what they want, to listen their demand. And also in terms of the management levels like, you know, water systems, in the bottom of the levels like some of the irrigation systems, we do help the -- we do encourage and help the farmer to set up what I call the irrigation associations or water user associations. And this also includes what I call the special groups like the ethnic (inaudible) those kind of things. Maybe some religion peoples, but I don't know.

MR. BADER: I'm now going to contradict myself. I said that was going to be the last question, but that was the second to the last question. I'd like to ask Jeff Sachs if he has -- if he would like to ask the last question?

MR. SACHS: I'd like to ask a question. Thanks. Thank you for the wonderful presentations. On the question of the south and north difference, if you were to take a guess 30 years from now of how China will have adjusted to this, how would you put the relative weight of the south to north water transfer strategy? Better efficiency in the north as a

second alternative? A decrease of food production in the north? Perhaps moving the food to the south rather than the water to the north, or some kind of more general shift of populations at least slightly more towards the middle and south as the urbanization continues?

So if you're looking to move from the business as usual to the efficient, is that mainly through more efficient water use along something we would see as our current trajectory? Or is by internal transfers of water? Or is it by internal transfers of where people live or where the food is grown? Because all of those are choices for closing the gap.

LI YUANYUAN: Well actually the south to north water transfer has been discussed more than 50 years to make the decisions because actually there are a lot of alternatives have been compared including to stop the agriculture or reduce the scale of agriculture in the north part of China or move more people to the southern part or those kind of things. Actually there are some special things we need to consider. First of all, in the southern part of China, although the water is available in there, but actually there are not much of the land resources, because mainly concentrated with mountainous areas.

All the -- because the planning and the development in the southern part are actually already (inaudible) in years. So almost all piece

of land are already developing. As you know, in China now is a (inaudible), is more rich people, because why are they rich? Because they don't have land, so they work hard and they go outside and they go to Europe, they to U.S., they go to other places in China and they work hard and get money. So actually it's not so much (inaudible) in there and since the reform of 1980's and because the reform and open policy was actually put in practice firstly in the southern part of China in a particular -- in the Pearl River delta and second is Yangtze River delta. And we tried to encourage more rural peoples to go to there for working, but actually during the past 10 years, we find it's also quite difficult for that place to absorb much more peoples. Like I remember the figure, you know, five years in the Pearl River delta -- it got about 20 to 30 million labor force in there. But nowadays, because of the increase of the environmental cost, because of the change of the production (inaudible), actually the people -- some labor force was actually quite difficult to remaining on that part. And if we go back to the northern part of China, that's only the place they still have some available land resources. Of course, they are short of the water. And traditionally in China, actually the food was from south to north. But actually since 1980's, the food will actually from north to the south because of these situations. So they have been discussed many years and still we -- we are seeing because of the south to north transfer

was put implementation or soon will be. And actually this south to north water transfer actually is not any -- not any drop of the water was supported for the agricultures -- so only (inaudible) for the industry and domestic use. And also we -- when this water was coming, we tried to reduce some local water currently being used by industry and domestic and tried to get back to the agricultural then to increase the agriculture production.

Then the last question is regarding to the water saving or water efficiency in northern China. I think as Professor Cai already mentioned before -- actually current daily water use efficiency in the agriculture sector, in the northern part of China, particularly in north China (inaudible), actually is per capita -- the unit water use for per unit, per unit (inaudible) is about 115 of the hector. It's only about less than, less than, less than 200.

It's about -- I remember it's about 180 meters per (inaudible) and actually it's already at very, very low levels. Actually if you want to improve efficiency, if you want to save more water from this, very low levels -- like you said to a poor people with just a $10 income. You have to save money to make you rich. That's almost impossible.

MR. SACHS: So what's the answer?

DR. XIMING CAI: I'll just add a few points to his question. So actually Mr. Li just described a (inaudible) water flow in China. So right now, water is moving from north to south with food. But physically, you know, in a few years we will have water -- physical water from south to north. We have done some scenario analysis on the impact of south to north water transfer project.

So by 2025, the water transfer is about 30 (inaudible). And we found this is almost the same amount of over (inaudible) ground water in north China. It's about the same amount. So, let's say if we use that water from the south and then in the north, we store up ground -- we try to adopt sustainable ground water use. We store up ground water or (inaudible). Then that could be a solution. And also we did some analysis -- actually your questions is really relating to agriculture policy.

If we use that amount of water, 30 (inaudible), we could actually produce 17 million metric tons in north China and that's about five -- four to five person of the total food demand. Then the question is if China -- will China accept that policy, because the food self sufficiency has been a fundamental national policy and it's very important for China. So, the issue is we talk about (inaudible) water flow around the world -- so go to China -- import significant amount of food like five percent of the food demand, or 20 percent of the total food demand from other countries.

Because we also -- we did some projections on the environment. We said if we -- actually if China, if north China reduces food production by 20 -- actually that's about 60 metric -- 60 million metric tons -- then they could save a lot. That's about 20 percent. Together with the kind of food they import, that's about 20 percent of the total food demand.

And if China accepts that policy -- if China could import 20 percent of the total food demand, it looks like there is a good solution for the environment. Of course, of course, we are doing numerical analysis. But the south-north water transfer is approaching. It's a real thing. Okay. So.

MR. BADER: Thank you very much to all of you. If I could just make closing comments. Gary Mitchell referred to the discussion we had last week with some religious leaders, this discussion today was I think a little more calm and with participants less excitable than the discussion last week, which I think suggests that when the issues have to do with planning and engineering rather than the soul, people can be more rational.

But, specifically on your point, Gary, about the role of the public and developing an environmental ethic -- I think it's an important point. I mean, many if not most of the demonstrations and episodes of public disorder in China in the last few years have revolved around water

use, land use, environmental related issues. And if you look at polling data in China, whereas once environment was about the thirteenth or fourteenth most important issue -- in more recent polling, it's about the fourth most important issue.

And there have been literally thousands of NGOs formed in China on environmental issues. Since China lacks an NGO legal structure, they are not registered, but they are informal and I guess this raises the question of at what point China's legal structure will catch up to the realities of what's going on on the ground so that the involvement of civil society will be reflected in a legal way. And finally, the last point on the question about the International Energy Association -- I would just like to offer a personal comment.

I think it's absolutely absurd that the number two oil consumer and the number two oil importer in the world is not a member of the International Energy Agency. We are operating under -- as Mr. Gao pointed out -- on the basis of three decade old rules. This is just one I think particularly egregious example of the failure of world institutional structures and organizations to keep up with the evolving nature of our world. When these rules were put in place, China was not part of the global system and now they are at the pinnacle of the global system. This is one of the absurdities that we should be correcting in years to come.

Thank you all very much for coming and thank you to our participants for a very informative discussion.

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