
China: Climate Change Superpower and the Clean Technology Revolution

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Move over America. China has sprinted to the front of the pack in carbon dioxide (CO₂) emissions. Lost in the euphoria of skyrocketing stock markets and the debate over trade imbalances, poisoned pets, and toxic toothpaste and toys was the announcement that China now has the dubious distinction of being the largest producer of CO₂ in the world. Following closely on the heels of the International Energy Agency's prediction that China was expected to overtake the United States as early as the end of 2007, the Netherlands Environmental Assessment Agency announced that this milestone had already been reached. According to the Dutch report, "[t]he surging power demand from China's rapidly expanding economy caused CO₂ emissions to rise by 9% in 2006 . . . that increase, coupled with a slight United States decline, meant that China's emissions for the year surpassed those of the US by 8%." Press Release, Chinese CO₂ Emissions in Perspective, (June 22, 2007), www.mnp.nl/en/service/pressreleases/2007/20070622ChineseCO2emissionsinperspective.html. Despite a knee-jerk response by a high-ranking Chinese official disagreeing with the report and criticizing its measurement criteria, an official at China's Energy Research Institute remarked in a less bellicose fashion that Chinese researchers would study the report but that their estimates indicated that China would in any event surpass the United States by the end of 2007.

This revelation puts China front and center in the climate change debate. The sleeping giant has truly emerged from its century-long slumber to become not only the workshop of the world but the climate change superpower. The speed with which China has overtaken the United States is particularly worrisome. In 2005, China's CO₂ emissions were 2 percent lower than those of the United States; in 2006, they were about 8 percent higher at 6.2 billion tons compared with U.S. emissions of 5.8 billion tons. In fact, recent research from University of California Berkeley indicates that the Kyoto Protocol underestimated the magnitude of the projected increase of CO₂ emissions in China, and with her plan to quadruple gross domestic product (GDP) by 2020, greenhouse gas (GHG) emissions will skyrocket—possibly double—thus

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negating any attempt at reduction by the rest of the globe.

The Energy Information Agency predicts that China will experience the largest growth in CO₂ emissions between now and the year 2030. While current emissions per capita are only about one-fifth of U.S. per capita emissions, China's economy continues its meteoric rise with an 11.9 percent GDP growth in the second quarter and a recent overtaking of Germany as the third-largest economy. The rise is fuelled largely by inexpensive, dirty coal-fired power with installation at the rate of two large 500 megawatt (MW) coal-fired units per week. As the world's largest producer and user of coal, China continues to depend on CO₂-heavy coal for nearly 70 percent of her primary energy consumption, and this will not change anytime soon. In addition, with the exponential growth in car ownership in China expected to reach 140 million by 2020 and the importance of the automobile industry as an engine of economic growth, vehicle carbon emissions are also expected to surge.

With the fast-approaching expiry of the Kyoto Protocol in 2012 and the absence of any successor framework, there is a new urgency to mount global efforts to combat climate change. Indeed, how China handles this new responsibility will have far-reaching repercussions for the world, especially in light of the Bush administration's official stance that it will not sign onto any emission reduction pact unless China follows suit with her own caps.

It's Not Fuzzy Science

Just four years ago, nobody talked about *quan qiu bian nuan* (climate change) and certainly not about the effects of climate change in China. The subject of climate change at that time involved no more than a handful of officials trying to determine how Clean Development Mechanism (CDM) investment could serve as a means to gaining much-needed technology. All that has changed. Climate change stories appear almost daily in the English language *China Daily News*. The 400-page *First National Climate Change Assessment*, drafted over a four-year period by scientists and officials from dozens of Chinese ministries and agencies, clearly shows consensus among a broad range of officials that global warming poses a clear and present danger to China's development. For example, rising sea levels threaten low-lying megacities such as Shanghai, the jewel in China's financial crown.

With extreme weather and other classic global warming manifestations occurring across the country, China sees climate

change as a grave threat. Western glaciers will have largely melted by century's end, drying up large portions of the rivers that they feed. Other predictions are direr, indicating that 80 percent of Tibet's glaciers could be lost by 2035. In far north-west China, Number One Glacier in Xinjiang's Tian Shan Mountain has already lost 20 million cubic meters of ice in just four decades and actually split in half in 1993, with the eastern and western sections receding by 3.5 and 5.9 meters annually. The total glacier area has shrunk by 20 percent.

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The changing climate threatens not only China's dwindling and heavily polluted water resources but possibly her food security. The northeastern province of Liaoning, a leading corn-producing area, is suffering its worst drought in more than thirty years, limiting drinking water for more than 1 million people. Shortly before the drought's onset, Liaoning suffered its worst snow storm in half a century. A recent study also found that 17.5 percent of the lakes at the source of the Yangtze have completely disappeared. Coupled with an increasing rise in annual mean temperatures (expected to exceed 3.3° Celsius (C) by 2050), the absence of a viable water supply (in the absence of adaptive changes) could result in grain production declines of up to 10 percent by 2030 and a staggering 37 percent by midcentury. Clearly, this latter scenario especially cannot be permitted to play out, not only for China's sake, but for the stability of world grain markets.

Climate Change: The View from Behind the Great Wall

In a June 4, 2007, press conference, Ma Kai, Minister of the National Development Reform Commission, said that “China is committed to pursuing a more sustainable, lower-carbon future, but *not* at the expense of economic development . . . it is too early, too abrupt and too blunt for the international community to impose emission caps on China.” Despite the growing number of predictions of a grand environmental disaster, climate change remains to China more about politics and economics than about global environmental

health. Her interest in climate change is driven primarily by (1) energy security, (2) the opportunity for technology transfer, and (3) the need to build her credentials as a global power.

So what does China propose to do in the face of mounting pressure from the international community to cap her emissions? The simple answer is very little, at least in the near term. In June 2007, just two days before President Hu Jintao attended a meeting of the G8 in Germany, China unveiled her first national plan on climate change (the Plan), setting out broad policy goals for tackling the effects of global warming and for cutting GHG pollution. See NATIONAL DEVELOPMENT AND REFORM COMMISSION, PEOPLE'S REPUBLIC OF CHINA—CHINA'S NATIONAL CLIMATE CHANGE PROGRAMME, (2007), <http://en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf>

In reality, the Plan simply rehashed China's official stance: China is very aware of the global warming conundrum but has no intention of sacrificing her economic growth to mitigate global warming. Moreover, in China's view, as most of the GHG emissions were released by the developed nations, those nations should bear the brunt of mitigation responsibility, not China. Even the modest “carbon intensity goal” of reducing intensity (CO₂ per unit of gross national product) by 40 percent from 2000 levels by 2020, as suggested in an early draft report, was absent in the final Plan.

Despite China's ranking highest in annual CO₂ emissions, the Plan defends China's low per capita emissions and states that its climate change policy will be guided by the principle of “common but differentiated responsibilities.” Under this doctrine, developed countries, such as the United States, should take the lead in reducing GHG emissions, rather than developing countries, such as China, that are not responsible for the present climate predicament. Developed countries likewise should provide financial and technical support to developing countries, as they continue to enjoy unfettered economic growth born mostly on the backs of developing countries. The Plan acknowledges that China lacks the best technology in virtually all areas of energy production and use. For China, the issue is one of environmental justice—the outsourcing of both production and CO₂ pollution from the developed to the developing world.

Beyond broader policy statements, however, the Plan articulates several goals and initiatives that, on their face, suggest intent to take action. For example, the Plan elevates the issue of climate change (at least in the political hierarchy) to a whole new level through its establishment of the National Leading Group to Address Climate Change with Premier Wen as its head. In addition, the Plan calls for the establishment of a regional administration system for coordinating climate change work and mandates local government leadership to formulate and implement local climate change programs.

The Plan also generally discusses a broad array of policies that China already has and will implement to mitigate and adapt to climate change, including the existing “one child family planning” policy. The most significant part of the Plan deals with the reduction of energy intensity to 20 percent below 2005 levels by 2010 (although this is a reiteration of

existing policies) and increasing renewables in the primary energy supply, such as hydroelectric energy, by 10 percent by 2010. In addition, the Plan calls for an expansion of nuclear power, as well as the promotion of clean coal technology and biofuels. In the area of energy efficiency, the Plan prohibits the production, importation, and sale of products that fail to meet energy efficiency standards; encourages consumers to purchase energy-saving products; and devises incentives to encourage energy saving in buildings, vehicles, iron and steel manufacture, and other high-energy-use sectors. The Plan also states that industrially produced nitrous oxide will be held at 2005 levels, the growth rate of methane emissions will be controlled, and the percentage of forest-covered land will be increased from 18.2 to 20 percent, in an effort to soak up ever-increasing emissions of carbon dioxide.

In addition to the Plan, China enacted other domestic policies and programs designed to alleviate the side effects of climate change. The “Top 1000 Enterprises” program of 2006 sought to ramp up energy efficiency of the one thousand largest consumers of primary energy in China. During the last few years, the National Institute of Standardization issued new appliance efficiency standards for consumer appliances, such as air conditioners, washing machines, refrigerators, televisions, and lamps, with the purpose of reducing electricity use by 10 percent in 2010. The last year also has seen several developments in the area of energy conservation, with new national conservation standards for public and residential buildings seeking to reduce energy consumption by 65 percent in Beijing, Chongqing, Shanghai, and Tianjin and by 50 percent in smaller cities. By 2020, China plans to renovate 25 percent of public and residential buildings in large cities, 15 percent in medium-sized cities, and 10 percent in small cities. To improve compliance and enforcement in energy and environmental standards, the central government is setting up an “accountability system” under which officials’ promotion will be tied to their performance in environmental protection and energy efficiency. In fact, China’s Communist Party elite abandoned their business suits and ties for white, short-sleeved shirts at the recent Central Committee meeting at the Central Party School in Beijing. The sudden change in attire by China’s top officials proved very welcome as temperatures approached triple digits and as China literally begins to “warm” to the idea of being more energy efficient.

In June 2007, the State Council decreed that public buildings could not set their thermostats below 26°C (79 degrees Fahrenheit (F)) during the summer and above 20°C (68°F) in the winter. The latest weapon in China’s energy efficiency arsenal is a team of twenty-two highly trained officials, whose job is to roam the streets of Beijing to make spot-checks on offices, hotels, malls, and other large buildings to ensure that the “no cooler than 26°C rule” is followed. At a macroeconomic level, investment, fiscal, and trade policies are being transformed to promote a series of green policies. For example, taxes on energy intensive industries are being increased, while tariffs on environmental goods and services will be lowered in order to attract cleaner technology. Additionally, a new “green credit system” is being developed, under which enterprises

with poor environmental records are identified and then provided to financial institutions in order to dry up their funding sources. Sun Xiaohua, *Blacklist of Polluters Distributed—New System Aims to Cut Credit Availability to Non-Green Firms* CHINA DAILY (July 31, 2007).

Finally, on the automobile front, new passenger vehicle fuel-efficiency standards took effect in July 2005 that call for more stringent standards than those in the United States, with average fuel economy of new vehicles rising to an impressive 36.7 miles per gallon in 2008. As for public transport, China already has one of the largest bus fleets in the world using cleaner-burning compressed natural gas (CNG) and plans to convert 90 percent of buses to CNG by 2008. There is also a move afoot to introduce hybrid-electric buses, which can be converted to use fuel cells.

From Red to Green: A Different Kind of Revolution

Will China be able to successfully meet her long list of climate mitigation goals, including the 20 percent energy intensity reduction by 2010 and the boosting of renewable energy use to 10 percent by 2010? China is well known for announcing lofty goals and launching old-style campaigns together with the appropriate slogans and rhetoric. However, when looking at her compliance track record and woefully inadequate enforcement of environmental laws, one can be excused for being a little skeptical about future success. Or will it be different where energy goals are concerned, given China’s current fixation with energy security and the opportunity to acquire much-needed technology transfer?

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In a country with a strong disconnect between the more progressive central and the development-at-any-cost local governments, a chronic lack of capacity at the implementation level, institutionalized corruption (30,000 officials were prosecuted in 2006 alone, *Broken China*, BUS. WK. (July 23, 2007), www.businessweek.com/magazine/content/07_30/b4043001.htm), little sense of civic responsibility, a lack of transparency and accountability, as well as the general absence of the rule of law, the challenges presented by climate change seem almost insurmountable. Notably, China lacks a credible monitoring system to measure carbon, and even if she had one, she probably would not be very eager to share the information publicly, as witnessed in a recent World Bank report where

“sensitive information” regarding critical health impacts from pollution was taken out at the government’s insistence.

While market-based mechanisms are part of the answer, significant help is needed at a very fundamental level to build sound legal and governance capacity and to create a new sustainable growth paradigm. Moreover, laws need to be enforced through an independent judicial system not subject to the whims of local government, even when it comes to prosecuting important members of the local corporate community and the Party. This transformation, however, can only be expected to occur from within and incrementally over the longer term. Where the West can help now and be a part of a short- to medium-term solution is in the area of clean technology transfer, an essential part of the aforementioned new sustainable growth paradigm.

Given China’s poor track record and apparently tough international stance on climate change, pessimism is to be expected. Yet the ascension of China to climate change superpower status may not be the harbinger of gloom and doom that some might expect. In fact, China will benefit enormously from much-needed clean technology transfer, helping not only to alleviate energy security concerns, but precipitating a clean technology revolution by creating unimagined economies of scale to address global climate change. In other words, the country that poses the greatest threat could actually provide the solution. Clean technology venture capital investment in China will reach \$580 million in 2007, rise to \$720 million in 2008, and is expected to approach \$1 billion by the end of this decade.

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In 2002, China ratified the Kyoto Protocol, but as a non-Annex I developing country, she is exempt from the current phase (2008–12) of GHG emission cuts. One of the most significant aspects of the Kyoto Protocol is the CDM, which allows developed countries (Annex I Party) to invest in cost-effective projects aimed at reducing or sequestering GHG emissions in developing countries (non-Annex I Party) such as China. The resulting certified emission reductions (CERs) can then be used by the developed country to meet its own emission reduction targets, thus reducing its cost of compliance.

For information on China’s CDM process, visit <http://cdm.ccchina.gov.cn/english/>.

Although the CDM got off to a slower start in China than in other large developing countries, such as India and Brazil, China is rapidly catching up and is expected to host upwards of 60 percent of the world’s CDM projects. As of mid-July 2007, China had more than 13 percent of the world’s CDM projects (ninety-nine registered and more than six hundred approved by China’s Designated National Authority and now on the way to the CDM Executive Board for review) and roughly 44.26 percent of expected annual CERs. France, Japan, Canada, and Italy have entered into bilateral agreements with China to establish local CDM centers (sometimes called environmental service centers) at provincial and city levels to help build CDM capacity and pave the way for developing projects with their respective corporate interests.

As China grows as a “clean tech” consumer, domestic innovation and manufacture will be further bolstered with the investment of a significant portion of taxes collected by the \$2 billion CDM Fund launched in February. Taxation rates of CERs have been structured in such a way as to incentivize the priority development of renewables, methane, and energy efficiency CDM projects, with a whopping 65 percent rate for the least desirable industrial hydrofluorocarbon (HFC) projects (China produces most of the world’s HFC-23) to only 2 percent for high-priority renewables and energy efficiency. According to the Plan, the CDM Fund will also support climate-change-related science and technology research, raising national adaptation and mitigation capacity. Methane capture is poised to become one of the hottest CDM project areas in the next few years as China strives to alleviate water pollution problems caused by manure from the world’s largest herds of pigs and flocks of poultry; remove the dangerous gases that make China’s mining industry the deadliest in the world; and use ever-mounting landfill waste.

The Renewable Energy Law (<http://china.lbl.gov/publications/re-law-english.pdf>), which took effect in January 2006, provides for government support in the form of tax breaks, targeted loan subsidies, and special funding for wind, solar, water, and biomass, with the lion’s share going to wind. According to a recent report, China intends to spend around \$200 billion on renewables in the next fifteen years. The past five years have seen the investment of more than \$1 billion in wind turbines in a dozen provinces, with a goal of increasing capacity tenfold by 2020 (from 3.5 gigawatts (GW) to 30 GW). By offering significant financial incentives, China has set ambitious targets for biomass power generation (20 GW by 2020). Although most of China’s biomass power is in the bagasse (fiber remaining after extracting sugar from sugarcane) sector, there is significant untapped biomass potential, especially in agricultural and forest residues. However, China lacks mature conversion technologies to harness this energy.

The United States has a very significant role to play in providing funding, technology, and know-how. Companies from China are already tapping American equity markets, creating frenzy over Chinese solar stocks, reflecting the con-

fluence of two major trends: growing interest in clean technology stocks and demand from investors for more plays on China's booming economy. Given China's size, even modest adoption rates of solar, wind, biofuels, and other renewables, could result in significant cost reductions globally. Last year China overtook the United States as the world's third-largest producer of solar panels (mostly for export), coming in after Germany and Japan. China is already the largest producer of solar water heaters in the world with nearly one in ten households owning one, accounting for approximately 60 percent of the world total installed capacity. Wind turbine manufacture is also rapidly growing as the Chinese government is determined to build her domestic industry, demanding that 70 percent of wind turbine equipment purchased for wind farm projects be made with local components. In addition, China is the third-largest biofuels and ethanol producer in the world; she also manufactures 80 percent of the world's energy-saving lights (although local use remains low).

Climate change is also creating other opportunities for China's agricultural sector, raising farmers' incomes by attracting international investment for voluntary emission reduction projects through forest and soil sequestration and biogas from manure and agricultural waste. In addition there are programs supported by the United Nations focusing on provinces that are most susceptible to climate change and fossil-fuel intensive areas in order to analyze the effects of climate change and identify opportunities for mitigation.

China is also a member of the Asia-Pacific Partnership for Clean Development and Climate (APP), an initiative hatched by the Bush administration and launched in 2006. The program rejects all mandatory efforts to reduce emissions, and it is too early to tell if it will have any effect in the near term. This is also the case in regard to cooperation with the United States in "cleaner coal" research and development, such as FutureGen and Integrated Gasification Combined Cycle (IGCC) electricity generation.

The initial trickle of investment in clean technology is becoming a veritable flood, with some describing it as a "clean tech gold rush." China's already voracious appetite for clean tech will likely create one of the most lucrative market opportunities in the next two decades for cleaning up the almost three decades of environmental degradation affecting not only China but neighboring countries and now even the West Coast of the United States. In fact, California is already feeling the effects of Chinese pollution via the jet stream. According to Dr. Steven Cliff, an atmospheric scientist at University of California Davis, "it's apparent that there is a lot of pollution coming from Asia (mostly China), and that pollution is increasing. A persistent Asian plume is evident in the air over California." John Boudreau, *Dirty Side of China's Boom*, CONTRA COSTA TIMES, June 18, 2007. Fellow researcher, Tony VanCuren at the California Air Resources Board similarly observed that "much of the year, Asian pollution, including soot, ash and dust from farms, motor vehicles, factories and coal-fired power plants hovers high over the Golden State and is on average equal to a quarter of the State's legally allowed concentrations of these particles." *Id.*

And this, of course, is only the pollution that we can see, unlike insidious and invisible climate warming GHGs. Chinese government officials and environmentalists alike are saying that the only hope to head off environmental catastrophe is through the use of the kind of technology the Silicon Valley offers. Thus, perhaps there is a certain poetic justice to the application of innovative technology and expertise as the "clean tech capital of the world," Silicon Valley, is poised to take advantage of this great opportunity. Indeed, veteran valley venture capitalists see a "tidal swell" of interest in the clean energy tech market over the next twenty-four months. According to Cleantech Group, an industry research body, clean tech investment in China shot up by 147 percent from \$170 million in 2005 to \$420 million in 2006.

With China sprinting past the United States as the largest

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CO₂ emitter, the pressure is on for some sort of deal after 2012, when the Kyoto Protocol expires. But are we asking too much of China too soon, given the fact that her per capita emissions are only about one fifth of those in the United States? China has coined a new phrase, "Climate Terrorism," to refer to what she sees as the latest weapon in the West's arsenal to hold back China's growth—the endeavor to impose a cap on GHG emissions. To China, climate change is very much a "fairness" issue. Why should China accept caps on GHGs and slow down her growth when the West has already enjoyed unfettered economic development? Ironically, China's fairness argument provides the United States with a good cover as it continues to spew GHG into the atmosphere while arguing that it will not accept caps without China doing the same. This global game of "chicken" is a game that the world cannot afford to play. While the United States continues to drag its feet, knowing full well that China will not "blink first," China's emissions continue to grow at an alarming rate. Although it will be impossible for China to make absolute reductions, she must make an international commitment to reducing her carbon intensity as the first step. As for the United States, she needs to take leadership in the face of a real WMD (weapon of meteorological destruction), global climate change. 🌳