

# ChinaFAQs

## The Network for Climate and Energy Information



## China's Carbon Intensity Goal: A Guide for the Perplexed

**In late November 2009, China announced its intention to reduce the intensity of carbon dioxide emissions within the Chinese economy by 40-45% by 2020, as compared with a 2005 baseline. China then reported this goal to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat on January 28, 2010.**

This announcement, coming on the heels of the United States' announced pledge of a 17% reduction in absolute greenhouse gas emissions between 2005 and 2020, garnered a great deal of attention both in the United States and internationally, with experts weighing in with both approval and doubts about China's ambition.<sup>1</sup>

To enhance understanding of China's commitment, we provide answers to the major questions related to the Chinese carbon intensity target below.

### WHAT IS A CARBON INTENSITY GOAL?

Carbon intensity is the ratio of carbon dioxide emissions per unit of output, which in this case is economic activity measured as gross domestic product (GDP). The Chinese carbon intensity goal will be calculated as energy-related CO<sub>2</sub>/GDP. Therefore, while the target includes CO<sub>2</sub> emissions, it will not include other greenhouse gases or emission reductions from the land use sector. A carbon intensity target can

help advance a country's transition to a low-carbon economy. It is especially attractive to many developing countries, which have historically contributed relatively low levels of greenhouse gas emissions and do not feel in a position to take on quantifiable economy-wide emission reduction targets. These countries' current and future emissions growth compels them to take measures that promote early action. The assumption is that because these countries are still developing and have large infrastructure and development needs, absolute emissions will continue to grow, but the target will encourage a slower rate of emissions growth. How much slower is a key question in the overall global effort to address climate change.

### WHAT IS THE BASELINE FOR CHINA'S CARBON INTENSITY GOAL?

We don't yet know the baseline for China's carbon intensity goal, but we can get an indication of the 2005 baseline by examining International Energy Agency's (IEA) World Energy Outlook 2009 (WEO), US Energy Information Agency's (EIA) International Energy Outlook (IEO) 2009, and Chinese Energy Research Institute (ERI) data. However, it is worth remembering that these are not the official data sources the Chinese government will use, and China has yet to publish an official 2005 baseline figure.

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Our understanding is that the target was set using an estimated 2005 baseline. China is in the process of conducting its greenhouse gas emissions inventory, which will be submitted as part of its Second Communication to the UNFCCC. We have not been able to determine when China plans to submit this Communication, but under the Copenhagen Accord signed in December 2009, the Chinese agreed to submit such a document every two years. Although the inventory will be for an earlier year than 2005 and China may need to establish the 2005 baseline calculation before a full 2005 inventory is complete, the upcoming inventory should give the Chinese government a more precise figure for basing its target.

Table 1 calculates emissions intensity using these various data sources. These calculations provide an indication of China's carbon intensity in 2005. The numbers are all in U.S. dollars (using PPP exchange rates), but it is likely that the Chinese government will track its carbon intensity in domestic currency – called the renminbi (RMB) or yuan – rather than in dollars.

## WHAT IS THE PURPOSE OF A CARBON INTENSITY GOAL?

Under the Bali Action Plan (BAP) adopted by the UNFCCC in 2007, developing countries are committed to establishing nationally appropriate mitigation actions (NAMAs), but neither the BAP nor the Copenhagen Accord, which refers to “mitigation actions,” requires them to develop overall economy-wide targets or goals. China's carbon intensity target provides such an overarching goal for the economy. It is derived from its domestic programs focusing on energy efficiency and renewable energy development. Included in this target is a 2020 goal for renewable and other non-fossil energy that constitutes 15% of total primary energy demand. China has not yet announced what its energy intensity goals will be after 2010. It agreed in the Copenhagen Accord to report domestic mitigation actions by January 31, 2010, and on January 28 reported the 40-45% carbon intensity target, the 15% renewable target, and a reforestation target.

Table 1: Estimated 2005 Emissions Intensity for China

	Emissions (million metric tons CO <sub>2</sub> )	GDP (International \$billion, PPP)*	Emissions Intensity
EIA IEO 2009	5429	5389	1.01
IEA WEO 2009	5099	6019	0.85
Other	5018 (ERI)	5315 (World Bank)	

Sources: EIA IEO 2009, IEA WEO 2009, ERI 2009, World Bank World Development Indicators 2009.

\*Please note that EIA and World Bank GDP data are in 2005 dollars and IEA data are in 2008 dollars. Because we are ultimately concerned with comparing the percent change from 2005 to 2020, this does not affect the rate of intensity change over time; however, the 2005 values across data sources are not comparable for this reason. Also, as stated above, the government is likely to use GDP in RMB (in 2000 or 2005 yuan), rather than in PPP, to track progress. It is important to note that the U.S. dollar figure in a PPP calculation tends to be higher than the U.S. dollar figure equivalent of the RMB real GDP calculation; therefore, the actual carbon intensity number itself will be different when China uses real GDP. As long as GDP is calculated in the same way each year for reporting purposes, comparisons and measures of progress over time will be valid. China is now in the process of preparing its Second National Communication, including its greenhouse gas inventory. There is no information on the progress of data collection to date, but the Chinese have significantly improved energy data collection in the last several years, and have signed a Memorandum of Cooperation with the US Environmental Protection Agency, which includes assistance with inventory methodology.

Domestically, the carbon intensity goal is a tool to ensure that provincial and local governments, as well as enterprises, focus on reducing carbon dioxide emissions as part of their energy policy. Chinese government officials in Copenhagen said that the carbon intensity target will be adopted into law by China's National People's Congress. Thus, its legal character will be equivalent to many Annex I countries' pledges once they are translated into domestic legislation.

## WHAT DOES THIS CARBON INTENSITY GOAL MEAN FOR ABSOLUTE EMISSIONS?

It is difficult to project precisely what impact the carbon intensity goal will have on absolute emissions, since at the same intensity, emissions can vary depending on the GDP growth rate. If China's economy grows quickly, absolute emissions could grow at a higher rate and still be within the 40-45% intensity target. Conversely, a slower growth rate would require lower absolute emissions growth to stay within the same intensity goal.

The figures below illustrate several scenarios for emissions trajectories from 2005 to 2020, based on reference case emissions pathways and the 40% lower end of the intensity target range and 45% higher end of the range. Modelers at the IEA and EIA prefer the more policy-neutral term "reference case" to the term "business as usual." In the context of Chinese emissions scenarios these two terms are interchangeable, and we use both in this paper.<sup>ii</sup> The figures are based upon both EIA (Figure 1) and IEA (Figure 2) reference case scenarios for China's emissions and GDP in 2020. The IEA scenario also incorporates China's emissions and GDP under a pathway consistent with stabilizing atmospheric concentrations of carbon dioxide equivalent (CO<sub>2</sub>e) to 450 ppm – a concentration of greenhouse gases in the atmosphere within the range that keeps temperature increase limited to 2°C above pre-industrial levels.<sup>iii</sup>

Were China to achieve a 45% improvement in carbon intensity it would either be more ambitious or in line with reference case scenario trajectories under both the IEA and EIA projections respectively and move closer to, but still fall short of, IEA's scenario for controlling atmospheric concentrations of greenhouse gases to 450 ppm CO<sub>2</sub>e. Many believe this level is too high to avoid significant loss of hydrological, physical, and biological system functions. Were China's carbon intensity to improve by 40%, the picture is more mixed. It would come in just under the IEA's reference case scenario's projection, but roughly 8% above the EIA's reference case emissions trajectory. These differences illustrate why the Chinese have chosen to state their target in terms of carbon intensity rather than a deviation from BAU emissions trajectories, given the various assumptions that play a role in the construction of business-as-usual trajectories. Illustrative of the role assumptions play is that the EIA reference case scenario was published several months earlier than the IEA's, and thus did not incorporate the full ramifications of the recession. The IEA and EIA reference case scenarios differ with regard to other assumptions as well. In the end, China will be judged by its actual performance, rather than a projection.

Given that the carbon intensity goal is stated in terms of GDP, and that China's GDP will continue to grow, since it is a developing country with significant unmet infrastructure and energy needs, there is no doubt that China's absolute emissions will also grow over this next decade. Figures 1 and 2 show significant growth in carbon dioxide emissions according to any of these scenarios, including the IEA's scenario for China's role in a global effort to control emissions below a 450 ppm target. Absolute emissions will grow more if the economic growth rate is greater. For example, if the growth rate were 6% per year, total emissions could be 30-40% higher and still meet the carbon intensity target, whereas at 8% per year they could increase by 75-90% over the 15-year period from the base year, and still meet the intensity goal.

Figure 1: China's Intensity Target in Relation to EIA Projections, 2005-2020

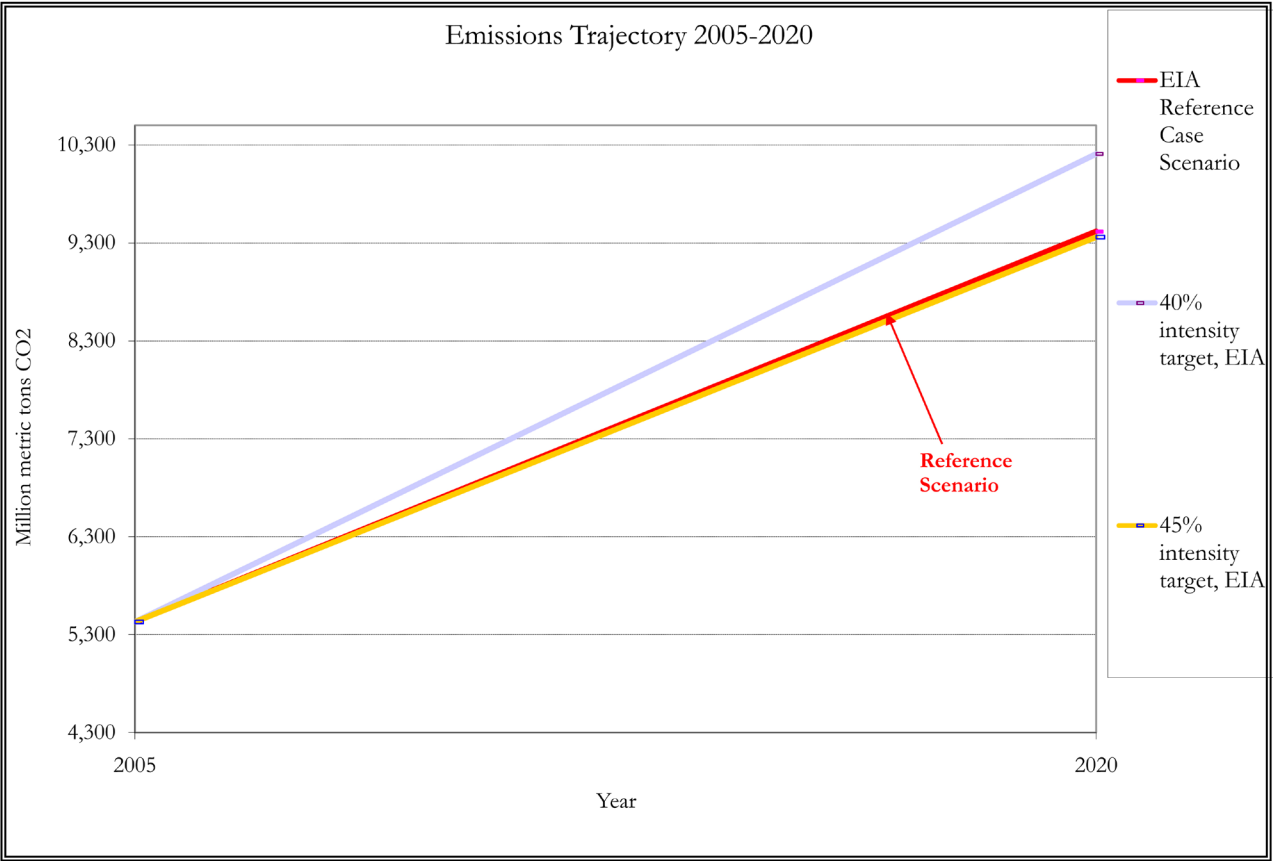
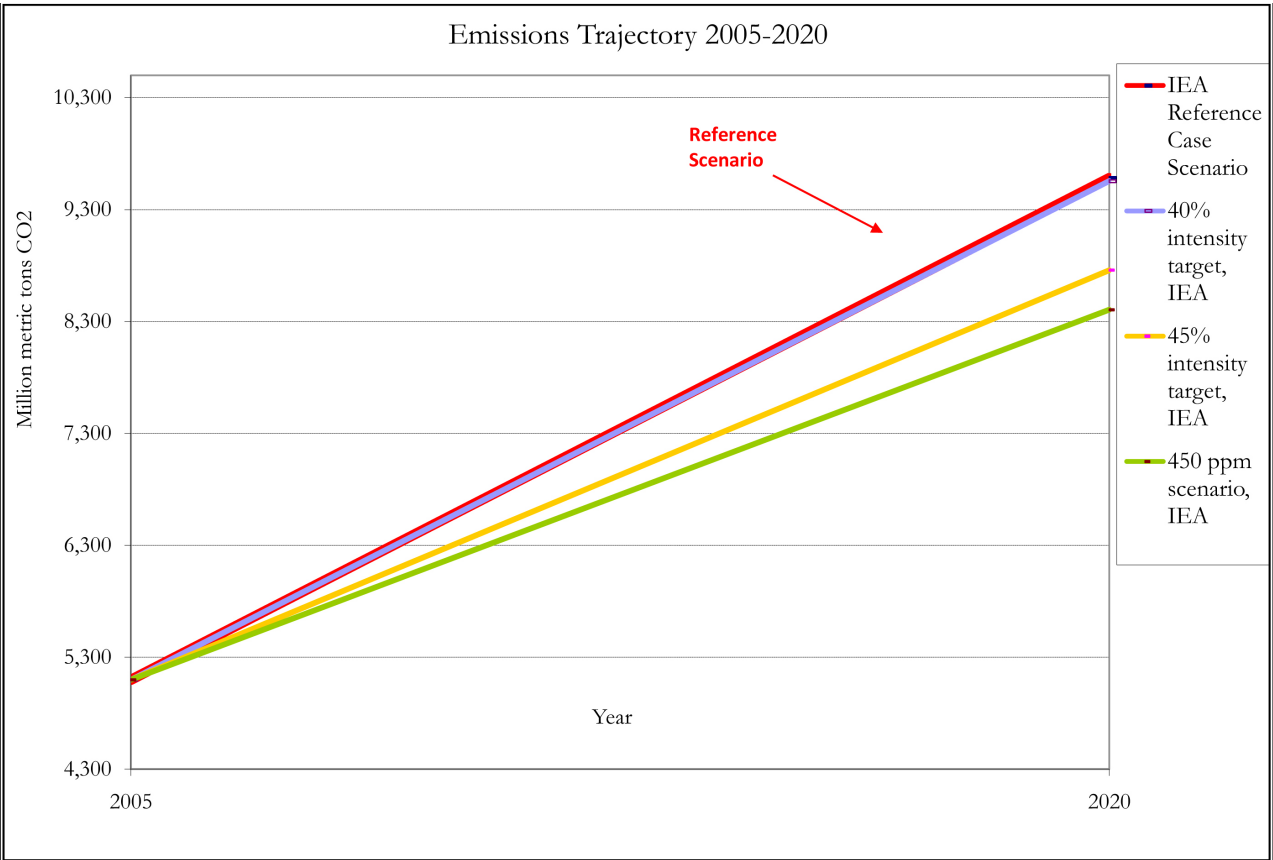


Figure 2: China's Intensity Target in Relation to IEA Projections, 2005-2020





In theory, a carbon intensity target can be set high enough to induce absolute reductions in emissions – essentially, if the rate of reduction is set higher than the economic growth rate. While this scenario is unlikely in the next decade given the announced goal, unmet energy needs, and likely growth rates, as Chinese planners look beyond 2020 they will need to consider whether a carbon intensity or absolute target will be necessary to ensure that Chinese emissions peak and then decline.

## IS CHINA'S TARGET A SUFFICIENT CHALLENGE?

Developing countries generally have low per capita emissions relative to developed countries. China's per capita emissions, for example, are less than one quarter that of the United States (CAIT 2006). Even if they promote energy efficiency and renewable energy, as they pursue sustainable development and try to enhance wellbeing for their citizens, these countries' emissions are likely to grow unless there is significant technology transformation in high emitting sectors. Thus, many developing countries have chosen to demonstrate their efforts to control emissions by comparing future emissions to a "business-as-usual" (BAU) line calculated before these measures are put in place.

But what is "business-as-usual?" In the case of China, this is particularly difficult to assess. China has now adopted ambitious energy efficiency and renewable energy plans and is already achieving results. In recent years the IEA has been revising China's reference case scenario to incorporate policy developments.

China did not choose to present its target in terms of emissions growth below business-as-usual; rather, it framed the goal as a carbon intensity target. The carbon intensity results can be calculated directly – depending on whether emissions or the economy is growing at a faster rate. Yet, many still look at the implications of the carbon intensity target on emissions growth above or below a BAU trajectory. Perhaps

references to BAU trajectories still occur because the Intergovernmental Panel on Climate Change (IPCC) suggests stabilization at 450 ppm CO<sub>2</sub>e would require substantial deviation of developing country emissions below BAU. Or perhaps it is because many assume the BAU scenario is a "no effort" scenario. However, reference scenarios already factor in China's planned energy efficiency and renewables programs. Nonetheless, energy analysts, such as those at Lawrence Berkeley National Laboratory, suggest that China will need to both implement additional programs and improve some current programs to meet such a goal. The IEA reference scenario, for example, already factors in subsidies for solar power projects and off-grid projects, on-grid tariffs for new wind projects, and planned expansion of nuclear capacity. Elements of the financial stimulus package and vehicle efficiency were also factored in. The EIA's reference case scenario also incorporates current commitments.

It is also important to assess the role the base year plays in determining the level of ambition of the goal. China is using 2005 as its base year. From 2001 to 2005, Chinese energy intensity actually rose, rather than decreased. With new policies in 2006, China turned this trend around. Thus, although all of China's policy is new since 2005, much of it is already in place. Continuing to implement such policies will entail applying lessons learned from the first years of energy efficiency and renewables programs to a broader range of sectors and continuing to scale up.

As shown in the previous section, with any given carbon intensity goal absolute emissions grow more if the economic growth rate is higher. Most analysts believe the target will be easier to meet if economic growth is higher, because with higher growth comes greater investment in new infrastructure, which can be less carbon-intensive than earlier investments.

Chinese economic planners generally set their targets based on a conservative growth rate, yet the country's economic growth has been robust over the last three decades and was over 8% in 2009, and over 10% (on an annualized basis) in the fourth quarter of 2009, despite the global financial crisis. Some economists believe rapid growth is likely over the next decade, but others argue that China is at a point where it may naturally slow down soon. If Chinese growth does continue at 8% or more per year, it may be necessary for China to revisit this target in its 13th Five Year Plan to control the growth of absolute emissions.

## HOW WILL CHINA AND THE REST OF THE WORLD TRACK AND REPORT ON PROGRESS TOWARD MEETING THIS GOAL?

Chinese officials have announced that the carbon intensity goal will be included as a binding target in its 12th Five Year Plan, to be introduced at China's National People's Congress (NPC) in March 2011. Progress on targets under Five Year Plans are then reported annually by the government, either by the Premier or by the responsible Minister, in Work Reports to the NPC. China's National Bureau of Statistics (NBS) and the ERI under its National Development and Reform Commission (NDRC) have already been tasked by China's State Council with tracking emissions data.

Under the Copenhagen Accord, China committed to reporting its actions in its National Communications every two years and these are subject to "international consultations and analysis," a provision that should allow international experts to clarify any statistical issues.

## Acknowledgments

The authors are grateful to the following colleagues and peers who provided critical reviews and other valuable contributions to this publication: Manish Bapna (WRI), Hyacinth Billings (WRI), Rob Bradley (WRI), Thomas Damassa (WRI), Kejun Jiang (Energy Research Institute), Paul Joffe (WRI), Jennifer Morgan (WRI), Nick Price (WRI), Janet Ranganathan (WRI), Ranping Song (WRI), James Rawlins (UK Consulate in Shanghai), Jonathan Sinton (International Energy Agency), and Lutz Weischer (WRI).

## List of Acronyms

BAP	Bali Action Plan
BAU	business-as-usual
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> e	carbon dioxide equivalent
EIA	Energy Information Agency
ERI	Energy Research Institute
GDP	gross domestic product
IEA	International Energy Agency
IEO	International Energy Outlook
IPCC	Intergovernmental Panel on Climate Change
NAMA	nationally appropriate mitigation actions
NBS	National Bureau of Statistics
NDRC	National Development and Reform Commission
NPC	National People's Congress
ppm	parts per million
PPP	purchasing power parity
WEO	World Energy Outlook
UNFCCC	United Nations Framework Convention on Climate Change

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## Notes

<sup>i</sup> The China Energy Group at the Lawrence Berkeley National Laboratory, for example, described the new target as "unprecedented" and "a serious commitment," while Michael Levy of the Council on Foreign Relations described the target as "disappointing."

<sup>ii</sup> One could construct other "reference case" scenarios, not based on business as usual (BAU) assumptions, but in these cases, we are using the reference case scenarios based on business as usual projections.

<sup>iii</sup> The Copenhagen Accord, as well as the Major Economies Forum and G8, have agreed to a goal of limiting the increase in average global temperature to 2°C over pre-industrial levels. A 450 ppm CO<sub>2</sub>e stabilization scenario, which has been assessed by both the IPCC and IEA, is associated with a 26-78% chance of overshooting a 2°C goal (Meinshausen 2006). Some have said 2 degrees is an appropriate threshold beyond which there is an unacceptable risk of exceeding the UNFCCC's objective, namely to stabilize atmospheric concentrations at a level that averts dangerous anthropogenic interference with the climate system. It should be noted, however, that others argue neither a 2°C nor 450 ppm CO<sub>2</sub>e limit is in line with this objective. Instead, they would argue for limiting warming to 1.5°C or for a 350 ppm CO<sub>2</sub>e goal. In response to these calls, the Copenhagen Accord includes a consideration of strengthening the long-term goal to limiting warming to 1.5°C after a scientific assessment is conducted by 2015.

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