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Comparative Assessment of China and U.S. Policies to Meet Climate Change Targets

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China and the United States together emit more than 40 percent of the world's carbon dioxide (CO_2) according to the latest available data.[1] Therefore any successful global effort to reduce greenhouse gas emissions must include meaningful contributions from both countries. Each country has started down this path by committing to reduce CO_2 emissions and both have announced plans, policies, and programs to meet those commitments. However, the character of the carbon problem in each country is different and so while the plans, programs, and policies they are pursuing have some similarities, the emphasis is different.

China and the United States have different fundamental energy supply potential. China's energy resource base is coal-intensive, while the United States has large oil and gas reserves. China does not have the option of dramatically increasing natural gas or oil supplies unless it chooses to import them. In fact, China has become the world's largest importer of oil— importing 6.71 million barrels per day in 2015.[2] Energy security, which has historically been a political priority in the United States, now receives less attention due to the recent boom in shale oil and gas. The oppo-

1 IEA, 2016. http://www.iea.org/publications/freepublications/publication/co2-emissions-from-fuel-combustion-highlights-2016.html

2 Reuters, 2016. http://uk.reuters.com/article/uk-china-economy-trade-crude-idUKKCN0WA0EP

site is true for China, which faces no significant growth in domestic oil and gas production, forcing it to import more oil and gas. Due to a combination of logistical obstacles and slow growth in coal reserves, China is now a net importer of coal, and thus energy security is becoming more of a concern.

China's total CO_2 emissions increased from 3.35 billion tons in 2000 to 8.95 billion tons in 2014. Admittedly the annual growth rate is slowing down (18% in 2011 to a little below 3% in 2014). China has made a huge effort to improve the carbon intensity of its economy, as measured by the amount of carbon emitted per 10,000RMB of economic production. The increase in CO_2 emissions was accompanied by a 57% decrease in the country's carbon intensity during the 2000-2014 period.

U.S. CO_2 emissions peaked in 2007 (at 7.48 billion tons) and have gradually decreased to a level of 6.87 billion in 2014. CO_2 emissions from burning coal as a percentage of total CO_2 emissions dropped from 36.25% in 1990 to 31.75% in 2014. This decrease is primarily a result of the dramatic increase in natural gas production, accompanied by low natural gas prices. Interestingly the share of CO_2 emissions from natural gas use increased almost as much as the percentage from coal declined.

While U.S. CO_2 emissions are in aggregate less than China's and the differential is growing, U.S. per-capita emissions are almost double (17 tons of carbon per-capita, compared to 6.26 tons in China in 2012).[3] This gap will shrink as China's economic growth levels remain higher than the United States. As the gap shrinks, so will the emissions-per-capita ratio. However, for China to meet the U.S per capita GDP level, it would require an unsustainable level of fossil fuel consumption—both economically and environmentally. While this gap will narrow, it will not close.

China and the United States use their energy differently, with different percentages of energy consumed in different sectors. China uses a large percentage of its energy to fuel industries such as steel, cement, and petrochemicals. Almost 70% of China's energy consumption is in the industrial sector compared with 20% in the United States. On the other hand, transportation accounts for 26% of U.S. carbon emissions compared with 6% in China.[4] Although emissions from this sector in China are now increasing at a rate greater than that for its industrial sector, it will be many years before emissions from the transport sector will surpass that from the United States.

3 The Chinese economy is about 59.5 percent of the size of the United States'. Data source: http://www.visualcapitalist.com/china-vs-united-states-a-tale-of-two-economies

4 Zhu Liu, Harvard Kennedy School, 2015. http://belfercenter.ksg.harvard.edu/files/carbon-emissions-report-2015-final-chinese.pdf

Over the last fifty years, the United States has transitioned from an energy intensive manufacturing to a less energy intensive service economy. China is only beginning to make a similar transition. Regions such as Beijing, Shanghai, and Guangdong have moved away from heavy manufacturing to a service economy, but this is not the case in regions such as Shanxi or Inner Mongolia. China is changing, but it will take time to make the transition. Provinces that rely on energy intensive industries and have low per-capita income levels will not be able to quickly embrace a low-carbon economy. This structural challenge is smaller in the United States.

Policy Responses for different energy resources and economies

To meet their respective emission goals, both China and the United States are using a portfolio of policy tools, ranging from command and control mandates and standards to market mechanisms. Both countries are constrained by historical experience and traditions and by political considerations. It is not surprising that their focus differs because the nature of their emissions differ. The United States passed legislation to reduce conventional pollutants in the early 1970s and adopted a cap-and-trade program for sulfur dioxide emissions in 1990. China's experience in designing and implementing standards to reduce air pollution is more recent. The U.S. system relies heavily on state governments enforcing federal environmental standards. Each state has an environmental regulatory agency that monitors and enforces the standards. Foiled in its attempt to persuade the Congress to pass comprehensive climate legislation, the executive branch issued regulations requiring the fifty states to design plans to reduce CO_2 emissions from the power sector.

The United States has a strong decentralized capacity to develop, monitor, and enforce plans to implement national air pollution standards. However, political and legal problems have recently emerged, which may make it difficult to use this capacity for meeting the Obama Administration's carbon reduction target. There is now strong opposition from some states and certain stakeholders who claim that the executive branch does not have the authority to unilaterally mandate state plans to reduce carbon emissions. Recently the U.S. Supreme Court failed to support the administration's position, throwing the Clean Power Plan's future into significant uncertainty.

China has a greater ability to require all levels of government to implement mandates from the central government, including transferring the national carbon intensity target into provincial-level targets to support enforcement. So it does not have the same problem as a federal system (as in the United States), but its implementation capacity deficit is much larger.

China reached the conclusion that monitoring and enforcement capacity to implement an emissions abatement program must be developed at the provincial level. This capacity exists in some provinces, but must be developed in others. This is a major challenge, especially given the great diversity among the provinces in per-capita income, manufacturing and resource base, and the structure of the economy. Should all provinces meet the same national low-carbon standards or should there be different standards and timetables for each province, reflecting their circumstances, needs, and economic status?

Both the United States and China have concluded that effective low-carbon policies will have to be monitored and enforced at a sub-national level and building this capacity will be a major challenge—although the nature of that challenge will be different in each country.

Reducing CO2 emissions from coal. A second area of focus is coal combustion. Burning coal emits approximately two times the carbon per unit of energy than natural gas. It also is a major source of sulfur and particulate emissions. The U.S. coal industry and its large customers, primarily electric utilities, have resisted government efforts to mandate reductions in coal combustion. The one exception is new coal electricity generating facilities. Permits given out for new coal plants decreased significantly after 2007.

Both China and the United States realize that a low-carbon program must focus on reducing coal consumption. The United States has benefitted from a very favorable natural gas market, while China has not. Instead the Chinese government is gradually addressing carbon emissions from existing coal plants through government imposed mandates and standards and building a number of new coal plants with ultra-supercritical thermal power technology, while U.S. efforts have been more indirect or tied up in the courts.

In China, coal continues to have a big price advantage over any other fuel. Thus, any changes in coal use must either result from changing patterns of economic growth or from government intervention. As a result of government action, regional coal consumption is being reduced in Beijing, Hebei, Tianjin, Shandong, Shanghai, Jiangsu, Zhejiang, and the Pearl River Delta region in Guangdong. The Chinese government ordered that coal combustion be reduced in the ten cities with the worst air quality. Further, the government requires that all new coal-fired plants must meet very strong efficiency standards and that small, less efficient units be closed down, while U.S government efforts to reduce coal use have been more indirect or tied up in the courts.

Energy efficiency and economic development. China and the United States are in different stages of economic development. China's industry structure is still evolving. As a result, China has concentrated its attention on policies to control energy consumption, stimulate investments in industrial energy efficiency improvement, develop clean energy, optimize industrial structure, and invest in energy saving industrial engineering programs.

As a result, China's industrial energy saving policies are more stringent than in the United States. For example, China's "Top-10,000 Energy-Consuming Enterprises Program" is a mandatory comprehensive energy saving project, including systematic industrial energy saving action plans, while the U.S. "Better Factories" energy saving project and "Energy Star" program are mostly voluntary energy efficiency efforts.

Carbon emissions from the U.S. transportation sector is three times greater than the Chinese transportation sector, primarily as a result of high per-capita vehicle ownership in the United States. In 2013, the United States had 809 vehicles for every 1,000 people, while China had only 88.6 per 1,000 people.[5] While the U.S. per-capita number has been largely stable around 800 vehicles in recent years, China's car fleet increased dramatically to 105.83 in 2015.[6] Both countries have promulgated aggressive efficiency standards for automobiles, but China has higher gasoline and fuel taxes on gasoline. While both countries have ambitious programs to incentivize the development and commercialization of alternative fuel vehicles, neither country has met its targets.

Market mechanisms or command and control? Historically, China's low-carbon policies are based on command and control programs, taking the form of compulsory standards, such as its energy intensity regulations and technology performance requirements. It also has established very generous subsidies to promote renewable energy technologies, alternative vehicles, and other low-carbon initiatives. Despite its historical use of market incentives, U.S. initiatives to date have largely been in the form of standards, such as Corporate Average Fuel Economy (CAFE) standards for automobiles, building and appliance codes, and state renewable portfolio standards or subsidies in the form of production and investment tax credits, loan guarantees, or government grants for R&D. Two U.S. regions (California and the Northeast) have adopted modest cap-and-trade programs aimed at the electric utility sectors, but the federal government and most sub-national governments have rejected the use of market incentives, despite the strong argument that they would be both more effective and less expensive.

5 Transportation Energy Data Book, Edition 34, 2015. http://cta.ornl.gov/data/tedb34/Edition34_Full_Doc.pdf

6 China Association of Automobile Manufactures, 2015. http://www.caam.org.cn/zhengche/20150227/1505148841.html

China, however, seems poised to take a different route. In 2017, it will launch a national carbon emission trading system (ETS) covering several key industries and sectors. China's ETS will build on the experiences of the seven regional pilots initiated in 2012. China's challenges are substantial, including a major upgrade in its emissions data and information necessary to allocate the allowances, build enforcement and monitoring capacity, and establish a regulatory structure. There is active discussion on developing a carbon tax for the sectors and firms not covered by China's ETS.

China, with little experience in using market incentives or instruments to meet environmental goals, seems committed to a path that the United States, with all its institutional capacity, has chosen not to go down.

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