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China's Climate and Energy Policies: Looking for the Best New Initiatives*

Key Points:

- China has been experimenting with many different policies to control carbon and energy intensity
- By updating building codes to international best practices, China could save in 20 years an equivalent of the amount of CO2 that would be emitted by 15 large coal fired power plants over 20 years.
- If China continues to improve fuel efficiency standards at its current rate, it will save the equivalent of the amount of CO2 that would be emitted by 10 large coal fired power plants over 20 years.
- By expanding from pilots to a national level policy, the use of environmental priorities in selecting what electricity sources to use to respond to increased demand could significantly reduce coal use in the power sector.

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While China has great challenges when it comes to addressing climate, air pollution, and clean energy, the country is also earnestly working to make progress and considering a number of new initiatives.

In 2006, China for the first time set a binding target for energy efficiency by requiring a 20% reduction in energy intensity (energy used per unit of GDP) for its 11th Five Year Plan (11FYP), covering 2006 to 2010. To accomplish these goals, China began initiating multiple sector-specific policies for improving energy efficiency. The result was a 19.1% reduction in energy intensity by 2010. China has followed up this achievement with targets for further reductions of energy intensity and carbon intensity in the 12th Five Year Plan, covering 2011 to 2015. China's overall goal has been to reduce the carbon intensity of its economy (carbon emissions per unit of GDP) by 40 to 45% from 2005 levels by 2020.

To figure out the best path towards reductions in both carbon intensity and energy intensity, China has been experimenting with many different policies throughout different sectors of the economy and different parts of the country. Some trial policies, such as carbon markets in select cities,[1] are more well known, while others, such as testing the use of prioritizing environmental considerations in dispatching energy sources to respond to electricity demand, have attracted much less attention.

Lawrence Berkeley National Laboratory's China Energy Group (CEG) has analyzed over 30 different policies with which China is currently experimenting or planning implementation, looking at how each individual policy would affect China's energy use and carbon emissions if scaled up to a national level. Here, three specific policies are discussed: new building codes, new fuel economy standards, and the adoption of environmental dispatch by utilities. These three policies are among the most promising of China's efforts to control energy intensity and carbon intensity.

Buildings: Building Codes

For the past few decades, urbanization has been a major driver of increased energy consumption in China. This is partially because, as in the United States, urban households frequently consume more commercial energy than the equivalent size rural households because a lot of Chinese rural households' energy is provided by biomass. Additionally, urbanization and rising household incomes often lead to larger housing units. In addition to the growth in residential building space needed to sustain an increasingly urban population, commercial building space is also expected to increase as the size of China's service sector and need for office space grows.

The changing nature of the Chinese population and economy means that China will continue to construct many more buildings in the coming years. These new buildings will add to the already substantial energy demands from China's existing buildings. However, updating China's building codes to a version more closely aligned with international best practices[2] would significantly reduce the energy costs associate with China's new buildings.

One of the main ways updating building codes to international best practices would reduce energy costs is by requiring more insulation for buildings and requiring improved efficiency for a building's heating, ventilation and air conditioning systems. Updating current building codes in China would lead to a 45% reduction in energy needed for heating and an 18% reduction in energy needed for cooling for residential buildings. For commercial

** This fact sheet is largely based on Zhou, N, et al., Quantitative evaluation of the potential impacts of low carbon and energy efficient policies for China. China Energy Group, Lawrence Berkeley National Laboratory. In press. For a conference paper on the same topic see:* http://china.lbl.gov/publications/quantifying-potential-impact-energy-e buildings, updates to building codes that more closely align with international best practices would lead to a 50% reduction in energy use for heating and a 40% reduction in energy used for cooling. This would amount to cumulative energy savings of 201.1 million tons of coal equivalent (Mtce) for residential buildings and 249.9 Mtce for commercial buildings from 2010 to 2030. Given China's expected energy mix over the next 20 years, this translates to about 843 Mt CO2 for residential buildings and 1.1 billion tons CO2 for commercial buildings. This is equivalent to a total cumulative reduction of 1.9 billion tons CO2, which is equal to the amount of CO2 that would be emitted by 15 large coal fired power plants over 20 years.[3]

Transportation: Fuel Economy Standards

In 2004 China announced its first ever standards for vehicle fuel economy. These standards were designed to be revised and made more stringent in phases, with the first phase finishing in 2006. The second phase went into effect for new models in 2008 and all currently produced models in 2009. The third phase is set to be fully completed by 2015, and the fourth phase of standards for 2015 through 2020 is currently under development.

Currently, the average fuel efficiency for China's passenger vehicle fleet is 30 mpg. However, after the third phase of China's vehicle efficiency standards is implemented, the average fleet efficiency is projected to further improve to 35 mpg.

Assuming that the policy of improving vehicle fleet fuel economy continues under the next phases at the same rate, by 2020 average passenger fleet fuel economy would reach 47 mpg and by 2030 it would reach 55 mpg. Because the number of personal passenger vehicles in China is expected to increase dramatically in the coming years, continued increases in fuel economy standards would reduce fuel consumption in 2030 by 44% compared to a situation with no continuous increases in standards.

By 2030 this increase in fuel economy standards is projected to be responsible for a savings of over 1.2 billion tons of CO2 between 2010 and 2030, the amount of CO2 that would be emitted by 10 large coal fired power plants over 20 years.[4] The fuel economy standards would also result in reducing oil consumption by nearly 1 million barrels of oil per day.

Power Sector: Environmental Dispatch

Dispatch in the power sector refers to the order in which power generation is turned on and supplied to the grid. For power beyond base load generation, all power generating sources are not on all the time, so the order in which generation is turned on to meet demand can have a dramatic effect on the fuel mix for electricity generation.

For most electricity systems, dispatch order is determined by selecting the generation which has the lowest marginal cost first, and not taking into account environmental factors such as emissions intensity. China, however, has traditionally used a proportional dispatch system, where each generator of a particular type (solar PV, wind, coal, natural gas, hydropower, etc.) is given approximately the same number of operating hours each year as all other generators of that type and size. The level of operating hours for each type of generator is set to ensure sufficient revenue for cost recovery for each generator type. This proportional dispatch system not only does not take into account environmental factors, but is also economically inefficient because generators of a given type that are less efficient can receive the same number of operating hours as more efficient generators.

However, China has begun to address the lack of incentives for cleaner power generation dispatch. During China's 11th Five Year Plan, the State Council issued rules for pilot regions to prioritize wind, solar, hydropower and nuclear before fossil fuel generation. Currently environmental dispatch pilots are being conducted with the grids for Jiangsu, Guangdong, Guizhou, Henan and Sichuan provinces.[5]

Extending these trial environmental dispatch programs to the entire Chinese grid could have a dramatic effect on reducing CO2 emissions. Even given China's plans for ambitious deployment of renewable energy, it was projected that under the proportional dispatch system 75% of electricity demand will be met by coal in 2020, with that number falling to 69% by 2030. Switching to a national environmental dispatch system could decrease coal input to the power sector by as much as 30% by 2030 due to better utilization of deployed low carbon energy sources. However, major electrical infrastructure challenges, such as maintaining grid stability, would need to be overcome in order to achieve this change in energy mix. Assuming that the required major changes in grid infrastructure are made, coal could account for as low as 51% of electricity generation in 2030 under environmental dispatch, rather than the 69% projected if proportional dispatch continues. This would amount to a cumulative savings of 5.9 billion tonnes of coal equivalent from 2005 to 2030. Furthermore, a national environmental dispatch system could contribute to China's CO2 emissions achieving a peak earlier than they otherwise would.[6]

Find out more about the ChinaFAQs Project at: http://www.ChinaFAQs.org/.

Sources

[1] For more information on China's carbon trading pilots see: Song, Ranping. "Emissions Trading in China: First Reports from the Field" ChinaFAQs. http://www.chinafaqs.org/blog-posts/emissions-trading-china-first-reports-field

[2] The updated building codes in the report are assumed to be in alignment with levels defined by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). For more information see: https://www.ashrae.org/standards-research--technology/standards--guidelines

[3] This is based on a 1 GW coal-fired power plant with 80% capacity factor, 2010 reported heat rate of 320 gce/kWh (38% efficiency), and IPCC CO2 emission factor for coal. A 20 year time period was used for comparison to cumulative savings from 2010-2030.

[4] This uses the same assumption as footnote 3.

[5] For more information on the environmental dispatch pilots see: Gao and Li, "Evolution of China's power dispatch principle and the new energy saving power dispatch policy." Energy Policy, 2010. http://www.sciencedirect.com/science/article/pii/S0301421510006257

[6] For discussions of coal or CO2 emissions in China peaking see: Jiang, et al., "China's role in attainting the global 2°C target." Climate Policy, 2013 http://www.tandfonline.com/doi/full/10.1080/14693062.2012.746070#.U1V8vPldXhA; Fridley, et al., "China Energy and Emissions Paths to 2030 (2nd Edition)." Lawrence Berkeley National Laboratory, 2012. http://eetd.lbl.gov/node/49965; and "World Energy Outlook 2013" International Energy Agency, 2013. http://www.worldenergyoutlook.org/publications/weo-2013/

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