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Carbon lock-in, rebound effects and China at the limits of statism

Rasmus Karlsson *

Hankuk University of Foreign Studies, Graduate School of International and Area Studies, Seoul, Republic of Korea

HIGHLIGHTS

- Highlights the problem of carbon lock-in in China.
- Discusses why rebound effects cast doubts about the effectiveness of energy conservation efforts in China.
- Explains why statist perspectives limit our ability to achieve climate stability.
- Argues that the developed world has a responsibility to provide breakthrough energy innovations.
- Challenges established views on energy, climate and global sustainability.

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ABSTRACT

From the beginning, the statist frame of the Kyoto Protocol has invited a focus on national carbon budgets and piecemeal mitigation within rich countries. Despite the Clean Development Mechanism and other efforts to diffuse low carbon technologies to developing countries, China has over the last decades continued to construct hundreds of new thermal coal power plants leading not only to skyrocketing emissions in the present but also to long-term carbon lock-in. In light of this, China is likely to continue to put strong upward pressure on global emissions for many decades to come. Ignoring the seriousness of this situation, many rich countries have persisted to seek marginal improvements to intermittent low-energy sources such as wind power rather than taking the lead in developing breakthrough baseload technologies such as nuclear fusion. This paper argues that only such high-energy technologies, if made significantly cheaper than any fossil alternatives, will be capable of breaking the current carbon lock-in process in China and other developing countries.

1. Introduction

Although both the United Nations Framework Convention on Climate Change (UNFCCC) and its subsequent Kyoto Protocol speak of the common responsibility of humanity to avoid dangerous climate change, its statist frame still differentiates that responsibility on a nation state basis, famously emphasizing the responsibility of the developed countries to take the lead in mitigating climate change. In practical terms, this has translated into specific quantitative emissions targets for developed countries and different so called "flexible mechanisms" such as the Clean Development Mechanism (CDM) to diffuse low-carbon technologies and to provide financial assistance to help developing countries in their mitigation efforts. Operating with 1990 as the most common baseline year, some countries such as Sweden have been fairly successful in meeting their obligations under the Kyoto Protocol whereas others have instead seen moderate emissions growth, in the case of Canada to an extent that the country recently decided to withdraw from the Kyoto Protocol altogether. The most substantial emissions growth however has taken place in countries that did not have any binding emissions targets under the Kyoto Protocol.

Closely mirroring its spectacular economic rise (Lardy, 2012), China in particular stands out with its increase of emissions from two billion metric tonnes of CO_2 in 1990 to more than eight billion tonnes in 2010. Much of this emission growth comes from a frenetic expansion of thermal coal power carried out to drive an increasingly globalized economy (Yungfeng and Laike, 2010). Being already the largest consumer of coal in the world (BP, 2011), China has also become increasingly specialized in the kind of energy-intensive manufacturing that inexpensive and reliable coal power makes possible, such as shipyards, cement and electrolytic aluminum production. Every year, China commissions dozens of new coal power plants and, even if it simultaneously decommissions some older and less efficient plants, this still means a rapid expansion of its installed base of coal power plants. Not only does this lead to skyrocketing emissions in the present, every new plant also comes with upto 40 years of expected life

* Tel.: +82 1025123700.
E-mail address: rasmuskar@gmail.com

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time, creating a formidable long-term carbon lock-in effect (Unruh and Hermosilla, 2006).

Meanwhile, the realities of climate change are becoming ever harsher. The atmospheric concentration of carbon dioxide is likely to reach 400 ppm within the next couple of years as the temporary effects of the global financial crisis give way to record emissions growth. Such surging concentration levels make the two-degree target seem increasingly unattainable just as more research is telling us that even a return to 350 ppm may be insufficient to "maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted" (Hansen et al., 2008:228). This means that keeping the concentration of greenhouse gases below dangerous levels is likely to be far tougher than previously thought (Monastersky, 2009; Edmonds et al., in press). Even if the probability of catastrophic climate change is both small and difficult to quantify, the mere possibility of a disastrous collapse in planetary welfare points to the inadequacies of using traditional deterministic cost-benefit analysis to evaluate the risks of climate change (Ng, 2011; Weitzman, 2009).

Despite the urgency of this situation, the rich world continues to procrastinate (Gardiner, 2011), focusing on piecemeal improvements to existing low-energy technologies such as wind power while failing to see beyond the statist frame and recognizing the magnitude of technological change necessary to make possible universal affluence in a world of more than seven billion people (Victor, 2011:117). In its turn, the focus on expensive low-energy technologies has strongly reinforced the public perception of climate change mitigation as a financial burden rather than a transformative investment opportunity. Unlike, say nuclear fusion technology, it is difficult to see how for instance wind power will ever be able to deliver sufficient energy to allow developing countries to grow and to make possible mass desalination and other key technologies necessary for global prosperity.

2. Aim

Much scholarly work has been done on China's economic rise, its heavy reliance on fossil fuels, and the fact that China recently has become the largest national source of greenhouse gas emissions (Heggelund, 2007; Raupach et al., 2007; Sheehan, 2008). The aim of this article is to take this discussion beyond its usual statist frame of reference and to challenge the logic behind the Chinese approach to climate change mitigation but also to challenge how the developed world sees its own role in relation to China and climate change. Instead of focusing on narrow national emission targets, the article argues that the developed countries, in light of their historic responsibility, have a unique moral responsibility to make radical investments in new high-energy baseload technologies. It is further argued that only such technologies, if made substantially cheaper in absolute terms than existing fossil alternatives, will be capable of breaking the current carbon lock-in in China and other developing countries. Whereas the current approach depends on a shared understanding of the threat that climate change poses and international agreement to make fossil energy relatively more expensive through taxation, an accelerating rate of innovation of the kind suggested in this article is essentially a "no-regrets option" which should be appealing even to those who think that the threat of climate change has been exaggerated. However, before further exploring this global political dimension, we need to understand the Chinese case in some detail, in particular why the Chinese government so fiercely has been resisting any calls to accept absolute emissions targets as well as why the existence of rebound effects is likely to cast doubts about the effectiveness of the official Chinese climate policy based on energy conservation.

3. China's industrial rise

It is often suggested that the legitimacy of the Chinese communist party is closely linked to its ability to deliver economic development and alleviate poverty. As living standards have increased dramatically over the last decades, in particular along the coast and in the major cities, the party and the people seem to have settled into an apprehensive coexistence where recurring local protests over land use and corruption are smothered by nationalist indoctrination and the common determination to make China a "moderately prosperous" and "harmonious" country.

In international negotiations, China has repeatedly stressed that outside calls for absolute reductions of its carbon emissions are premature and that China has a moral right to economic development (Ford, 2007). Instead of absolute emissions reductions, China prefers to focus on the relative carbon intensity of its economy (Hu and Monroy, 2012; Zhou et al., 2010). In its first national climate change strategy from 2007, China explicitly stated that improvements in energy efficiency and conservation should be seen as fundamental to its mitigation ambitions. Yet, as will be discussed shortly, there are good reasons to be skeptical about these ambitions and, in any case, even if China would succeed in reducing the carbon intensity of its economy, that would only translate into absolute emissions reductions if the rate of decarbonization at some point becomes higher than the overall economic growth rate.

In terms of global trade, China has taken on a unique role as the world's factory. Although the original lure of cheap abundant labor has faded (Zhang et al., 2011), the proximity to other manufactures, a rapidly growing domestic market, a disciplined and increasingly educated workforce as well as the capacity to quickly scale production are all crucial factors when companies decide to locate their production to China (Amitia and Javorcik, 2008). Unlike India and many other developing countries, China's also has a distinct advantage thanks to its superior infrastructure and access to cheap and reliable energy. As local leaders compete to deliver ever higher quantitative growth rates, it is not surprising that they have been unwilling to rein in the country's energy-intensive construction boom or forego new manufacturing jobs. While rebalancing away from export-led growth to domestic consumption has long been a priority for the Chinese national leadership, there are also strong forces working in the opposite direction, in particular spatial agglomeration effects (Ng and Tuan, 2006). After a long period of declining energy intensity in the Chinese economy, the decreasing trend was reversed in 1998 and the last decade has seen an increase in China's energy intensity, contrary to official policy intentions. Decomposition analysis reveals that expanding scale of production in energy-intensive industries, rapid urbanization, major civil construction works and an overall shift towards heavy industry are the main reasons for this environmentally problematic trend (Chang et al., 2010; Zhao et al., 2010). In addition to this, growing affluence and urban household energy use have also contributed significantly to increasing carbon emissions (Feng et al., 2009).

Looking ahead, Joanna Lewis clearly spells out the competing future priorities of the Chinese leadership, on one hand economic development to ensure political stability, and on the other, concern for climate change (Lewis, 2007). Although China may be more vulnerable to the effects of climate change than many other countries (Lewis, 2009; Most et al., 2007) and thus presumably have a more acute interest in mitigating those effects, its stark income disparities and its hundreds of millions of people still living in absolute poverty are likely to make it extraordinarily difficult for the Chinese leadership to abandon its aggressive pursuit of economic growth, even if that growth comes at the