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Government initiatives

Analysis of the co-benefits of climate change mitigation and air pollution reduction in China

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ABSTRACT

The unprecedented resources and energy needed to support the high growth of urbanization with the emerging issues of environmental degradation and GHG emissions is increasingly dramatic in China. A series of national and local policies have been implemented for achieving the co-benefits of reducing emissions of greenhouse gas (GHG) and air pollution for China's sustainable development. In this paper, the achievement of climate change mitigation and air pollution reduction in different sectors through implementing policies is reviewed. This paper reports on the types of policy measures that have been introduced in two cases (i.e. Tiexi District of Shenyang and Baoshan District of Shanghai) to affect air quality and energy efficiency improvements, which are then collectively examined in terms of their impacts on GHG and air pollutant emissions. Recommendations are made for achieving co-benefits effectively through the integrated approach by comprehensively concentrating on the short and long-term environmental protection and energy conservation at local and national levels based on the analysis made in the paper. The limited coordination and lack of capacity in different government bodies may be the main barriers to the implementation of a co-benefits approach. Enhancing the cooperation and capacity building could overcome these obstacles.

1. Introduction

In China, the current urban population has exceeded the rural population (i.e. 51.3%),[1] and it has kept the average growth by 3.9% since 1990 (Global Macro Economic Data, 2012). The urban population in China is expected to reach a level of 62% of the total population by 2030 (Department of Economic and Social Fares of United Nations, 2011). The urbanization in China has significantly enhanced economic development and increased the prevalence of social changes. The process of urbanization is attracting China's youth to urban centers, bringing with them increasing labor forces that assist in supporting urban structural and economic development. The contribution of urbanization to China's gross domestic product (GDP) was 61% in 2009 (National Bureau of Statistics of China, 2010). Since 1980s, China has placed increasing focus on policies that are associated with urban and economic development.

Negative outcomes of increased urbanization have emerged with the rapid urban development in China. The unprecedented amounts of resources and energy needed to support China's scale of urban growth rate is leading to increasing issues of emerging environmental degradation, an issue of China's development that needs to be tackled immediately. For instance, the large amounts of fossil fuels that are consumed in association with China's urbanization process, leads to billions of tons of greenhouse gases (GHGs) and other pollutants being emitted into the atmosphere every year, which causes climate change and air pollution. The fossil fuels that urban development heavily depends on are finite, and their reserves are concentrated to only a few countries and regions such as the Middle East and Africa, unstable political and economic situations in these regions place China's energy supply at a high risk.

According to the information from the China's Statistical Yearbook 2010 (National Bureau of Statistics of China, 2010), the total energy consumption was 3066 million tons of standard coal equivalent (2496 TWh equivalent) in 2009. With the high growth of economy, the energy consumption has increased by 13.5% between 2000 and 2009 (Fig. 1). China has become one of biggest energy consumers of oil and natural gas with the highest imports in the

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[1] BBC news on 17 Jan. 2012. Available at http://www.bbc.co.uk/news/world-asia-china-16588851.

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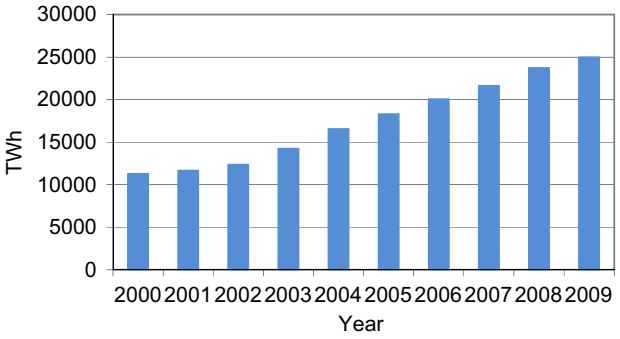

Fig. 1. The total energy consumption in China between 2000 and 2009.

world (BP, 2011). The percentage of energy use in different sectors is broken down in Fig. 2.

Coal comprises 70.4% of the total energy consumption in China in 2009 (Fig. 3) (National Bureau of Statistics of China, 2010). Because coal is the dominant energy source in China, GHG emissions and other air pollutants (e.g. SO_2, NOx, CO and particulate matter (PM)) produced by consuming fossil fuels are higher than many developed countries. For example, the generation of one kWh of electricity in China produces about 0.8 kg CO_2 (Qiu et al., 2007) which is higher than Japan (Kiko Network, 2008). Since the total energy consumption in China will continue to increase with its rapid urban growth in the following decades, reducing the energy consumption, especially the use of fossil fuels and cutting GHG and air pollutant emissions have become core national policies in order to create more sustainable development. Relevant studies carried out on China's energy conservation show that many policies and measures with the aim of reducing GHG emissions lead to a decrease in air pollution creating a co-benefit (Aunan et al., 2004). A range of energy saving policies also entail reductions in air pollution and the improvement of public heath as a co-benefit (Chen et al., 2007). This implies that climate change and air quality issues are closely linked. First and foremost, the main greenhouse gases CO_2 and the main air pollutants to a large extent stem from same sources, mainly of fossil fuels.

IPCC (2007) also clearly points out that the implementing policies of GHG emissions mitigation and energy efficiency will also have other benefits, such as reducing air pollution, achieving public heath, and improving working environment.

However, there are important differences at the temporal and spatial scales between air pollution control and climate change effects. Benefits of reducing air pollution are more certain and can be achieved quicker in the places where measures are taken while the impact of climate is a long-term and global (Swart et al., 2004; Rypdala et al., 2005). Furthermore, different focuses have been put

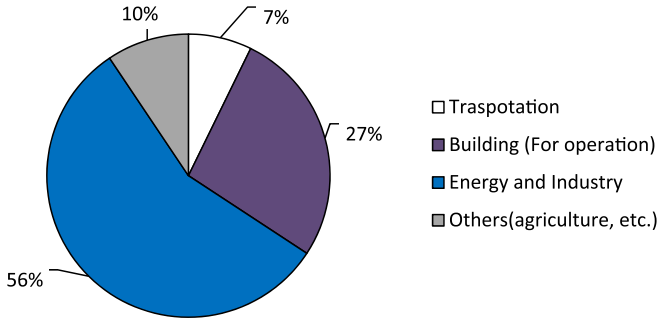

Fig. 2. Energy use in different sectors in China in 2009.

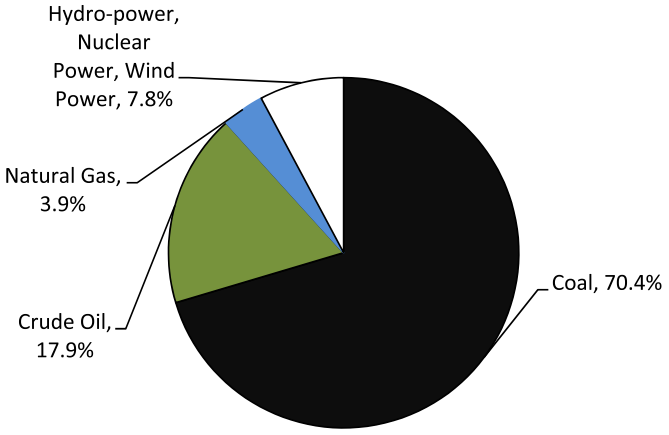

Fig. 3. The composition of total energy consumption in China in 2009.

on policies and measures of energy conservation, carbon reduction and air pollution control regarding various urban development situations and economic development levels in different places. So, the main question in this paper is how to achieve comprehensive co-benefits effectively through the approach with addressing the short and long-term goals in implementing policy measures at local and country levels in China.

2. The co-benefits approach

The "co-benefits" is a term which is increasingly being used in climate change discourse. In the field of environmental protection the term co-benefits means synergies of energy conservation and pollution reduction (reducing GHG emissions and reduce pollutants emissions). Recently, the varying use of this term in "Climate co-benefits" and "Climate and air co-impacts"(Department of Economic and Social Fares of United Nations, 2011) indicated that there are almost no agreement on assessing co-benefits with diverse methods and tools. As witnessed, different institutions and organisations have a different understanding, definition and interpretation. For instance, the co-benefits is defined by the Ministry of Environmental of Japan (MOEJ) and IPCC that co-benefits is the process of controlling GHG emissions and reducing other local emissions (e.g. SO_2, NOx, CO, and PM); on the other hand, local pollution control in the sustainable development process can also reduce or absorb CO_2 and other GHG emissions (Ministry of Environmental of Japan, 2008; IPCC, 2007). The general co-benefits definition with the context of GHG emissions mitigation, pollutants reduction, health improvement and other aspects within the scope of sustainable development can be presented in Table 1.

With the high growth of urbanization and economy, China has become the largest energy consumer in the world since 2010 (BP, 2011). And the coal dominated energy consumption lead to much higher emissions of CO_2, SO_2, NOx and PM for producing per unit of GDP than many countries. The climate in China has had many experienced and noticeable changes by increasing GHG emissions since last century (National Development and Reform Commission of China, 2007). And SO_2, CO, NOx and PM emissions made in the process of energy consumption also lead to serious regional air pollution which has huge impacts on the ecosystem and human health. The challenge of climate change, tense energy safety and unhealthy atmospheric environment make Chinese government to think the solution to these issues through a comprehensive strategy of sustainable development.