Environmental Development xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Environmental Development

journal homepage: www.elsevier.com/locate/envdev

Total emission control policy in China

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ARTICLE INFO

Keywords:
Environmental policy and management
Total emission control
China

ABSTRACT

China is facing serious environmental problems as a consequence of rapid economic growth of the past three decades. To curb increased levels of environmental pollution, China piloted a system of Total emission control (TEC) in 1988 and implemented the TEC policy nationwide in 1996, allotting emission quotas to its provincial governments with a target of 10% reduction in pollutants emissions over a five-year period since then. It was claimed that the TEC policy played a critical role in cutting annual emission of targeted pollutants and improving the quality of the environment. This report briefly discusses the scope and the effectiveness of the TEC policy and suggests that the scope should be more focused and the TEC as one of the national pollution control strategies should be carefully reviewed yet acquiring reliable and accountable pollution data has been a technical challenge.

1. Introduction

Over the past three decades, China has achieved rapid economic growth at an average annual rate of nearly 10% at the expense of serious environmental degradation, despite pollution control having been on the top of the Chinese government's agenda since the 1990s. The central government launched a clean air action plan in 2013, declared a "war on pollution" and amended its environmental protection law in 2014. National action plans on water and soil pollution were then enacted in 2015.

Total emission control (TEC) is the one of the major environmental policies China has created to control pollution. It was piloted in 1988 and extended nationwide in 1996 with a 10% reduction for the targeted pollutants over the next five-years. Since 1996, the government has set further ambitious environmental goals and established the TEC as the most important tool to combat rising pollution levels. The TEC was considered as a foundation for many environmental policies and regulations, played an important role in improving the quality of the environment and provided the possibility for market-based emission trading mechanisms (Ge et al., 2009).

It was claimed that the reduction targets of 10% were basically achieved and the TEC system played a critical role in cutting annual emission of targeted pollutants and improving the quality of China's environment (MEP of China, 2013a). By example, it was announced that the total emissions of chemical oxygen demand (COD, a measure of organic pollutants concentration in water), sulfur dioxide, ammonium-nitrogen, nitrogen oxides in 2015 were reduced by 3.1%, 5.8%, 3.6% and 10.9%, respectively relative to 2014 and 12.9%, 18.0%, 13.0% and 18.6%, respectively relative to 2010 levels, meeting the targets for air and water pollution control (MEP of China, 2016).

However, the public perceives ever-increasing air, water and soil pollution levels (Kong, 2014; Larson, 2014; Liu and Diamond, 2005, 2008; Wang, 2013b; World News Report, 2014; Zheng, 2014). Heavy smog blanketed more than 40 cities in early December

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https://doi.org/10.1016/j.envdev.2017.11.002
Received 29 March 2017; Received in revised form 14 November 2017; Accepted 15 November 2017
2211-4645/

Please cite this article as: Hu, Q., Environmental Development (2017), https://doi.org/10.1016/j.envdev.2017.11.002

2015 with a density of PM2.5 (particles smaller than 2.5 micrometers used to measure air quality) exceeding 300 μg/m^3, triggering the first "red alert", the country's highest emergency response level to severe air pollution. The average annual density of PM2.5 in China's capital city Beijing in 2015 was 80.6 μg/m^3, more than 5 times higher than the safe level of 15 μg/m^3 recommended by the World Health Organisation. Official data showed that average PM2.5 readings in Beijing in January and February this year reached 95 μg/m^3, up 69.6% from the same period last year. In early November 2016, heavy smog developed in one-tenth of the country over 7 days consecutive, with a maximum density of PM2.5 greater than 500 μg/m^3. One-fifth of the country was engulfed by polluted air for a week in mid-December 2016. Two weeks later, smog blanketed 60 northern cities, including Beijing for nine consecutive days from 30 December 2016 to 7 January 2017, triggering pollution red alerts in more than 20 cities. The average level of PM2.5 particles hit 135 μg/m^3 in the period between 15 November and 31 December 2016 in the 13 cities of the Beijing-Tianjin-Hebei region and increased by 43.8% in January 2017 when compared to the same period of 2016. Data collected from 338 cities in the first two months of this year showed that concentrations of PM2.5 rose 12.7% to 71 μg/m^3.

Overall, China's pollution has not seen a significant improvement since the implementation of TEC system. This has raised concerns regarding the effectiveness of the TEC system to control pollution (MEP of China, 2014; Xue et al., 2013). As the world's largest population and second largest economy, China has begun to take a leading role in dealing with climate change and environmental issues. China's environmental management experience (successes and failures) will be vital for emerging economies in the world.

2. Broad scope

In general, a TEC system is based on the total eco-capacity of a specific area for the targeted pollutants and requires high levels of technical expertise and financial resources to determine each pollutant capacity, which is difficult to quantify and has often been controversial for complex ecological and large-scale systems. Therefore, the TEC is generally considered as an interim and/or supplementary measure in controlling pollution (Wang et al., 2010) and is best suited to a relatively closed area (e.g. a well-defined watershed) or a particular industry with a definite number of polluters. China's environmental conditions and capacities differ significantly from area to area and it is unfeasible and impractical to identify the eco-capacities and the sources of many pollutants across such a diversified and large country. In this context, the scope of China's nationwide TEC system is too broad and lacks a scientific rationality and underpinnings from an environmental perspective (Geng and Sarkis, 2012; Ma, 2010).

3. Continuity

The TEC system lack continuity when targeting the range of pollutants, which was reduced from 12 pollutants in the period of 1996–2000 to 6 for 2001–2005 and further to 2 for 2006–2010. The 12 pollutants designed for the 1996–2000 period included soot, sulfur dioxide, industrial dust, COD, cyanide, arsenic, mercury, lead, cadmium, hexavalent chromium, oil pollutants, and industrial solid waste. However, the heavy metals (arsenic, mercury, lead, cadmium and hexavalent chromium) were removed from the list of targeted pollutants for 2001–2005 and 4 more pollutants were removed from the list for the period of 2006–2010 leaving only sulfur dioxide and COD (China's State Council, 2006). For 2011–2015, ammonium nitrogen (NH_4^+-N) and nitrogen oxides (NOx) were added.

This removal of pollutants from the list over time has led to skewed development of industries. For instance, local governments have attempted to shut down industries with high COD (e.g. pulp mills) and promote the development of low COD discharging industries e.g. mining, metallurgical and building industries. This has likely led to a rising level of heavy metals pollution since 2000. By example, the national soil pollution report released in April 2014 reveals that 82.8% of the contaminants are heavy metals and 16.1% of the country's total soil area are polluted by heavy metals among 41,938 sampling points (Ministry of Land and Resources, 2014). Water pollution remains the severest environmental problem facing China since the 1990s (Economy, 2010; Hu and Cheng, 2013; Liu and Yang, 2012; Qiu, 2011; Yu, 2011) and overall the quality of water environment has not improved. For example, of 4778 monitored sites across the country, "poor quality" ground water was found in 40.4% in 2011, 42.7% in 2012 and 43.9% in 2013. The worsening environmental pollution since 2000s was considered to be related to removing many key pollutants and leaving only two pollutants (sulfur dioxide and COD) in the pollution list (Ma, 2010).

To deal with exacerbated pollution levels in air, water and soil, China has started to take enormous remedial steps, including amending Environmental Protection Law, setting additional action plans for heavy metals, air, groundwater, surface water and land pollution since 2011 (China's State Council, 2012; MEP of China, 2011; SEPB, 2012; Yangzi Evening News Network, 2014). In spite of the determined efforts China has made to control pollution, it is important to have consistent and strong environmental policies to accomplish these action plans. It is applauded that the central government has ordered national pollution inspection since the late of last year as one of the major institutional arrangements for promoting ecological progress and protecting the environment.

4. Emission quotas

One of the major strategies for implementing the TEC system nationwide was to allocate TEC quotas to each provincial government principally on the basis of industrialisation, historical emissions data and the facilities' emissions reduction capabilities (see Fig. 1). Each provincial government then allocates the quotas to its prefectures and cities within its jurisdictions using the same criteria. It is critical for authorities to obtain accurate and reliable data on levels of pollutant emissions and determine the ecosystem's absorption capacities of the pollutants. However, methods and methodologies for accurately measuring these are, as yet, not