ELSEVIER

Energy Policy 29 (2001) 581–594

ENERGY POLICY

www.elsevier.com/locate/enpol

World bank energy projects in China: influences on environmental protection

Eric Martinot*

Stockholm Environment Institute—Boston, 11 Arlington Street, Boston, MA 02116, USA

Received 20 November 2000

Abstract

A study of the World Bank's energy-related project portfolio in China reveals several areas where World Bank assistance has clearly influenced broader trends in energy and environmental protection in China. This paper reviews the World Bank's 36 energy-related projects approved from 1984 to 1999 in the context of these broader trends. Projects helped accelerate development of large-scale efficient coal power plants, hydropower, state-of-the-art technologies for controlling power-plant emissions, and international-best-practice environmental assessments of energy projects. The World Bank has just begun to fund several promising initiatives for energy efficiency and renewable energy. At the same time, some opportunities for the Chinese government and the World Bank to jointly promote environmentally sounder energy development are only just now being addressed, such as natural gas distribution and utilization, rural energy and development, wind power, energy efficiency of heat supply and buildings, energy efficiency in industry through performance contracting, and greater support for clean energy options within ongoing electric power sector reform.

Keywords: Electric power; Air pollution; Energy efficiency; Multilateral assistance strategies

1. Introduction

China has borrowed the most money from the World Bank for energy projects of any country in the world. From 1984 to 1999, the World Bank provided about $7 billion for 36 energy-related projects, and the Global Environment Facility provided an additional $90 million in co-financing for energy efficiency and renewable energy projects.[1] How has this assistance helped China address pressing energy and environmental problems? How has it not? What have been the main influences of this assistance on environmental policies, energy technologies, and direct environmental emissions in China? To answer these questions, this paper presents a framework of 15 important strategies for reducing the environmental consequences of energy use in China, and analyzes the historical influence of World Bank assistance within each of these 15 strategies.

The findings presented here are based on a review of the World Bank's energy-related project portfolio in China carried out in 1998 and 1999 by the Operations Evaluation Department of the World Bank. The author served as a consultant for that evaluation. During that period, the author conducted interviews with approximately 80 people, including World Bank staff, Chinese government officials, utility managers, private-firm managers, project personnel, academic researchers, representatives of other donor agencies, and representatives of non-governmental organizations.[2] This paper provides a summary of the author's findings. The views expressed are strictly those of the author and do not necessarily reflect the views of the World Bank or the Chinese government.

* The research underlying this paper was conducted where the author was an Associate of the Stockholm Environment Institute—Boston. He now works for the Global Environment Facility.

E-mail address: emartinot@worldbank.org (E. Martinot).

[1] The Global Environment Facility has also provided $38 million in grants for energy efficiency and renewable energy projects in China through the United Nations Development Program. See Martinot and McDoom (2000).

[2] Chinese interviews took place in six cities (Beijing, Chengdu, Shanghai, Hangzhou, Wuxi, and Yantai) during September 1999.

0301-4215/01/$ - see front matter
PII: S0301-4215(00)00152-X

2. Energy and environment in China

China has had double-digit rates of economic growth for much of the past two decades. This growth has had huge implications for energy consumption and environmental impacts. For example, with growing income and affluence, urban households are dramatically increasing their material consumption — and demand for energy (Ikels, 1996). The total stock of refrigerators went from 4 million in 1985 to 60 million in 1996 and refrigerators now account for half of residential energy consumption. Energy consumption in the residential sector grew by 16 percent annually on average from 1980 to 1994 (UNDP, 1997). Air conditioners are now becoming ubiquitous in urban areas as well. Private automobile ownership, at one time illegal, grew to 4 million in 1996 and is now rising by an estimated one million cars annually (Walsh, 2000; World Bank, 1998b). The environmental consequences of this economic growth are staggering, as accelerating air and water pollution threaten public health, damage ecosystems, and add to global climate change (Bardeen, 1995; Ryan and Flavin, 1995; Kam, 1996; Byrne *et al*., 1996; Smil, 1997; World Bank, 1997c; Lin, 1998).

Even so, China has been praised by many for expanding its economy while restraining the growth of energy consumption. While the economy grew by an average rate of 12 percent/year from 1980 to 1995, primary energy consumption only grew by an average of about 4 percent/year during the same period — an unprecedented situation for a developing country. Energy consumption in 1995 would have been 2.2 times greater had the economy consumed energy at the same intensity in 1995 as it did in 1977, according to Sinton and Levine (1998).[3] This situation has been attributed to policies directed at energy efficiency, particularly reductions in industrial sectoral intensities (Levine *et al*., 1992; Yang *et al*., 1994; Zhang, 1995; World Bank, 1997a; Sinton and Levine, 1998). It has also resulted from a concerted drive away from central planning and towards a market economy, which has raised energy prices (often within a two-tier system of co-existing "state prices" and "market prices") and forced enterprises to begin to think about profitability and cost-minimization like never before (Hamburger, 1995; Cao *et al*., 1997; Morita and Zaiki, 1998).

Energy efficiency in industry and power production remain the highest priority in continuing to reduce the energy intensity of the economy, although energy efficiency in the residential and transport sectors becomes more important with each passing year. In 1995, industry accounted for 75 percent of electricity use, agriculture for 6 percent, residential consumers for 10 percent, municipal and commercial consumers for 7 percent, and transport and communications for 2 percent (World Bank, 1997a).

Many have looked at China's large dependence on coal — coal provides 75 percent of China's total primary energy consumption — and proposed alternative energy solutions that would be more environmentally sound (Lenssen, 1993; Johnson, 1995; Wu and Li, 1995; China State Council, 1996; Martinot *et al*., 1997; Chandler *et al*., 1998; Logan and Zhang, 1998). Indeed, other energy forms are entering the picture, including oil, natural gas, wind power and other renewable energy sources. Still, coal remains among the cheapest forms of energy in most parts of China. Coal prices have historically been distorted due to explicit and implicit subsidies for coal mining and rail transport of coal — but price increases in conjunction with the transition away from central planning and towards a market economy have begun to alter the picture (Yang *et al*., 1994; Cao *et al*., 1997).

The power sector in China has featured prominently in China's modernization drive over the past two decades, and China has become the second largest producer of electricity in the world. Electric power production increased by an average of 8 percent/year from 1980 to 1995 (World Bank, 1998b).[4] Three-quarters of that production comes from burning coal. Older coal plants (especially pre-1990) often use coal relatively high in sulfur content and lack end-of-pipe pollution abatement equipment. The remaining 25 percent of power comes from hydropower, with continuing efforts are underway to develop hydropower — most notably now with the massive and controversial Three Gorges project (Chau, 1995; Chinese Academy of Sciences, 1995; Lu, 1996). The need for investment in the power sector has consumed Chinese officials' priorities, and they have turned to foreign sources, including foreign multinational firms and multilateral assistance agencies like the World Bank (Blackman and Wu, 1998; Murray *et al*., 1999; World Bank, 2000).[5]

[3] Sinton and Levine (1998) note that contrary to many claims, decreases in sectoral energy intensities (energy per unit of economic output in a specific sector) were much more important than structural change (shifts in the sectoral shares of total output) in the decline in overall energy intensity (energy per unit of GDP).

[4] This rapid growth rate has faltered in the late 1990s. In 1998, electric power production growth was reportedly only 2.6 percent (World Bank, 2000).

[5] The decrease in electric power demand growth in 1998–2000 has led to a drop in coal use during this period.