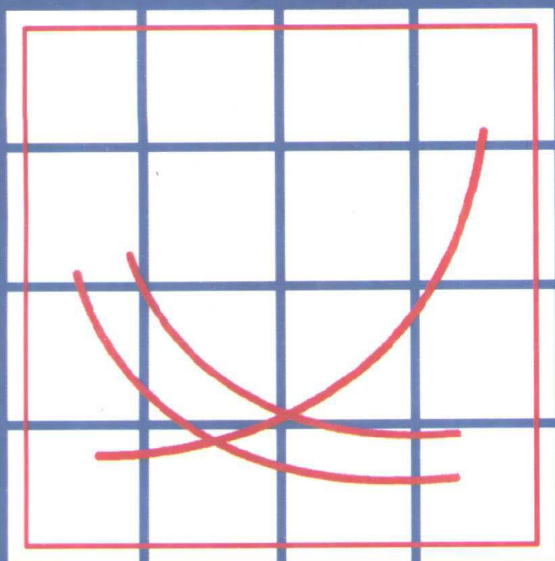


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能源 - 环境的 经济分析与政策研究

朱 达 著



中国环境科学出版社

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能源—环境的经济分析 与政策研究

Economic Analysis and Policy
Study on Energy-Environment

朱 达 著

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序

能源环境问题是国际社会普遍关注的热门话题。随着经济的快速发展，能源需求不断增加，但是，能源消费带来的环境问题也日益严重。所以，能源环境问题的实质是经济、能源、环境三者相互关系问题，也是我国经济发展过程中正面临的巨大挑战。世纪之交，很高兴看到越来越多的中国学者开始关注这一领域，并取得了可喜的成果。

此书是作者在其博士论文的基础上修改而成，看得出作者对能源环境问题进行了大量的研究和思考，提出了一些有新意、有实践意义的观点。同中国传统的能源环境研究相比，该研究成果的主要特点是：其一，作者用经济学理论，计量经济学方法构建了中国能源需求模型，对中国能源需求关系进行了解释，其结果令人信服；其二，作者分析了中国能源消费过程中的二氧化硫和二氧化碳排放，分析了环境政策与能源结构、经济增长的相互作用关系。

中国正处在由传统的计划经济体制向社会主义市场经济体制过渡的转型时期，制度变革和结构调整是现阶段的重要经济特征。如何走一条适合中国国情的可持续发展之路？如何正确看待环境与经济的相互关系？如何通过政策优化选择有利于环境的能源结构 and 经济结构？专著提出了许多有益的启示。

该书翔实的资料来源，充实的数据分析以及严谨的写作风格给我留下了深刻的印象。我相信，这一专著的出版将吸引更多的

人关注环境、能源和经济政策问题，并有利于我国能源环境问题研究的更深入发展。

鲁明中

1999年11月于中国人民大学

ABSTRACT

Why Choose This Topic

China is facing serious energy-environmental problems. On one hand, it has a large population and insufficient energy resources. With the rapid economic growth and continuous increase of people's living standard, energy demand is growing. Insufficient energy supply, especially the shortage of high-quality and clean energy, has become a bottleneck of China's economic growth. On the other hand, energy consumption has brought about tremendous environmental impact. Coal dominates China's energy structure, accounting for about 75% of the country's aggregate energy consumption. Coal fuel emits large amounts of pollutants such as sulphur dioxide and soot in its life cycle, resulting in a unique coal-burning type of air pollution in China and acid rain pollution which has spread to one fourth of the country's territory. This has caused huge economic losses and has harmed people's health.

Energy-environmental problems have aroused attention from the international community. The outbreak of oil crisis in the 1970s triggered world-wide panic. Although energy crisis has never happened again, environmental impact by energy consumption, espe-

cially global warming caused by carbon dioxide emission during the consumption process of fossil fuels, is worsening. The world is worried about the impact, which threatens human existence. In 1992, the United Nations Framework Convention on Climate Change opened for signatures. According to the Convention, carbon emission by developed countries should be kept at their levels in the year 1990 by 2000. There had been 165 signatory parties by the end of 1996.

China is a developing country. Energy demand will increase continuously and environmental condition will keep deteriorating if the existing development models are followed. Even if energy resources have not exhausted, environmental capacity will reach its limit and the ecological system on which the human kind relies for existence will collapse. In fact, omens for such a scene have appeared in some Chinese cities and regions.

Now China's sulphur dioxide emission is world No. 1 and carbon dioxide emission world No. 2 (following the United States). According to the National Ninth Five-Year plan for Environmental protection and the policy of Total Amount Control of pollutant Discharge, China's sulphur dioxide emission will be kept at the level of 1995 by 2000. Although China is not obliged to control carbon dioxide emission now, it has to make preparations for cutting down its huge carbon dioxide emission.

What are the relations among energy, environment and economy, and how do they interact? What does economic growth demand for energy, what pollution emission does energy consumption cause, and how can environmental policies constrain economic growth and energy demand? How to solve today's energy-environmental prob-

lems in China? This thesis is intended to answer such questions.

Research Methods

This thesis, first of all, establishes a model reflecting the relations among energy, environment and economy - the environment-energy-economy system. Then analysis of economic relations among environment, energy and economy is given, followed by analysis on the system and policy layers. Research methods used here are a combination of normative economics and positive economics.

In economic analysis, functions of the environment are classified into three types, namely supply of resources, absorption of wastes and offer of comfort. An analysis triangle is formed, based on the two functions of supply of resources and absorption of wastes that are more important ones displayed in the environment-energy-economy system.

The economic analysis can be divided into two parts. One is environment→energy→economy. Energy is mined out of the environment and is put into economic activities, becoming power for economic growth. Here environment is the supplier of energy resources. Given the exhaustion possibility of energy resources, environment resources should be allocated over an even longer period of time to ensure sustainable development. The other is energy→economy→environment. Energy is put into economic activities and then gives out pollutants, exerting pressure on the environment. The pressure on the environment brings about changes in relations between economy and energy. This thesis explains the relationship between energy and economy as commodities' demand and supply relationship on the

energy market. Given the description of the overall environmental impact of energy consumption, sulfur dioxide and carbon dioxide emissions are calculated and forecast.

Policy study on energy-environment is made on the four layers of substance flow analysis, value flow analysis, system analysis and policy analysis. Subjects of the analyses on the four layers are all environment, energy and economy, however, their emphases and contents are different. Analyses on the four layers are correlated and go deeper and deeper.

Main Contents

Looking at the overall structure of this dissertation, Chapter 1 Introduction covers basic concepts used in this thesis, background of energy-environment, and goals, significance and contents of this thesis. Chapter 2 establishes the framework for theoretical research. Chapter 3-7 are economic analysis. Chapter 3 concentrates on energy resources, dealing with the relationship of environment→energy; Chapter 4 and 5 are about energy demand models, dealing with the relationship of energy→economy; Chapter 6 and 7 discuss environmental impact of energy consumption, dealing with the relationship of energy→economy→environment. Chapter 8 and 9 are system analysis and policy analysis respectively.

Chapter 2 The Environment-Energy-Economy System is the fundamental framework of the whole study. In this chapter, the concept of sustainable development is introduced, functions of the environment are classified and essence of environmental problems is analyzed. Under the guidance of the thought of sustainable develop-

ment, this thesis expands the economic system in traditional economics to environment-economy system, and separates environment-energy-economy system from the environment-economy system. Based on analysis of relations among substances, energies and economy within the environment-energy-economy system, research concentration of the economic analysis and policy study on energy-environment is determined. Roles of other chapters in the research concentration are also explained.

Chapter 3 Energy Resources provides economic analysis of optimal exhaustion of fossil fuels—irrenewable and exhaustible resources, which are the main energies consumed in China. It also discusses how to develop new energy to substitute fossil fuels.

Chapter 4 Theoretical Foundation for Energy Demand summarizes major energy demand theories in economics and the latest research results in energy demand models.

Chapter 5 Energy Demand Model establishes a China energy demand model based on market demand and supply. First of all, China's economic development process is divided into two periods, the planned economy period before the reform and opening-up policies were adopted (before 1978) and the transitional market economy period after the reform and opening-up policies were adopted (after 1978). Then a China energy demand model for the transitional market economy period is established based on energy and economic data during 1980-1996. The results indicate that the energy demand model explains quite well China's energy demand.

Chapter 6, Environmental Impact of Energy Consumption: Analysis of Substance Flow and Value Flow, examines environmental impact during the whole process of production, transportation,

transformation and final consumption of energy from the perspectives of substance flow and value flow. It compares pollution contributions of fuels in their life cycles, and investigates China's energy-environmental problems and pollution cost of energy consumption.

Chapter 7, Environmental Impact of Energy Consumption: Econometric Analysis of Pollution Emission, uses econometric analysis methods and concludes that coalburning is the main cause of China's sulphur dioxide emission. It also forecasts China's energy demands during 2000-2040 under hypothesized economic growth rates by use of the energy demand model elaborated in Chapter 5. With these data and corresponding pollutant emission coefficients, sulphur dioxide and carbon dioxide emissions and pollution cost of carbon dioxide emission are calculated and forecast. The Chinese Government has made out many environmental policies targeting at pollutant emissions. Chapter 7 takes the policy of total amount control of pollutant discharge as an example to analyze the constraining effect on coal consumption by environmental policies, and necessary adjustments in economic growth rates and energy structure for the purpose of sulphur dioxide emission control.

Chapter 8 Market and Government discusses the main characteristics and defects of the market and government in the energy-environment field from the perspective of system. In particular, it features China's energy-environment administration system after the reform of government institutions in 1998. System is another layer in energy-environment study and is part of policy analysis.

Chapter 9 Policy Study on Energy-Environment looks at the unsustainability of the traditional energy development strategies. It explains the targets and connotation of energy-environmental policies

and analyzes some of the main energy-environmental policies. Finally, it puts forward suggestions on how to solve China's energy-environmental problems.

Main Results

(1) The thesis establishes an environment-energy-economy system.

(2) China's economic development process is divided into two periods, the planned economy period before the reform and opening-up policies were adopted (before 1978) and the *transitional market economy* period after the reform and opening-up policies were adopted (after 1978). The thesis establishes a China energy demand model for the transitional market economy period with market supply and demand as the theoretical basis.

(3) Energy demand functions for coal, oil and electric power for the transitional market economy period are established. The basic form of the energy demand functions is:

$$E_t = f(I_t, P_t, E_{t-1})$$

E_t : energy demand during the t period or the current period, tce; I_t : income during the t period or the current period, in this thesis it is represented by current GDP calculated at real prices in 1987; P_t : energy prices during period t or the current period; E_{t-1} : energy demand during $t-1$ period or previous period, tce.

(4) Environmental impact and economic losses caused by China's energy consumption are analyzed.

(5) The thesis calculates and forecasts China's energy demand, emission of sulphur dioxide and carbon dioxide, and pollution losses

of carbon dioxide during the period of 1995-2040.

(6) The thesis takes the example of the three environmental policies - total amount control of pollutant discharge, sulphur dioxide and acid rain control areas and charges for sulphur dioxide emission - to analyze the impact on economic growth and energy structure by environmental policies.

(7) The thesis analyzes China's energy-environmental policies and puts suggestions.

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