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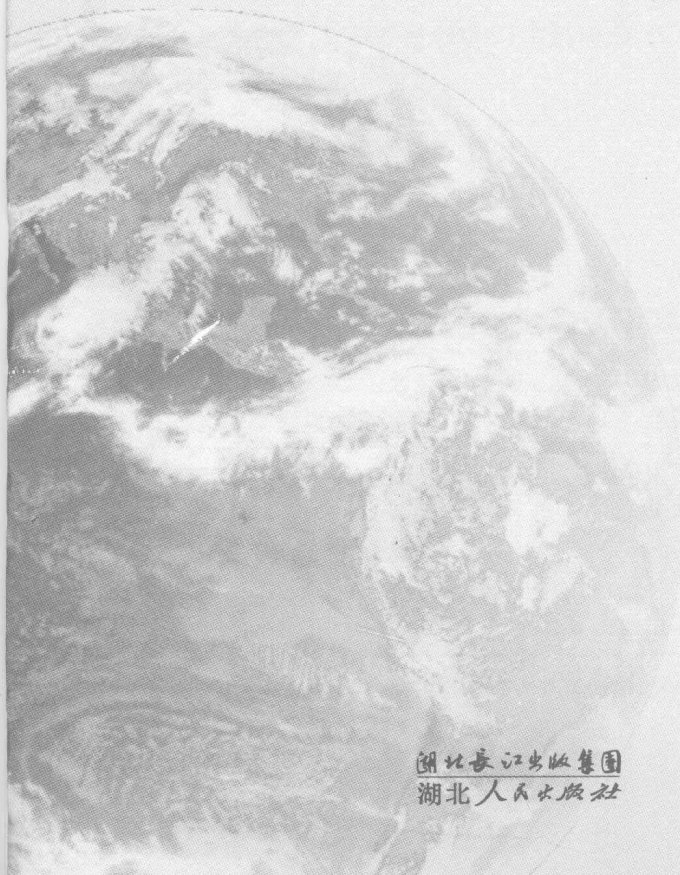
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摘 要

随着工业化和城市化进程的加快，非可再生能源可持续利用问题已经成为制约中国社会经济持续发展的瓶颈。为保证国民经济持续健康发展，必须对中国能源尤其是非可再生能源的发展现状和趋势进行科学的认识，依据国家经济可持续发展的战略需要，对中国非可再生能源可持续利用问题进行研究，以确保中国资源节约、环境友好、社会和谐发展局面的形成和国民经济发展可持续发展战略目标的顺利实现。

在国家和区域视角下，本书在经济、能源、技术与环境发展的总体框架下，建立了一个综合性的非可再生能源战略评价模型，并运用这一模型，对中国非可再生能源可持续利用中最为关键的能源供给能力、生产效率和环境影响问题进行了实证研究，探讨了政府促进非可再生能源可持续利用的对策，这将对进一步完善国家非可再生能源开发利用的各项政策、促进国家能源安全产生积极的影响。

本书首先总结了非可再生能源战略评价的理论基础。尽管在早期的新古典经济学家的视野内，能源在生产中占有的地位并不突出，并把它看作一个是由资本、劳动和土地这些主要的生产要素所产生的一个中间变量，能源要素基本上也未纳入到主流经济增长理论框架之内，但是，“石油危机”给各国政府和经济学家的研究带来了巨大的冲击。此后，自然资源尤其是能源资源在经济增长中的地位、作用和波及效应不断引起了各国政府和经济学

家的关注。自然资源空心化和资源环境约束下的内生经济增长理论揭示了片面追求经济产值和经济增长速度,而不顾能源资源过度开发和因此造成的资源浪费和破坏,最终导致自然资源的不断衰竭的基本规律;自然资源的代际转移与最优配置理论也充分表明,要实现持续发展的社会最优目标,能源资源的管理将更多侧重于可持续性的保护;侯太龄定律与非可再生能源最适耗竭理论表明,技术进步,尤其是采选技术和冶炼技术的提高将在一定时期内显著影响非可再生能源的生产成本,使能源资源开采的边际成本持续下降,促进非可再生能源的持续利用,保障能源、经济与社会协调和全面发展。为了阐述非可再生能源在国民经济中的重要性,本书还对非可再生能源供给中断的经济影响以及能源安全对社会经济发展的贡献进行了讨论。能源生产厂商通过其价格行为和产出水平的调整,使社会福利水平和社会产品的总需求不断弱化,经济与社会的稳定持续发展面临了来自于产品供给不足的风险。能源的有效供给和可持续利用,成为了能源安全和经济安全的基本内涵和要求。能源安全是要满足国家生存与发展正常需求的能源供应稳定和使用安全,它包含了能源生产和运输领域的满足国家人口发展正常需求的能源供应的保障程度以及能源消费和环境保护领域的能源使用的安全性,即能源消费不对人类自身的生存与发展环境构成任何威胁。能源供应安全为国家创造了巨大的经济价值,能源供应安全产生了较高的经济联动效应,对社会福利水平的改进产生深刻的影响。

非可再生能源战略评价的主要内涵在于,识别和评价非可再生能源发展中社会、经济技术、环境等宏观因素对非可再生能源战略目标和战略选择的影响,将非可再生能源开发利用与经济、环境、社会发展密切联系起来,强调非可再生能源政策实施后产生的资源环境效果及其社会经济含义,不仅从经济和技术角度衡量非可再生能源开发利用或有关政策的可行性、合理性,而且还

考虑其资源环境影响,寻求社会、经济、能源、环境的协调发展。本书第三章重点介绍了非可再生能源战略评价的内涵。从非可再生能源可持续利用的基本内涵和实施条件来看,非可再生能源战略评价系统主要应该包含供给能力(如能源生产能力、储量条件、进口水平)、生产效率(消费总量、经济产出、能源效率)、环境影响(污染物存量、结构分布、福利损失)评价等多项评价子系统。非可再生能源战略评价具有系统性、层次性、动态性的基本特征。根据系统原理和非可再生能源战略评价的基本内涵,需要将还原论与整体论相结合、定性判断与定量计算相结合以及微观分析与宏观分析相结合,并合理有效地运用系统分析方法展开研究。

随着中国经济的不断增长,中国能源消费总量表现为不断增长的趋势,能源消费结构也逐渐由单一化向多元化演变。为了揭示中国非可再生能源开发利用的现状特征,本书第四章通过对中国非可再生能源的供应和消费状况的描述,发掘了中国非可再生能源开发利用中存在的一些突出的问题:随着中国非可再生能源供给需求总量矛盾的缓和,能源生产与消费的结构性矛盾已经成为当前中国能源发展的主要矛盾。不合理的非可再生能源生产和消费结构,已经成为中国经济社会持续快速健康发展的重要因素之一。石油资源的相对缺乏以及由此导致的石油进口对外依存度的提高,将对中国石油和非可再生能源供给甚至经济社会的发展产生越来越重大的影响和冲击;从能源经济系统的运行效率来看,中国的能源强度跃居世界前列,且中国的能源工业技术水平低下,劳动生产率较低,技术装备和开采方法落后,回采率低下,资源严重浪费,中国的能源利用水平明显低于发达国家;非可再生能源消费导致了严重的环境污染,在大气污染中,二氧化硫排放量呈现小幅度上升的趋势,而大气中的烟尘和粉尘排放量却保持在一个相对较高的平稳状态,中国的大气污染形势依然

严峻。另外，对于世界人均水平而言中国人均非可再生能源消费量还处于一个较低水平。

根据能源供给的基本内涵，本书第五章从中国能源供给的生产能力、市场条件、贸易状况、消费水平四个方面建立指标体系，采用因子分析方法对中国以石油、煤炭、天然气为主体的非可再生能源供给能力进行了实证研究。通过对中国非可再生能源供给能力的评价发现，影响中国非可再生能源供给能力的主要因素为生产技术因素、生产效率因素、产量增长因素、经济增长因素。为了提高中国非可再生能源的供给能力，确保中国经济社会发展所需的能源稳定供给，关于中国非可再生能源的开发利用，国家和能源管理部门需要继续重视非可再生能源生产领域的技术进步，大力促进非可再生能源产量的持续增长，调整和优化能源结构，提高社会经济系统的运行效率。

能源生产效率问题是非可再生能源可持续利用的关键性问题之一。本书第六章利用数据包络分析方法对 1990—2006 年间中国非可再生能源生产力的总体水平进行测算，从整体上把握了中国非可再生能源生产力指数及能源效率变化的基本趋势，并对 2001—2006 年中国 30 个省市区非可再生能源生产的规模效率、技术效率、技术进步及曼奎斯特生产力指数进行测算与分解分析，在此基础上对中国非可再生能源生产效率的区域特征进行了评价，分析中国非可再生能源生产效率变化的基本规律。研究发现，中国非可再生能源的生产效率总体上呈现不断提高的趋势，中国非可再生能源的生产利用处于良性发展的轨迹上。但是，在国家非可再生能源整体生产效率得到提高的同时，部分省区的非可再生能源生产利用还存在规模不经济问题，其原因在于这些省份非可再生能源生产的技术效率不足，即各种能源要素在现有技术条件下没有充分得以利用。要解决中国非可再生能源的供给与消费矛盾以及由此所形成的制约社会经济持续发展的瓶颈，必须

从非可再生能源生产的技术效率和技术进步上加以改进。继续完善国家的能源节约机制,大力推广利用先进的生产和节能技术,结合非可再生能源生产利用的区域特征,合理选择区域能源投入,加强非可再生能源生产效率的管理,提高区域非可再生能源生产效率,将成为进一步提高中国非可再生能源生产效率的有效途径。

非可再生能源的开发利用严重地污染了自然环境。本书第七章从中国非可再生能源开发利用的大气环境影响、开发利用的环境成本、主要工业部门污染物排放趋势和区域能源环境污染等角度,对中国非可再生能源开发利用之后所产生的环境污染问题进行评价,探讨了中国非可再生能源发展对环境变化的作用规律。研究显示,就每一种类能源消费的大气环境污染而言,煤炭消费量的增加是导致中国 SO_2 、 CO_2 排放和烟尘排放量增加的主要原因。中国以煤为主的非可再生能源开发利用结构对大气环境的影响主要表现在能源污染的直接经济损失、大气污染和由此导致的酸雨污染及社会公众的健康损失上。随着中国工业化、城市化进程的加快,未来中国的大气环境污染将表现为向行业集中、城市集中和区域集中的趋势。调整能源结构,促进能源消费结构的“绿色化”,加强能源消费的健康风险识别,全面实施污染物综合消减,运用市场化手段,促进能源消费环境成本的内部化,已经并将继续成为中国进一步改善环境质量与公众健康状况的现实途径。

本书的第八章在对全书的研究内容和基本观点进行总结的基础上,对今后的研究进行了展望。首先,对非可再生能源发展问题进行战略评价,不仅需要突破传统能源评价过于针对微观问题的局限,而且也需要运用更加开阔的视野将非可再生能源发展的众多经济社会影响问题如政策效果、人文发展、能源替代效应等等纳入到研究范围之内,使战略评价的内容更加丰富和充实,进

而能够较为科学具体地对非可再生能源发展引起的经济社会发展效应进行判断,从而促进国家非可再生能源战略制定和实施的科学化。同时,在对非可再生能源进行战略评价的时候,需要将各个经济子系统的运行状态作为约束条件纳入到分析框架之中,在同时考虑这些系统约束的情况下,展开针对各个子系统和非可再生能源之间相互关系的模拟和预测,这为决策者制定的能源长期战略规划和提供的政策信息支持将更加具备科学性和指导性。另外,对于一个国家而言,尤其是对幅员辽阔的中国而言,在不同的工业化和城市化背景之内的不同区域,非可再生能源与经济社会发展的矛盾关系也不尽相同。比如,在能源资源丰裕、经济社会发展缓慢的西部地区和能源资源贫乏、经济社会发展迅速的东部地区,非可再生能源的开发利用问题将呈现明显的不同,由此导致的能源供给、生产效率和环境影响也不尽相同。因此,以不同的经济区域为研究对象,把研究视野投入到中观层面,对区域非可再生能源发展进行战略评价,探讨非可再生能源开发利用与区域经济社会可持续发展的基本规律,将是一个更加具有针对性和指导性的研究内容。

ABSTRACT

With the accelerative process of industrialization and urbanization, the non – regeneration energy sources has become bottlenecks restricting the sustainable development of China's social and economics. To ensure the sustained and healthy development of national economy, we have to get a scientific understanding about China's energy development especially non – regeneration energy development status and trends, and according to the state's economics sustainable development strategic needs to research the problems coming from the sustainable utilization of China's non – regeneration energy. All these can ensure the national economics sustainable development strategy objectives be realized smoothly and the formation of the situation in which the resources can be conserved, environment be protected, and the society development be harmonious.

From the national and regional perspective, in the overall framework of economics, energy, environment, technology development, this book established a comprehensive non – regeneration energy strategy assessment model, and use this model, the paper put up empirical research about the most critical problems such as supply capacity, production efficiency and environmental impact of China's non – regeneration energy sustainable use, discussed the countermeasure to promote non – regeneration sustainable use for government. This will

further improve various policies of China's non - regeneration energy development and utilization and engender positive impact to China's energy security.

This book summarizes the theoretical basis of non - regeneration energy strategy assessment firstly. Although energies did not take up prominent status in production and they were seen as an intermediate variables generated by the major production elements such as capital, labor and land in the perspective of neoclassicism economist, and energy elements were not included in the mainstream economic growth theory framework basically, " Oil crisis" has brought tremendous impact to all governments and economists. Since then, the status, role and effect of natural resources, particularly energy resources in the economic growth have aroused the concern of the Government and economists. The Hollowness of natural resources and the endogenous economic growth theory under the environment and resources restraints revealed the basic rule that one - sidedly pursuit of economic output and the economic growth rate but disregard of the resulting waste of resources and destruction from over - exploitation of energy resources would eventually lead to the exhaust of natural resources. The inter - generational transfer and optimal allocation theory of natural resources fully showed that in order to achieve social objectives of optimal sustainable development, the management of energy resources will be more focused on the sustainability of protection. Hotel ling's rule and the optimal exhaust theory of non - regeneration energy indicate that technological progress, particularly mining technology and the improvement of smelting technology in a certain period of time would produce a significant impact on non - regeneration energy production costs and sostenuto drop the marginal costs in energy resources exploi-

tation. These will promote the sustainable use of non – regeneration and guarantee the coordination and comprehensive development of energy, economic and social security. For the sake of describing the importance of non – regeneration energy in of the national economy, this book also discussed the economic impact of energy supply disruptions and the contribution of energy security to the socio – economic development about non – regeneration energy. Energy manufacturers can make the needs of social welfare and social total products weakening by prices acts and the adjustment of output levels, Economic and social sustainable stability developments are facing the risk from inadequate energy products supply. The effective supply and sustainable use of energy has become the basic content and requirements for energy security and economic security. Energy security include stability supply which will meet the national demand for survival and normal development and the utilization safety which includes the Security to meet the needs of the energy supply for national population development in fields of transport and energy production and the energy utilization security of energy consumption and environmental protection. Energy supply security for the country has immense economic value, energy supply security has generated high economic linkage effects what will produce a profound impact on the level of social welfare improvements.

The connotation of the non – regeneration energy assessment is identifying and evaluating the impact from social, economic and technological, environmental, and other macroeconomic factors to non – regeneration energy strategic objectives and the strategic choice during the non – regeneration energy development, closely linking the economic development, the environment, social development and non –

regeneration energy utilization, emphasizing the resources, and environmental and socio-economic effects and their meaning after the implementation of non-regeneration energy policies, weighing the feasibility and rationality of non-regeneration energy development and utilization policy not only from the economic and technical view, but also considering the resources or environmental impact, and seeking the harmony development for the society, economy, energy, and environment. Chapter III of this book focuses on the connotations of non-regeneration energy strategy assessment. The non-regeneration energy strategy assessment system mainly includes supply capacity evaluation such as energy production capacity, reserves condition and the level of imports, production efficiency evaluation such as total consumption, economic output and energy efficiency, environmental impact evaluation such as pollutants stock, pollutants structure and the welfare losses and some other evaluation subsystem from the basic content and implementation of conditions of non-regeneration energy. The non-regeneration energy strategy assessment system has some systematic, layered, and dynamic basic characteristics. According to system principle and the basic connotations of non-regeneration energy strategy assessment, we need to combine the system theory, qualitative and quantitative calculation, microscopic analysis and macroeconomic analysis. Take system analysis methods rationally and effectively to research non-regeneration energy strategy assessment problems.

With the continuous growth of China's economy, China's total energy consumption is also growing continuously and the energy consumption structure is also evolving to multiplex from single gradually. In order to reveal the status and characteristics of China's non-regeneration energy development and utilization, Chapter IV of this book

explored some of the outstanding problems about China's non - regeneration energy development and utilization by describing the supply and consumption situation of China's non - regeneration energy: With the relaxation of contradictions between aggregate supplies demands of China's non - regeneration energy, the contradictions of structural from energy supply and consumption has become the main contradictions. The unreasonable non - regeneration energy production and consumption structure became one of the important influence factors to China's sustained rapid and healthy economy and society development. The relative lack of oil resources and the resulting dependence on foreign oil imports increase will bring a huge impact to China's petroleum and non - regeneration energy supply even economic and social development. For the operation efficiency of China's energy economic system, China's energy intensity rise to the forefront in the world, and the level of energy industrial technology and labor productivity of China's is low. And what's more, the technical equipment and exploitation method got behind and the resources waste seriously. China's energy utilization was significantly lower than the level of developed countries. China's non - regeneration energy consumption caused serious environmental pollution, in the atmosphere pollution, the emission of SO_2 showed a small upward trend, but smoke and dust emissions are maintained at a relatively high steady state. China's air pollution situation is still grim. Another, In terms of per energy consumption level in the world, China's consumption of non - regeneration energy is still in a lower level.

According to the basic content of energy supply, chapter V of this book established a indexes system from the production capacity energy supply, market conditions, trade situation and the level of con-

sumption of China's, and took empirical researched on the China's non - regeneration energy supply capacity by using factor analysis method. Through the evaluation of China's non - regeneration energy supply capacity found that the main factors which affect China's non - regeneration energy supply capacity are production technology, production efficiency, output growth and economic growth factors. In order to improve China's non - regeneration energy supply capacity, and ensure the energy steady supply which is necessary for China's economy and society development, the country and the energy management sectors should continually attach importance to the technological progress in non - regeneration energy production areas, vigorously promote the continued growth of non - generation energy production, adjust and optimize the energy structure, improve the operating efficiency of socio - economic system.

Energy efficiency is one of the most important problems for the sustainable utilization of non - regeneration energy. Chapter VI of this book measured the total productivity level of China's non - regeneration energy from 1990 to 2006 by using data envelopment analysis (DEA) and grasped the changing trend about the productivity index and the energy efficiency of China's non - regeneration energy. After then, the author measured the scale efficiency, technology efficiency and Malmquist productivity index on the data from 2001 to 2005 of the 30 Chinese provinces by adopting DEA what indicated the regional characteristics and the basic rule of China's non - regeneration energy. The research result revealed that the productivity efficiency of China's non - regeneration energy displays a slow growing state, which attribute to the rising from technology efficiency, scale efficiency and Malmquist productivity index. The utilization of China's non - regener-