

2011

CHINA ENERGY CONSERVATION  
AND EMISSION REDUCTION DEVELOPMENT REPORT

# 中国节能减排发展报告

从“十一五”到“十二五”

中国工业节能与清洁生产协会 ● 编  
中国节能环保集团公司



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# 前 言

《2011 中国节能减排发展报告》是我们对中国节能减排整体状况进行观察、描绘、分析的第三本年度报告，该报告将继续秉承“内容详实、资料丰富、数据准确、观点鲜明”的指导思想对节能减排工作进行持续跟踪，为产业界、政府部门、投资界、学术界的决策者、研究者以及实践者提供全面、权威、客观、多元的参考意见。

“十一五”时期，我国节能减排取得显著成效。全国单位国内生产总值能耗降低 19.1%，二氧化硫、化学需氧量排放总量分别下降 14.29% 和 12.45%，基本实现了“十一五”规划纲要确定的约束性目标，扭转了“十五”后期单位国内生产总值能耗和主要污染物排放总量大幅上升的趋势，为保持经济平稳较快发展提供了有力支撑，为应对全球气候变化作出了重要贡献。

“十二五”时期，我国节能减排形势仍然十分严峻，任务十分艰巨。特别是我国节能减排工作还存在责任落实不到位、推进难度增大、激励约束机制不健全、基础工作薄弱、能力建设滞后、监管不力等问题。这种状况如不及时改变，不但“十二五”节能减排目标难以实现，还将严重影响经济结构调整和经济发展方式转变。为此，国务院总理温家宝在部署“十二五”节能减排工作时强调，要把节能减排作为促进科学发展的“硬任务”，转变经济发展方式的“硬举措”，考核各级干部的“硬指标”。

站在“十二五”开端这一时间节点之上，《2011 中国节能减排发展报告》基于全球气候、能源、经济及政治大背景，真实记录国家总体、各地区、重点耗能行业节能减排目标完成情况，以及节能环保、新能源等战略新兴产业的发展，深入分析国际国内环境保护、节能减排政策及产业发展趋势，介绍关于节能减排的不同观点，为我国“十二五”期间开展节能减排工作提供判断、预测和展望，为中国节能减排事业发展作出贡献。

我们希望把《中国节能减排发展报告》塑造成高水平、高质量的中国节能减排发展蓝皮书，为节能减排事业奉献绵薄之力。为使以后的工作做得更好，希望您提出宝贵的批评和建议，也期待更多的专家给予斧正。

主编：王小康

2011 年 11 月

## Introduction of the *Report*

*China Energy Conservation and Emission Reduction Development Report* (hereafter referred to as the “*Report*”) is a major annual blue paper developed by experts and scholars in the relevant field, organized by China Industry Energy Conservation and Clean Production Association and China Energy Conservation and Emission Reduction Group. The paper aims at an in – depth research into and analysis of the energy conservation and emission reduction sector in China and presents the status quo and development trend for this sector in the area of policy, market, technology, investment opportunities, etc. In a word, the *Report* is a systematic document about the sector in discussion.

The *Report* has received support from a lot of senior officials. General counsels to the writing process include such figures as Li Yizhong, Former Minister of Industry and Information Technology, Xie Zhenhua, Deputy Director of the National Development and Reform Commission, and Wang Guangtao, Chairman of the Environment and Resource Protection Committee in the 11<sup>th</sup> National People’s Congress. Names on the Editorial Board for the *Report* are Zhou Jian, Minister of Environmental Protection, Zhai Ligong, Chairman of the Supervising Committee for Major Enterprises, the State Council, and Wang Xiaokang, President of CECEP and Head of China Industry Energy Conservation and Clean Production Association. In addition to the support from officials, the *Report* has enjoyed support and help from numerous government agencies, industry associations and research institutions, such as National Development and Reform Commission, State Assets Administration Committee, Ministry of Industry and Information Technology, China National Coal Association, China Electricity Council, China Academy of Building Research, China Energy Conservation Association, Petroleum and Chemical Planning Institute, Institute of Metallurgy Planning, China Non-ferrous Metals Industry Association, China Green Lights Association, China Building Materials Industry Association, Tsinghua University and Beijing University of Posts and Telecommunications.

The annual blue paper contains not only a snapshot of energy conservation and emission reduction in China, but also realities for different industrial sectors and regions in the sector. Moreover, the *Report* goes beyond mere summarization of the development for the sector. It researches into and explores development trends and investment opportunities, judging the future and looking into the prospect of the field in discussion.

The *Report* sums up the research subject, target readers, basic framework and major conclusions from re-



ports in the last three years. In this way, we want to tell readers our research subjects, aim, approach of research and main conclusions.

## 1 Research Subject

The sector of energy conservation and emission reduction, or our research subject, refers to a comprehensive industry cluster that pursues the three major goals of low energy consumption, pollution and emission, has under it three sub – industries, namely, energy conservation, environmental protection and new energy, and covers all links of the industrial chain, including upstream materials, equipment providers, midstream processing, manufacturers and downstream service providers.

There are two common ways for categorizing the energy conservation and emission reduction sector: the first divides it into two, energy conservation and environmental protection, and new energy; the second into three, energy conservation, environmental protection, and new energy. The second approach is explained by the fact of relevantly three independent industrial sections within the sector due to different industrial needs. Currently, we need to look at the inherent relations of the three branches so that they fit into an integral whole. Energy (in the sense of traditional fossil energy) conservation represents the best way of environmental protection. Introduction of new energy counts as the best way of saving conventional energy. Hence, the three fields are inseparable. An industrial plan that neglects their internal links means we do not have a clear mind of their relations.

## 2 Target Readers

Target readers for our report include:

- Decision – makers and managers of energy conservation, environmental protection, new energy and industrial energy – depleting businesses;
- Decision – makers and managers of the functional departments for energy conservation and emission reduction both in the central and local governments;
- Investors in energy conservation and emission reduction, environmental protection, new energy, low carbon economy and circular economy;
- Researchers on energy conservation and emission reduction, environmental protection, new energy, low carbon economy and circular economy.

For decision – makers and managers of energy conservation, environmental protection and new energy industrial energy – depleting businesses, we have included in the *Report* relevant forward – looking market opportunities, analysis of policy, economic, social and technology environment and industrial competitors, and research on the business model for the sector.

For decision – makers and managers of industrial energy – depleting businesses, we have included in the *Report* benchmarking progress for key indicators in the sector, road – map for energy conservation and

emission reduction in different sectors, and specific guidelines for the relevant businesses as to how industries can conserve energy and reduce emission through energy efficiency auditing and clean production verification, and how can they achieve relevant goals through Energy Performance Contracting.

For decision – makers and managers of the functional departments for energy conservation and emission reduction both in the central and local governments, we have included in the *Report* contents as to how to monitor the process of energy conservation and emission reduction, assess the implementation effect of government control policies and develop future control targets and relevant policies.

For investors in energy conservation and emission reduction, environmental protection, new energy, low carbon economy and circular economy, we have included in the *Report* snapshot of the sector they are about to enter, must – know analysis of the sector trends for a to – be – investor, fundamentals, key performance and financial indicators of major players in the field, investment and financing mode, legal and policy environment, and the status quo and trend for investment and financing needs.

In addition, for researchers on energy conservation and emission reduction, environmental protection, new energy, low carbon economy and circular economy, we have included in the *Report* relevant sector data, the latest ideas and representative case studies.

### 3 Basic Framework

To deliver the afore – mentioned promises, we have designed a basic framework for the *Report* as shown in the following table.

Number	Name	Contents	Written in the year(s) of
1	Snapshot	A general view, main institutions and latest progress on major issues in the sector of energy conservation and emission reduction in China in the global context	2009/2010/2011
2	International practice	Bring in advanced practices in the area of low carbon economy and energy conservation and emission reduction from government agencies and established businesses in developed countries. Their practices can be learned by domestic government agencies and businesses	2010
3	Progress across sectors	Track the progress in energy conservation and emission reduction across the main energy – intensive sectors, such as iron & steel, petro – chemical, non – ferrous metals and electricity	2009/2011
4	Emerging energy	Introduce the industrialization of new sources of energy, such as solar energy, wind power, nuclear power and biomass energy	2009/2010/2011
5	Environmental protection	Introduce the status quo and industrialization process of environmental protection sectors, such as waste water, air pollution and solid waste treatment	2009/2011
6	Regional comparison	Introduce the status quo of and make comparison among energy conservation and emission reduction across regions, such as the east, central, northeastern parts of China, divided by administration or economic development level	2009/2011

续表

Number	Name	Contents	Written in the year(s) of
7	Technology	Track the development of major and advanced technologies in the sector and analyze their applicability in the Chinese context	2010
8	Green businesses	Analyze the fundamentals, typical experiences and investment values of businesses in the area of low carbon economy and energy conservation and emission reduction	2009/2010/2011
9	Major events	Annual list of major events in the sector of low carbon economy and energy conservation and emission reduction	2009/2010/2011
10	Relevant data	Annual authorized data concerning low carbon economy and energy conservation and emission reduction	2010/2011

As made clear by the table, the 2009 Report gives a general and comprehensive view of energy conservation and emission reduction in China and introduces the situation of the sector in that year. The 2010 and 2011 reports can be discussed together, although each report has its own focuses. Both the 2010 and 2011 reports have included in them the parts about snapshot, green businesses, major events and annual data. As to focuses, the 2010 Report looks more at international practices, new sources of energy and technology, whereas the 2011 one gives more attention to progress across sectors, environmental protection and regional comparison.

## 4 Main Conclusions

### 4.1 General background

In the global context, research on energy conservation and emission reduction is attributable to the issue of climate change. Yet climate change is now not just a matter of climate, but one that concerns politics, diplomacy and economy, grabbing the centre place in the international arena. With the introduction of “low carbon economy”, the fight against climate change will shape people’s production mode, lifestyle, values, national interests, and even human civilization.

In the context of China, the gravity on climate change is accompanied by a focus on development. China is a developing country, characterized by the drastic expansion of its economic output in the last two decades, giving rise to surging aggregate needs of resources. In addition, in the process of speeding up its industrialization, China faces intensive resource and energy consumption. Genuine efforts to conserve energy and protect the environment are entailed by China’s basic national conditions, large aggregate economic output and economic development level. Also, energy – saving and emission reduction is needed to restructure its economy, transform its development mode and create a new pole for growth to develop the economy and fight against the financial crisis. In a word, a balance between energy conservation and emission reduction and economic development is in the following decades a core issue to be confronted and addressed in China.



## 4.2 From political consensus to industrial consensus

After 2009, new trends in global energy conservation and emission reduction have emerged. A major one is that despite controversy among scientists, climate change has been accepted as a political consensus; and low carbon development, an economic one. With accumulated advantages in industries, capital and technologies over time, developed countries are seeking the lead in developing low carbon economy and have produced initial fruits in advancing the sector of energy conservation and emission reduction. However, as a developing country, China faces a different set of challenges from its developed counterparts. To be specific, China has to balance energy conservation and emission reduction with its economic development.

According to the *Report*, the sector of energy conservation and emission reduction will be at the core for China to realize its goals concerning low carbon development and promote a balanced focus between economic development and environmental protection. The Chinese government has promised to the world that, by the year 2020, CO<sub>2</sub> emission per unit of GDP will be reduced by 40%—45% and clean energy will take up 15% of the total energy consumption. There are three approaches to deliver these promises. First, compulsory goals set by the government concerning energy conservation and emission reduction. Second, active and voluntary efforts on the part of businesses and the society at large. Third, developing a market – driven sector of energy conservation and emission reduction. Administrative efforts on the part of the government can be effective in the short term, but like heavy doses, they are only transitory and cannot work over the long term. Voluntary efforts by businesses and the society have their limitations since they are constrained by the willingness and consciousness of environmental protection in the minds of customers; such efforts are like “health products” that do not get to the core of an illness. As to a market – driven energy conservation and emission reduction sector, it is a sound combination of policy guidance and intrinsic needs for industrial development; it is like the overall long – term “therapeutic plan”. Expectedly, for China, whose carbon emission leads most of the countries in the world, energy conservation and emission reduction will in the future contribute more than 30% of the fruits in the development of a low carbon economy.

Also according to the *Report*, 2010, as the ending year for China’s 11<sup>th</sup> Five – year Plan of Energy Conservation and Emission Reduction and the beginning year for China’s 12<sup>th</sup> Five – year Plan, marks the transition from “energy conservation and emission reduction dominated by administrative measures” to “one dominated by market mechanism”.

In 2010, driven by economic recovery, global energy consumption has gone through a new round of rebound. As a result, the decline in global energy consumption as of the year of 2009 fails to develop into a medium to long – term trend. As regards further projection, global energy demand shall increase by a big margin by either 2035 or 2050. Among this, energy demand driven by rapid economic growth of the

developing countries shall take a lion's share with the energy demand of China in particular.

In order to curb the increase in carbon emission due to energy consumption, the development of renewable energy shall help to improve the global energy consumption structure. Being a mainstay in promoting the transition of global energy structure to sustainable energy, China shall play a leading role in the development of and investment into nuclear power and renewable energy. In the meanwhile, development of renewable energy shall boost economic recovery of the developed countries who are deeply affected by the financial crisis. However, to our concern, while becoming the engine for economic growth, 'low-carbon' is also constructed as green trade barrier under disguise, resulting in new international economic rules.

#### 4.3 Energy conservation and emission reduction sector in China has to learn from international practices and be based on our national conditions

Many developed countries have placed green and low carbon economy at the core of their national strategies and at the pinnacle of global competition. In other words, developing green and low carbon economy is a new international race initiated by the developed world, a competition of a higher level and more intense nature. In the sense of competition, developed nations and their businesses, with accumulated advantages in industries, capital and technologies, are our competitors, but also role models.

The *Report* has looked at the features of developing low carbon economy across the developed world: the UK is the initiator, advocate and pioneering paver in the global development of green economy; the US prides itself on its exploration of clean energy and clean application of conventional energy and hopes that such advantages can maintain its leading position in a world with new economic environment; Japan is trying to build a comprehensive "low carbon society", in the hope that such a development mode will get out the shackles of its limited resources and energy; European countries such as Germany, France and Denmark boast of their localized practices, showing the diversity in developing low carbon economy and the need for such an economy to fit national conditions.

As the *Report* suggests, even amidst competition among countries, China can learn from its competitors. For example, we should learn from the UK for its accurate understanding of new trends in the new economy; and from the US, for its determination to lead the global economy by improving energy efficiency and applying clean energy. Based upon these international practices, we have to develop the sector of energy conservation and emission reduction conforming to China's basic national conditions. For example, coal is the main resource of energy and China is in the process of speeding up industrialization.

A case in point in the *Report* is the part about new sources of energy. In developing new energy as a step of restructuring its energy mix, China has considered its national conditions by adopting a "double track"

strategy of supporting the development of new sources of energy and promoting reform in conventional energy. New energy refers only to new and renewable energy, such as nuclear, wind, solar and biomass power. New sources of energy cover a broader area, including clean application of conventional energy, such as smart grid and clean coal. In fact, development of renewable energy and clean application of conventional energy will become two driving forces for the low carbon course in China.

#### 4.4 Initial fruits in energy conservation and emission reduction in energy –intensive industries

Main energy – intensive industries refer to industries that consume a lot of energy, such as iron & steel, non – ferrous metals, electricity, petro – chemical, building materials, transportation, and industries with intensive energy needs and high emission and discharge, such as paper – making, spinning, printing and dyeing and building materials. These industries take up more than 64% of the total end industrial energy consumption, and almost half of the total national energy consumption.

The output and scale of many industrial sectors in China occupies the world front rows. The output of many industrial products such as steel, coal, cement, fertilizer and etc. all rank No. 1 in the world. In the 11<sup>th</sup> Five – year Plan, China still registered an apparent trend of heavy industrialization. The growth rate of heavy industry outsped that of light industry. For this reason, the industrial sector remains to be main energy consumer and main source of pollution emission. The priority and difficulty of energy conservation and emission reduction all lie in the industrial sector.

During the 11<sup>th</sup> Five – year Plan period, China has made remarkable achievements in industrial energy conservation and emission reduction, which contributes greatly to the attainment of energy conservation and emission reduction goals for the 11<sup>th</sup> Five – year Plan. For example, during the 11<sup>th</sup> Five – year Plan period, energy consumption for power supply has decreased from 367g/kw in 2006 to 335g/kw. Average energy consumption per ton steel output of key iron and steel manufacturers has declined from 694kg to 607kg in 2010 with a total of 46. 11 million tce saved. In the non – ferrous sector, energy consumption of major products has declined with technique and economic performance improved remarkably.

However, looking into the future, industrialization and urbanization in China shall continue to develop. The 12<sup>th</sup> Five – year Plan shall be a critical period for China's industrialization. People's consumption pattern shall be upgraded, resulting in increased demand for industrial products. The ratio of heavy industry in China shall remain relatively high. Demand for energy, transportation and raw materials shall increase further. Energy consumption shall be intensified. Consequently, the resource constraints on industrial development shall become more and more severe.

#### 4.5 Environmental protection shall be more than just end pollution treatment

The extensive growth pattern exerts great pressure on the environment and the environmental issue is becoming increasingly serious. Both the central government and ordinary people have come to realize the urgency of this issue. To this end, the government has put into place various policies to curb the emission of industrial pollutants and made the environmental issue an important economic one to be solved in the national development planning. The central government has made the construction of resource – saving and environment – friendly society as a top priority for China's economic and social development.

Hence, China should speed up its efforts in development energy – saving and environment – friendly industries and strategic sunrise industries. Investments and policies for such industries should be enhanced. With a strategic position in national economic development, these strategic sunrise industries are of great and profound significance to economic development and national security. They possess the potentiality to become the pillar industry for future economic development of a country.

However, energy conservation and environmental protection industry in China still lies in the medium and lower stream of international labor chain and takes a weak position in international competition. With a low industrial concentration rate, such industry has failed to form an industrial chain featuring labor division and coordinated development. Currently, guidance to the development of energy conservation and environmental protection industry is mainly implemented through launching of ‘large projects’ or subsidies for end products. In a bid to boost the development of energy conservation and environmental protection industry, we should take effective measures to stimulate both its external as well as endogenous growth.

With economic and social progress and the advancement of industrial restructuring in China, the sector of environmental protection will play an ever more important role in its national economy, and become a sector that speeds up economic development, improves its quality and brings into the economy more technologies. Future branches of the sector might include clean technologies, products and environmental protection services. In addition, the dominant concept in the sector will be “environment industry” or “green industry”.

#### 4.6 Renewable energy production and clean application of conventional energy will bring further the restructuring of energy mix

New sources of energy and new energy are similar in expression, but different in their contents. New energy refers only to new and renewable energy, such as nuclear, wind, solar power and biomass. New sources of energy cover a broader area, including clean application of conventional energy, such as smart grid and clean coal. The national “New Energy Industry Plan” has been renamed as the “New Sources of Energy Industry Plan”, a move signaling the “double track” strategy of supporting the development of new

sources of energy and promoting reform in conventional energy in restructuring the energy mix in China.

In other words, the renaming implies a quiet shift in China's energy industry plan in China. The revitalizing plan for new energy industry that focuses on wind, solar and biomass power before will be replaced by a new plan on new sources of energy that covers the whole industrial chain. According to the National Energy Bureau, the revitalizing plan for new sources of energy that encompasses nuclear, wind, solar, and biomass power, clean coal, smart grid, distributed energy and new energy for vehicles has been submitted to the State Council. By October, 2020, an additional investment of ¥5 trillion on these sources of energy is expected to have been made.

#### 4.7 Energy conservation and emission reduction will pressure regions for economic restructuring

Comparatively speaking, China has limited supply of resources and energy, which is vastly but unevenly distributed. In other words, specific resources and energy are concentrated in certain regions. For example, the eastern part is rich in offshore oil, gas and wind; the central part produces a lot of coal; the western part is the base for producing new sources of energy; the northeastern part is the base for producing conventional energy and rich in oil. Yet energy distribution cannot match the development needs of localities, the mismatch that entails the constant transportation of resources and energy from one place to another to meet the needs in economic development.

In terms of regional environment, the three kinds of pollution (water, air and solid waste pollution) have shown different trends. Generally speaking, water pollution has been getting better over the years, whereas air and solid pollution are getting worse. In this context, energy conservation and emission reduction has become a compulsory choice for different regions to address their shortage in resources, transform their economic development model and restructure their regional economy.

After the unveiling and implementation of measures concerning energy conservation and emission reduction by the Chinese government, localities have stricken major progress in this regard and significantly increased energy efficiency. Despite of such exciting news, there are still problems across regions. For example, industrial structure needs further improvement; energy – intensive industries are continuing their fast expansion. Particularly after the introduction of policies by the government to stimulate domestic consumption and promote a sound and fast economic development, some localities began again to give green light to energy – intensive and high – polluting projects; some green businesses suffered decreasing profits, undermining the implementation of projects on energy conservation and emission reduction. All these problems represent new challenges for the green sector.

During the 11<sup>th</sup> Five – year Plan period, national policies on energy conservation and emission reduction



focus more on the general arrangement of relevant requirements, without taking enough consideration of uneven social and economic development levels across regions. Hence, while implementing national policies, local governments should take stock of local social and economic conditions and come up with specific policies that fit local realities.

During the 11<sup>th</sup> Five – year Plan period, energy consumption and emission reduction in China is mainly driven by governments at various levels. It is expected that during the 12<sup>th</sup> Five – year Plan, this mode shall gradually evolve into a market – oriented one. However, the basic pattern of government dominance shall remain unchanged. That being the case, it is of realistic significance to analyze energy conservation and emission reduction in China by regions.

In order to comprehensively compare and analyze the overall effect of energy conservation and emission reduction by various regions in the 11<sup>th</sup> Five – year Plan period, in this *Report*, we construct three comprehensive evaluation indexes for regional energy conservation and emission reduction, namely emission reduction result, degree of effort – making and potentiality tapping. In line with such indexes, we divide various provinces into four categories.

According to our study, the first category mainly focuses on eastern China, including Beijing, Shanghai, Jiangsu, Guangdong and Zhejiang specifically. This indicates that among various regions, eastern China has done the best in energy conservation and emission reduction. The second category mainly includes Tianjin, Hebei, Fujian, Shandong and Hainan in eastern China, Anhui, Jiangxi, Henan, Hubei and Hunan in the middle part of China, Chongqing, Sichuan, Shanxi and Yunnan in western China and Heilongjiang, Liaoning and Jilin in northeastern China. The third category includes Shanxi in the middle part of China, Guangxi, Gansu and Inner Mongolia in western China. The fourth category mainly focuses on western China, including Guizhou, Qinghai and Ningxia specifically.

#### 4.8 Identify investment values on energy conservation and emission reduction in businesses

As the practitioners of energy conservation and emission reduction, businesses have on them clear responsibilities and obligations. The recent policy orientation in China has clearly emphasized the diversification of participants in developing low carbon economy and the co – investment of private and state – owned capital. Weak basis in low carbon development, imperfect policy and legal environment and lacking of supporting currency and financial policies all demonstrate the bumpy road ahead for the sector of energy conservation and emission reduction in the country. But excitingly, as a major sector for economic transition, it has received ever more attention. More consensus have been reached. Particularly encouraging is the solid improvement in the aspect of financing, which is characterized by the combination of indirect financing that depends mainly on bank loans and direct financing from the market in the form of equities.

There are already listed companies in the energy conservation and emission reduction plate of the stock market, a financing market. Since the introduction of Growth Enterprise Market (GEM) Board in China's capital market in 2009, nearly one hundred small – and – medium – sized enterprises, supported mainly by private capital, have entered the A – share market. By July, 2010, about 28 of these businesses were involved in different areas of low carbon economy, either in terms of their main business, or their future orientation. Altogether, they have received a finance of about ¥12.867 billion. To be specific, the industries they are in and their scope of business cover such areas as new energy, energy conservation and environmental protection, smart grid and new materials. These businesses also have their counterparts in the energy conservation and emission reduction plates on the main boards of Shanghai Stock Exchange and Shenzhen Stock Exchange. These small businesses have succeeded in utilizing both the industrial and financial capital, boast sound market performance and have attracted capital from all corners.

To analyze within the framework of industrial features and investment values, the *Report* has adopted the following sub – industry categorization based on the nature of industrial chains: new sources of energy (wind power, photovoltaic solar power, nuclear power and biomass), energy conservation (energy conservation from frequency conversion and using waste heat and excess pressure), environmental protection (air pollution treatment, waste water treatment and utilization of water resources and solid waste treatment). In each of the category, there are case studies of listed companies in the relevant field. The *Report* has chosen such an approach to explore opportunities for technology development and investment in energy conservation and emission reduction in the country, and to judge the future and expect the prospect of the sector.

In a nutshell, the annual *Report* on the development of energy conservation and emission reduction sets the sector itself as its research subject, gives a general view of the sector, analyzes the status quo for the sector and environmental protection, and tries to present the realities on environmental protection and new energy across industries and regions. We hope that this *Report* can become the most authoritative major annual blue paper in the sector of energy conservation and emission reduction.

## 特约专稿

# 低碳发展 绿色发展 和谐发展

冯之浚

“十二五”规划明确提出，我国要以科学发展为主题，以加快转变经济发展方式为主线，并把加快转变经济社会发展方式贯穿于经济社会发展的全过程和各领域。一言以蔽之，目前中国发展的主题可以概括为一个“转”字，即转变、转型、转轨、转制。转变，就是转变经济发展方式，创新发展模式，破解发展难题，提高发展质量；转轨，就是不能再走拼人力物力、拼资源能源、先污染后治理的路子，而是走出一条有别于先期工业化国家的资源节约型、环境友好型的新路；转型，就是政府要实现由计划经济向市场经济的角色调整。当政府在市场经济中担当主角时，政府更关心财政收入，对居民收入重视不够，更关心生产性投资，对公共需求投入重视不够，更关心效率，对公平的重视不够，更关心国有企业，对民营经济重视不够。我们要界定好政府与市场的关系，更加充分地发挥市场“无形之手”的基础性作用；转制，就是要大力推进经济体制改革，加快推进文化体制、社会体制改革，不断完善社会主义市场经济体制，为科学发展和社会和谐提供有力保障。

“转”的核心是转变经济发展方式。改革开放 30 年多来，中国的经济发展取得了令人瞩目的成就，年均经济增长保持了近 10% 的快速水平，国内生产总值居世界前列。但同时长期形成的粗放型增长方式尚未根本改变，工业化、城镇化快速发展同能源资源和生态环境的矛盾日趋突出，影响科学发展的体制机制障碍依然存在，转变经济发展方式迫在眉睫。

## 一、低碳技术在世界范围内方兴未艾

当前，世界经济走出国际金融危机最困难的时期并出现复苏，但同时影响世界经济全面复苏的不确定因素依然较多。面对国际金融危机冲击，尽管我国迅速采取一系列重大应对措施，实现了经济总体回升向好，但长期形成的粗放型增长方式尚未根本改变，工业化、城镇化快速发展同能源资源和生态环境的矛盾日趋突出，影响科学发展的体制机制障碍依然存在。因此，科学应对国际金融危机的影响，不仅仅是提高经济增长速度的问题，更是转变经济发展方式的问题。目前，我国要实现经济发展方式的根本性转变，一要依靠科技进步；二要依靠绿色发展。而发展低碳技术，则是兼具了两条路径的一项共同选择。

历史发展的经验表明，每一次大的经济危机常常伴随着一场新的科技革命。从增长周期角度看，世界经济史上存在着由重大科技创新所主导的周期性经济波动，依靠重大技术创新的形成，催生集群式产业发展，方能走出经济衰退的困局。信息技术自上个世纪引发了重大变革之后，生命科学、生物技术不断取得重大突破，相关的新产品、新产业快速发展，可再生能源、

绿色能源正处在替代化石能源的前期，循环经济、低碳技术方兴未艾。在未来一段时期内，这些领域的技术将成为推动全球发展、转变世界经济发展方式的新的动力。

事实上，目前世界上主要国家已普遍意识到金融危机将催生新一轮科技革命。英美欧等发达国家已经在这些领域投入了巨大的力量。就在许多国家受全球金融危机影响纷纷转移精力、削减投入甚而放松减排要求的情况下，英国却宣布启动了一项“绿色振兴计划”，尝试以低碳发展模式从衰退中复苏。目前，英国已初步形成了以市场为基础，以政府为主导，以全体企业、公共部门和居民为主体的互动体系，从低碳技术研发推广、政策发挥建设到国民认知姿态等诸多方面，都处在了世界领先地位。美国总统奥巴马上台以来，在能源政策方面采取了一系列措施，诸如计划在未来五年准备投入 1500 亿，用于能源新技术方面的大规模投资建设，这是继 IT 革命之后，美国技术储备的又一个主要方向。2007 年底，欧盟提出了战略能源技术计划，该计划是包括欧洲风能、太阳能、生物能和 CO<sub>2</sub> 捕集、运送和贮存以及电网、核裂变等的综合性启动计划。同时，欧盟采取了一系列有力措施推进低碳产业发展，无论从目标制定到科研投入、机制建设、标准与立法、项目投资，都走在世界前列。

可以相信，蓄势待发的低碳技术等新经济形态很有可能会改变未来的世界经济版图。对于我国来说，能否抓住这次历史变革的机遇，将对我国的未来产生极为深远的影响。

## 二、推行低碳技术是我国转变发展方式的当务之急

作为发展中的大国，我国全力贯彻落实科学发展观，努力建设资源节约型与环境友好型社会，大力倡导循环经济，在中央文件和领导人讲话中，多次提出要将节能减排、推行低碳技术作为国家发展的重要任务。

在我国，推行低碳技术是实现经济社会可持续发展的当务之急。研究指出，2007 年，我国消费煤炭约 23 亿吨，碳基燃料共排放出 CO<sub>2</sub> 达到 54.3 亿吨，居全球第二。在 2007 年，我国每建成 1 平方米的房屋，约释放出 0.8 吨 CO<sub>2</sub>；每生产 1 度电，要释放 1 公斤 CO<sub>2</sub>；每燃烧 1 升汽油，要释放出 2.2 公斤 CO<sub>2</sub>。这些数字表明，中国的能源消费处于“高碳消耗”状态，加上中国的化石能源占总能源数量的 92%，其中煤炭占 68%，电力生产中的 78% 依赖燃煤发电，而能源、汽车、钢铁、交通、化工、建材等六大高耗能产业的加速发展，使得中国成为“高碳”的典型代表。如果不推行低碳技术，实现经济发展方式的转变，我国的资源能源将难以支撑，生态环境将难以承受，国家竞争力将难以提升，国家安全也将难以保障。这就要求我们必须把推行低碳技术提到国家战略层面上加以思考。

(1) 资源能源难以支撑。我国的资源总量和人均资源都严重不足，而资源消耗的增长速度却十分惊人。在资源总量方面，我国石油储量仅占世界 1.8%，天然气占 0.7%，铁矿石不足 9%，铜矿不足 5%，铝土矿不足 2%。在人均资源量方面，我国人均 45 种主要矿产资源为世界平均水平的 1/2，人均耕地、草地资源为 1/3，人均水资源为 1/4，人均森林资源为 1/5，人均石油占有量仅为 1/10。我国的国内资源已难以支撑传统工业文明的持续增长，现实的情况要求我们必须通过加快转变经济发展方式，缓解经济增长中环境代价太大的问题。

(2) 生态环境难以承受。当前，我国所面临的环境形势十分严峻。我国现有荒漠化土地面积已占国土总面积的 27.9%，而且每年仍在增加 1 万多平方公里；我国七大江河水系，劣五类水质占 27%，75% 的湖泊出现不同程度的富营养化；我国 600 多座城市中有 400 多座供水不足，