中国煤炭工业可持续发展

Sustainable development of China coal industry

胡振琪

Hu Zhenqi

China university of mining and technology (Beijing)

Institute of land reclamation and ecological rehabilitation research

土地复垦与生态重建研究所

Institute of Land Reclamation and Ecological Restoration

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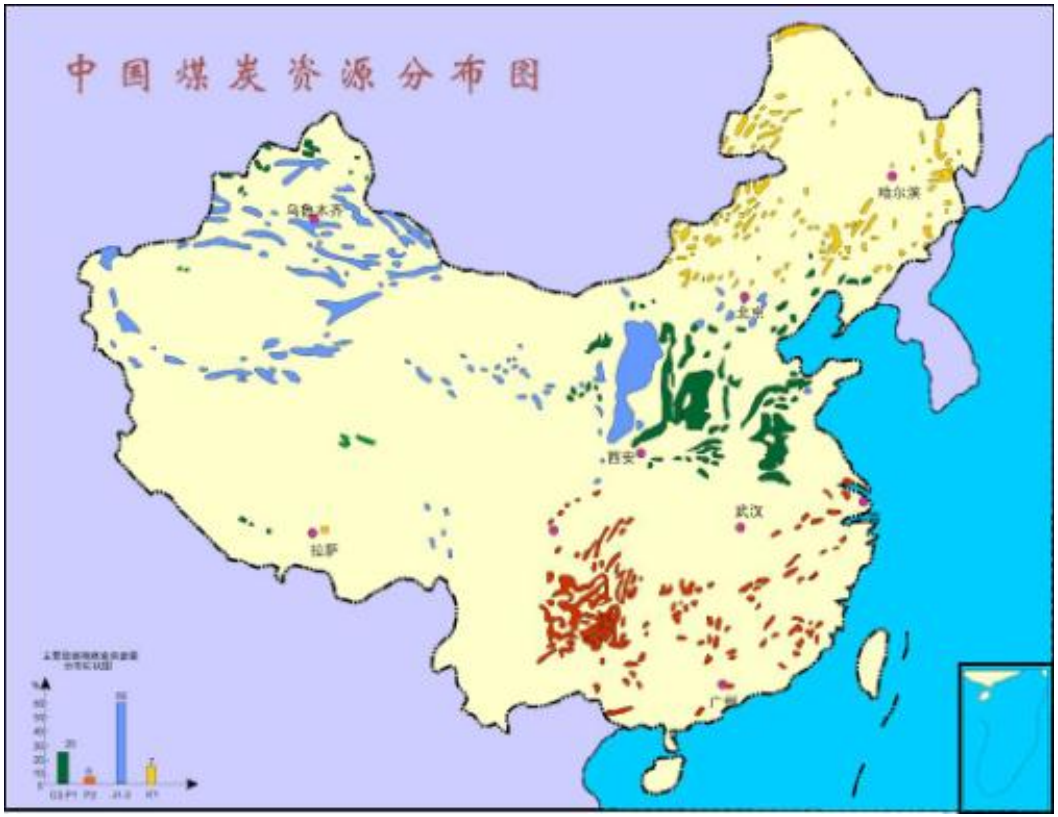
Status and Prospects of coal exploitation and utilization in China

1.1 中国煤炭资源总量与分布特点

Analysis on Characteristics of Coal Reserves and its Distribution



●根据世界能源理事会所作的最新“能源资源调查报告”估算，中国煤炭资源总量排名第一，其中查明资源储量居世界第二位

●**The latest "Report of Energy Resource Survey" delivered by the World Energy Council (WEC) estimated that China's gross coal resources rank No.1 in the world with proven coal reserves as No. 2**

●资源分布既广泛又相对集中，西多东少、北多南少

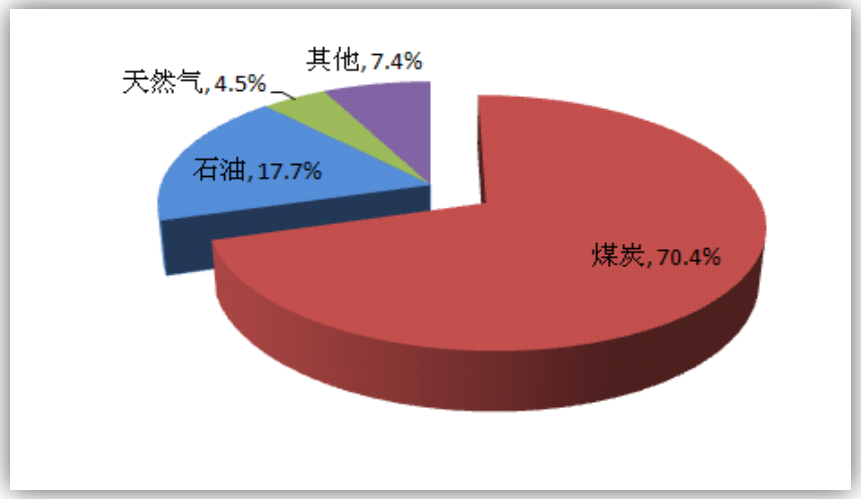
●**Extensive converge of coal resources across the country vs. heavy concentration in the west and the north**

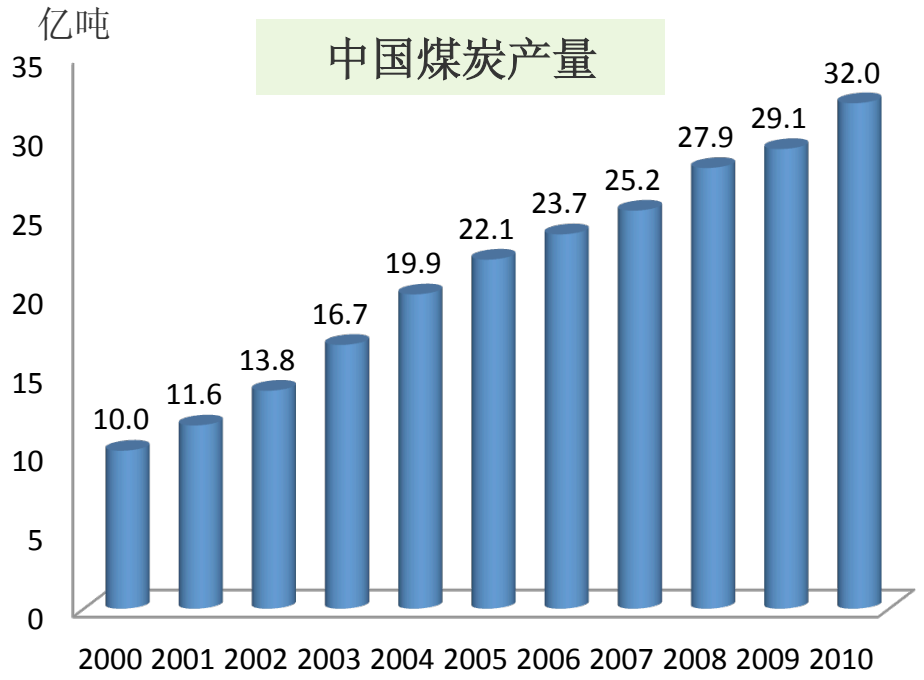
中国一次能源消费结构

The primary energy consumption structure in China

- 今天在中国一次能源消费结构中，煤炭占70.4%，石油占17.7%，天然气占4.5%，其它能源占7.4%。

The energy consumption structure in China : coal, oil, gas, and other energy resources account for 70.4%, 17.7%, 4.5%, 7.4% respectively.



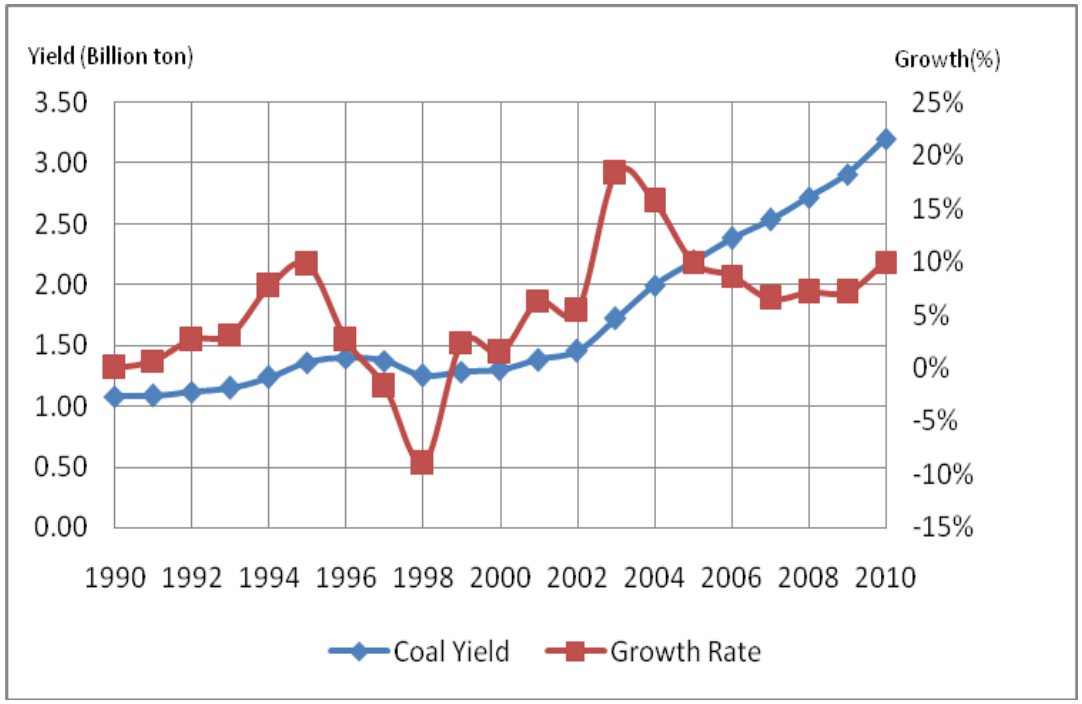


煤炭在中国一次能源生产和消费结构中占主导地位。

1.2 中国煤炭工业现状与趋势
Status and Prospects of Coal Development

A. 中国煤炭产量不断增加，是世界最大的煤炭生产国合消费国。

Coal output is increasing very fast. China has become the No.1 country with coal production and cola consumption.



中国自1990年至2010年的煤炭产量和增长率

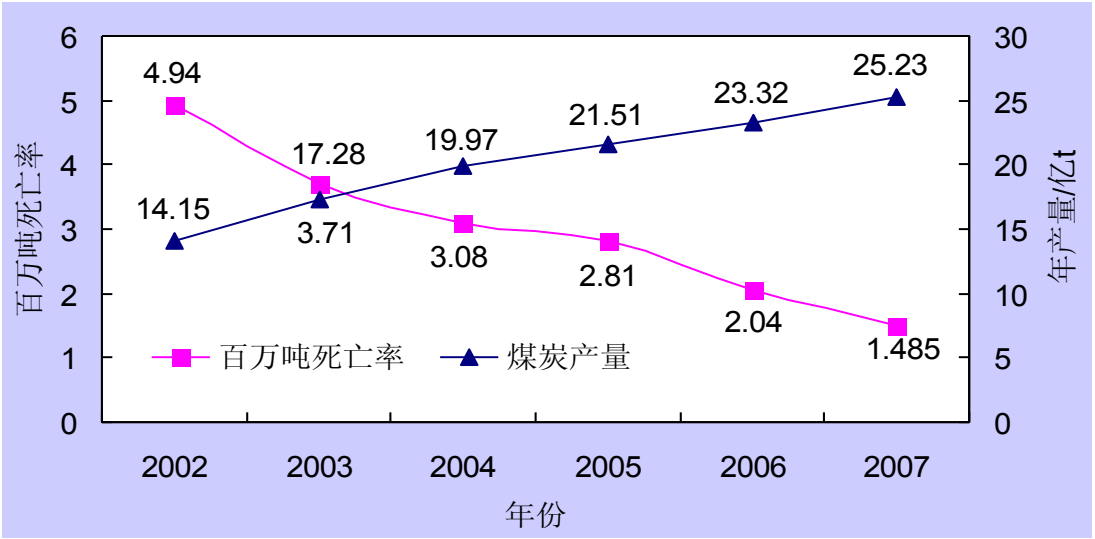
Coal yield and growth rate from 1990 to 2010 in China

在2011年，中国的煤炭产量为3.5亿吨, 92%来自地下开采。

China's coal production was 3.5 billion tons in 2011, and 92% come from underground mining.

B. 煤矿事故每年死亡人数、百万吨煤死亡率不断下降

Coal mine accidents and fatality rate per Mt of coal mined decreased continuously in these years.



Coal yield of China from Year 1949 to Year 2008

中国将用20年（到2030年）时间基本实现煤炭的科学安全开采。在安全方面，全国煤矿基本实现安全生产，平均百万吨死亡率降到0.1人/MT。

In terms of security, we are trying to realize the national coal mine safety production, with an average megaton death rate dropped to 0.1 people per million tons.

C. 煤炭科技装备水平大幅提高，大型现代化矿井建设速度加快。

Significant progress of high-tech equipment and machinery, rapid construction of large-scale modern mine shaft.

	原煤产量 Output of Raw Coal	占全国总产 Ratio of national gross output
全国规模以上煤炭生产企业8226家 8226 enterprises above the designated size	26.20亿吨 2.620 bt	93.80%
其中…… Including		
年产量超过1000万吨的34家企业 34 Coal Enterprises with Output over 10 Million per year	15.01亿吨 1.501 bt	53.8%

大型煤炭企业快速发展，生产集中度大幅提高

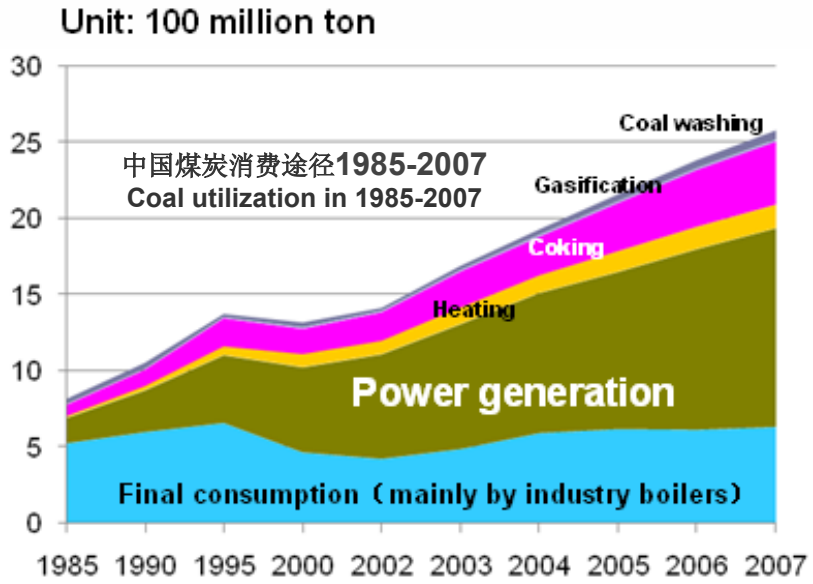
Rapid development of large coal enterprise groups, great improve of production concentration

煤炭科技装备水平大幅提高，大型现代化矿井建设速度加快。

Great progress of high-tech equipment, rapid construction of large-scale modern mine shaft.

	生产能力（产量） Output
全国已建成年产量达千万吨级煤矿24座 24 Ten Million Ton Mines have been constructed	3.2 亿吨 0.32 BT
在建和规划建设的千万吨级煤矿24座 24 Ten Million Ton Mines are under construction	3.3亿吨 0.33 BT
建成安全高效矿井（露天）292处 292 Safety and High Efficient Surface mines has been constructed	8.6亿吨 0.86 BT
建成年产120万吨以上的大型煤矿469座 469 Mines with Output over 1.2 Million per year has been constructed	14.23亿吨 1.423 BT

1.3 煤炭利用现状与趋势
Status and Prospects of Coal Utilization



煤炭终端消费的比例不断下降，转换加工的比例不断上升，发电消耗了一半的煤炭

The fraction of coal used for final consumption continues to decline, and the fraction of intermediate coal consumption (transformation) continues to grow. Power generation consumes 50% of coal in China.

仅1990-2007年间，中国煤炭消费量从10.55亿吨增长到25.86亿吨，期间发电消费煤炭则由2.7亿吨增长到13.1亿吨，增长了380% 。

Coal consumption in China has increased from 1,055 Mt in 1990 to 2,586 Mt in 2007. Coal consumed for power generation has increased from 272 Mt in 1990 to 1,305 Mt in 2007, the equivalent of a 380% increase during the study period.

伴随中国经济发展和城市化进程的逐步推进，能源消耗仍将稳步增长。

Energy consumption is expected to grow continuously due to economic growth and the urbanization process in China.

2.煤炭可持续发展的约束分析

Constraints for Sustainable Coal Development and Utilization

2.煤炭可持续发展的约束分析
Constraints for Sustainable Coal Development and Utilization

A.煤炭资源约束 Coal Resource Constraints

中国煤炭资源总量丰富，但资源赋存条件相对较差

Abundant Coal Resources and Undesirable Occurrence Conditions

B.煤炭开发中的约束 Constraints in coal development

a.煤矿区生态环境破坏严重

Serious Environmental Impacts in Coal Mining Regions

b.煤矿区社会稳定潜在威胁

Mining area social stability potential threat

C.煤炭利用中的约束 Constraints in Coal utilization

- a.污染排放严重：中国火力发电排放的二氧化硫、氮氧化物以及烟尘总量分别占全国排放量的45%41%和30% 粗略估计，煤电占化石能源燃烧二氧化碳排放的40%左右。

  Serious air pollutant emissions: coal-fired power plants represent 45% of national SO2 emissions, 41% of NOx, 30% of particulates and 40% of national CO2 emissions

- b.煤炭使用面临巨大的碳减排压力

  Urgent Needs of Carbon Emission Reduction in Coal Use

- c.分散燃煤,能源效率低，资源浪费严重

  Distributed Coal Combustion resulted Low energy efficiency levels and huge waste of coal resources

- d.煤的转化率低，仅为煤炭消费总量的18%左右。

  Percentage of coal consumed for the conversion processes is as low as 18%

2.煤炭可持续发展的战略目标
Strategic Target of Sustainable Use of Coal

煤炭的安全、高效、环境友好开采和科学、高效和洁净利用将是煤炭工业可持续发展的主题

Safe, effective, environment-friendly mining and scientific, effective, and clean use of coal will be the theme in the sustainable development of the coal industry.

在安全、高效、环境友好开采方面：2030年，采煤塌陷及挖损土地治理率达到当年塌陷面积的80%，煤矸石利用及处置率达到当年排放量的100%，其中利用率超过90%，基本消灭煤矸石山，煤矿矿井水利用率达到80%，瓦斯利用率达到70%.

Mining: By 2030, the subsided and damaged land for coal mining shall be recovered up to 80% of the subsided area of that year, and gangue use and disposal ratio shall be 100% of the gangue produced that year, of which the utilization ratio shall be over 90%. Hills of gangue shall be basically eliminated. The mine water shall have a utilization ratio of up to 80%, and the gas utilization ratio up to 70%

在环境保护方面，要严格控制煤炭燃烧的污染物排放。到2030年，SO_2和NOx排放量应分别控制在1400万t/a和1500万t/a，按燃煤排放量分别占85%和65%估算，燃煤SO_2和NOx排放量应分别控制在1200万t/a和 1000万t/a左右。同时通过节能和CCS技术应用，到2030年努力将CO_2控制在65亿t/a以内。

Use of coal: As for environment protection, the emission of SO_2 and NOx shall be controlled strictly. with the application of energy saving and CCS techniques, CO_2 shall be controlled within 6.5-billion t/a in 2030.

3.中国煤炭工业可持续发展的战略对策

Strategies and countermeasures for Sustainable Coal Utilization

3.1 积极开展煤炭绿色开采战略

Green Mining Strategies for Sustainable Coal Development

①全面推广煤炭绿色开采技术

Green Coal Mining techniques

②加强煤炭开采矿区塌陷地复垦

Reclamation of subsided land

③促进煤矸石处置与综合利用

Environment-friendly disposal of coal waste

④充分利用煤炭矿废弃土地资源

Good use of coal mine waste land

例1 加强煤炭开采矿区塌陷地复垦
Reclamation of subsided land

修复前before

采煤沉陷导致的粮田和农田破坏，使得粮食产量急剧下降，触动粮食安全问题.

Coal mining subsidence causing to grain fields and farmland destroyed that the food production plummeted and the food security issue to be worse and worse.

修复中process

土地复垦平整技术工程、动态预复垦技术工程和土壤重构技术的施工中

The land reclamation flat technology engineering, dynamic pre-reclamation technology engineering and construction of soil reconstruction techniques working.

修复后after

农田下采煤问题得到解决，恢复治理后的田地再次投入到生产

The mining issue in Farmland is resolved, and the land after the reclamation treatment will be put into production again

例2 促进煤矸石处置与综合利用
Environment-friendly disposal of coal waste


燃烧的矸山

治理

The retreatment

原位治理工程技术、矸石自燃防治技术
Situ treatment project technology, coal waste heap spontaneous combustion control technology

证书号第511447号

发明专利证书

发明名称：一种自燃煤矸石山的绿化方法

发明人：胡振琪;陈胜华

专利号：ZL 2007 1 0063475.5

专利申请日：2007年2月2日

专利权人：中国矿业大学(北京)

授权公告日：2009年6月17日

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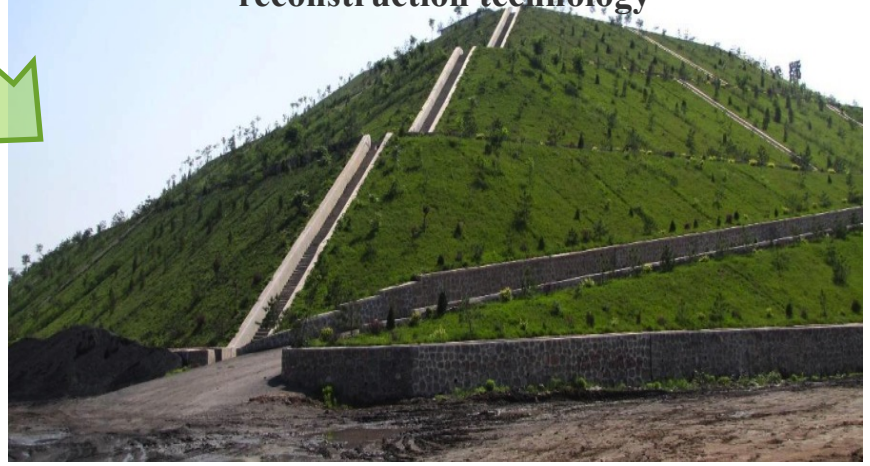
2009年6月17日

第1页(共1页)

覆土栽植技术、生态重建后
Earth-Casing planting technology, ecological reconstruction technology



例3 废弃矿区生态修复 ---安徽淮南大通湿地公园

Ecological Restoration in the abandoned mine--- Huainan Chase Wetland Park

废弃工矿旧址

Abandoned Location of Industry and Mining

通过生态修复与重建，建成以“山水林居”为特征，集生态、休闲、运动、办公、居住为一体的宜居公园。

The Eco-reclamation

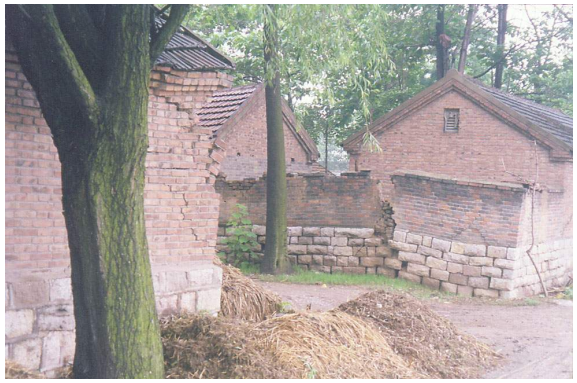
生态修复

The live-friendly Park, by Ecological restoration and reconstruction, including ecology, leisure, sports, office, will be built with the landscape forest-dwelling characteristics.

湿地是地球之肺

The lungs of the earth--Wetland

例4 压煤村庄搬迁
Village migration



Migration in harmony

和谐搬迁

山东菏泽

HeZe, Shandong province

安徽淮北

HuaiBei, Anhui province

The combined harmonious ecological relocation and new village construction — The new village address

3.2 实施高效洁净利用战略
Implement the strategy of high-efficiency and clean coal utilization

①高效洁净的燃煤发电战略

Implementation of High-Efficiency and Clean Coal Power Generation

●在持续改善在役主力的燃煤蒸汽发电技术的同时，应该积极促进以低碳为目标的电力结构多元化。

●The adoption of CCS will increase power-coal demand by energy penalty, and will influence the technology selection for future coal power.

●除常规煤粉锅炉外，循环流化床技术在中国也得到了较好的发展。煤和生物质掺烧发电可有效减少煤电的CO_2排放，应在应用CCS之前得到大力发展。

●IGCC and polygeneration should be promoted, and policy support should be given to promote coal/biomass co-firing power generation

3.3 稳步推进煤炭高效洁净技术转化战略

To smooth the implementation the effective and clean coal conversion strategy

- 在煤焦化行业中推广和应用大型、先进节能环保技术装备。重点推广干法熄焦、煤水分调湿等清洁生产技术；推行焦炉大型化

  Focus on the application of the clean production techniques such as dry coke quenching and coal moisture control, and to use large coke oven.

- 大力发展煤炭高效低碳清洁转化技术包括煤加氢液化、煤气化、煤基费托合成、煤制天然气、整体煤气化联合循环发电（IGCC）--多联产等现代煤转化技术。开发、引进先进煤气化、大型合成反应器等技术及装备，实现煤炭高效洁净转化零排放。

  To vigorously develop low-carbon techniques.

- 探索煤炭高效低碳清洁转化技术与碳封存技术的集成模式

  煤炭清洁转化过程能获得占总碳排放量50%以上的高纯度CO_2，可以直接进行碳封存。积极开展煤转化——CCS技术集成和工程示范。

  Develop CCS technique.

3.4 循环经济持续发展战略
Circular economy sustainable development strategy

中国政府注重发展循环经济，促进煤炭资源综合利用，节约资源和能源，煤炭资源利用效率大幅提高。

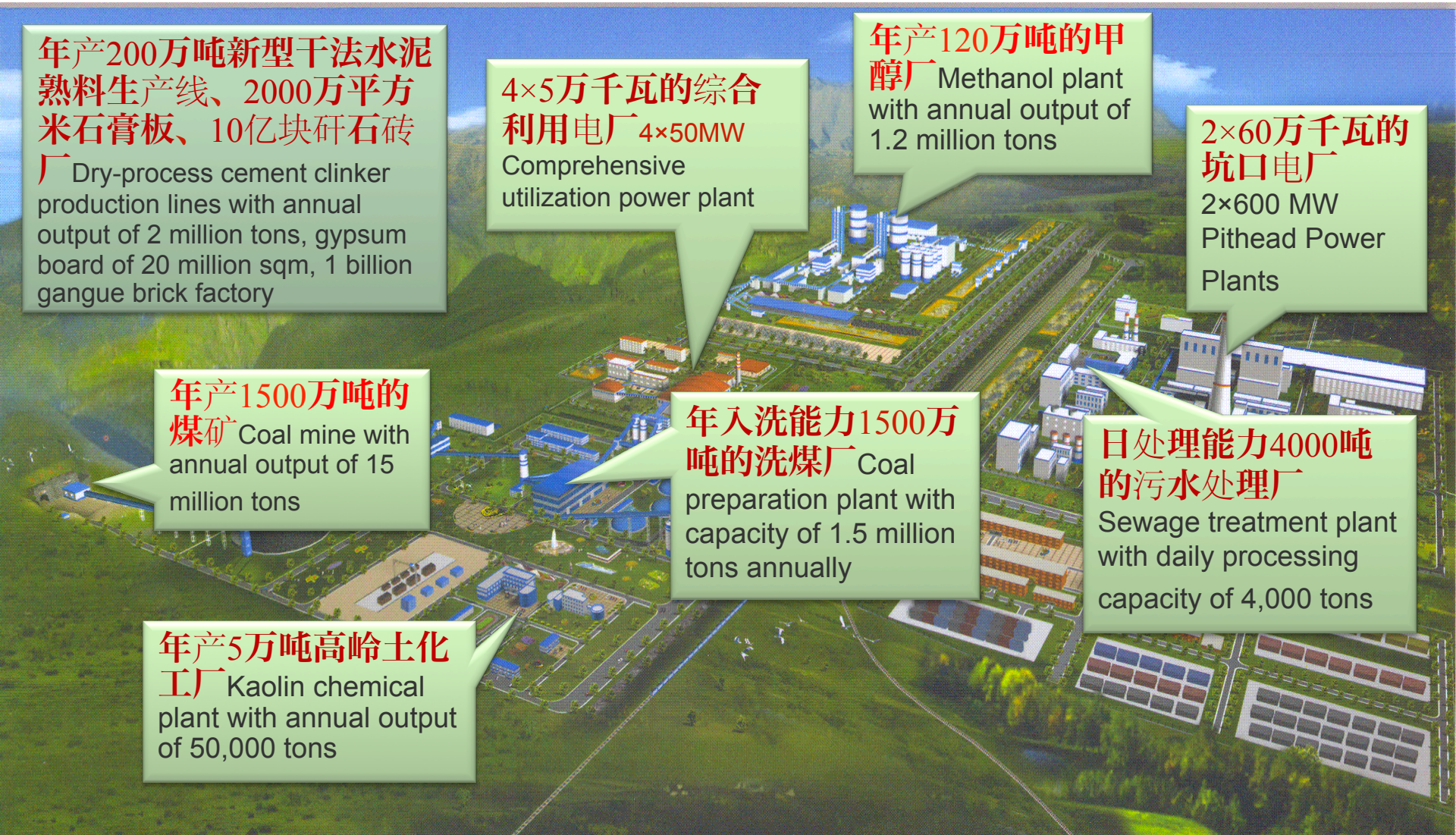
The Chinese government values the developing of a recycling economy and promotes the comprehensive utilization of coal resources, saving resources and energy, a substantial increase in utilization efficiency of coal resources.

如：中国山西大同煤矿集团公司塔山循环经济工业园区，建成了以一座年产煤炭1500万吨的大型煤矿为基础，一个煤矿、八个工厂、一条铁路的循环经济发展模式，经济效益和生态效益十分显著。

For example: Tashan circular economy industrial park of Datong Coal Mine Group , Shanxi province in China, Built a recycling economy development model with a large-scale coal mines with an annual output of 15 million tons of a coal mine as basic, eight factories and a railway, conduce remarkable economic and ecological benefits are very remarkable.

大同煤矿集团塔山循环经济园区重点项目示意图

Tashan circular economy park key projects Sketch map of Datong Coal Mine Group



3.5 运用经济手段促进煤炭的可持续开采

Promote sustainable coal mining using economic approaches

① 面推行煤炭采矿权有偿使用制度，加快改革煤炭资源税政策 。

Apply paid-use system of coal mining rights， Quicken the reform of coal resource tax policy

② 建立煤炭开采生态补偿制度，实施环境治理保证金制度 。

Establish the eco-environment compensation system in coal mining industry，Implement environment treatment security system

③ 进一步改革和完善排污收费制度，加快制定和实施环境税收制度。

Further the reform and improvement of pollutant emission charge system， Quicken the steps of making and implementing environmental tax system

④ 继续深化环保电价补贴政策 。

Further the application of the electric power subsidy policy for environmental protection

⑤ 全面推行排放指标有偿使用，积极开展电力行业排污交易试点。

Overall implementation of paid-use system for pollutant emission allowance， Active experiment of emission trade in electric power industry

4.中国煤炭工业可持续发展的展望

China coal industry sustainable development outlook

4.中国煤炭工业的展望

中国煤炭工业展的展望，关键就是“科学产能”

China coal prospect : the key is “scientific capacity”.

它是提升煤炭工业的生产安全度、生产绿色度和技术程度，由粗放、无序、污染转向高效、安全、生态环保、绿色开采，全面提高中国国煤炭开采的科学化水平。具体来讲是要推动五个转变：

一、由产量速度型向质量效益型转变。

Changes from the output-speed pattern to quality-benefit pattern.

二、由单一煤炭生产向煤炭综合利用、深加工方向转变。

Changes from pure coal production to coal comprehensive utilization and deep processing

三、由粗放的煤炭开采向以高新技术为支撑的安全高效开采转变。

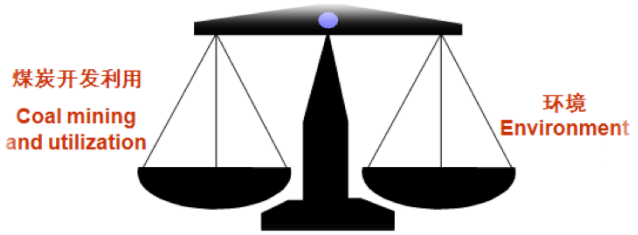
Changes from extensive coal mining to safe and effective mining with high-technology as support

四、由单纯控制煤矿伤亡事故向全面性的保障职业安全转变。

Change s from the simple control of coal mine accident to comprehensive security occupational safety.

五、由资源环境制约向生态环境友好型转变。

Changes from resources and environment restriction to the ecological environment friendly



4.3 中美合作展望
Perspective of cooperation on clean coal technology between China and USA

双方有很好的合作条件和基础

There are some good conditions and basises for the cooperation on clean coal technology between two countries.

- **都是煤炭生产和利用的大国**

  Both countries produce a lot of coal and utilize coal in many aspects

- **煤炭开发在西部、中西部较多**

  coal mines usually locate in the west or mid-west regions

- **两国相关科学家间已有很长时间的交流合作**

  A long history of academic exchanges among related scientists between two countries.

- **美国在洁净煤和矿区环境修复方面有很多可以应用到中国的新技术**

  USA have some advanced technologies on clean coal and mine reclamation, which could be applied to China.

中美在煤炭工业发展领域有着广阔的发展前景！

So China and USA will have wide perspective of cooperation on coal technology ！

土地复垦与生态重建研究所
Institute of Land Reclamation and Ecological Restoration

谢谢！

Thanks！

欢迎到中国矿业大学(北京)土地复垦与生态重建研究所

Welcome to Institute of land reclamation and ecological rehabilitation research