

内蒙古自治区煤炭生产与消费总量控制方案和政策研究

Study on the control scheme and policy of coal production and consumption in Inner Mongolia Autonomous Region

“中国煤炭消费总量控制方案和政策研究”内蒙古课题组

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前言

preface

- 内蒙古的能源资源居于重要战略地位，2015年内蒙古原煤占全国（37.5亿吨）的24.2%、发电量占全国（58105.8亿千瓦小时）的6.76%；风电发电量居全国第一位；原煤产量、煤炭外销量和电力外送量均居全国第一位。
- Inner Mongolia 's energy resources occupies an important strategic position in Inner Mongolia ,in 2015, coal accounted for 24.2% (37.5 tons), electricity (5810.58 billion kw/h) accounted for 6.76%; wind power generation capacity ranks first in the country; the output of raw coal, coal sales and power delivery volume ranking first in the country.



- 煤炭、电力和化工为主的产业是内蒙古经济的重要支柱产业，以此为依托内蒙古经济曾创造连续八年增速居全国之首的奇迹。但是，经济新常态下经济增长放缓、大气污染治理、煤炭进口等都给内蒙古的经济带来了不小的冲击。
- Coal, electric power and chemical industry is an important pillar industry in Inner Mongolia's economy, relying on Inner Mongolia's economy has created eight consecutive years of growth in the country's first miracle. However, economic growth slowed down under the new normal, air pollution control, coal imports and so on gave Inner Mongolia's economy no small impact.



1. 内蒙古煤炭储量、产能、产量变化情况

Inner Mongolia coal reserves, production capacity, production changes

表 1：内蒙古自治区煤炭储量（单位：亿吨）

年份	煤炭储量
2001	2232
2003	2239
2007	6763
2010	7414
2014	8081
2015	8250



- 全区目前共勘查含煤盆地103个，全区含煤面积12万平方公里，煤炭资源远景含量13000亿吨。内蒙古累计探明煤炭储量逾8000亿吨，居全国首位。在探明储量中，亿吨级以上的整装煤田36处，查明煤炭资源量居全国第一位
- The region currently has a total exploration of 103 coal basin, the region's coal bearing area of 120 thousand square kilometers, 13000 tons of coal resources vision of tons. Inner Mongolia total proven reserves of more than 8000 tons of coal, ranking first in the country. In proven reserves, more than 36 tons of bulk coal, discovered coal reserves ranks first in the country



从消费结构看：区内的消费增量幅度远远小于产量，大多数的煤炭逐渐转到区外消费。2000年区内消费占比高达79%，2008年跌破50%下降到44%，近几年进一步下降到35%-36%，有超过60%的煤炭被调往区外。

From the consumption structure: the incremental rate of consumption in the region is far less than the yield, most of the coal gradually shifted to outside the area of consumption. Consumption in 2000 accounted for as high as 79%, in 2008 fell below 50% to 44%, in recent years, further down to 35%-36%, there are more than 60% of the coal was transferred out of the area.

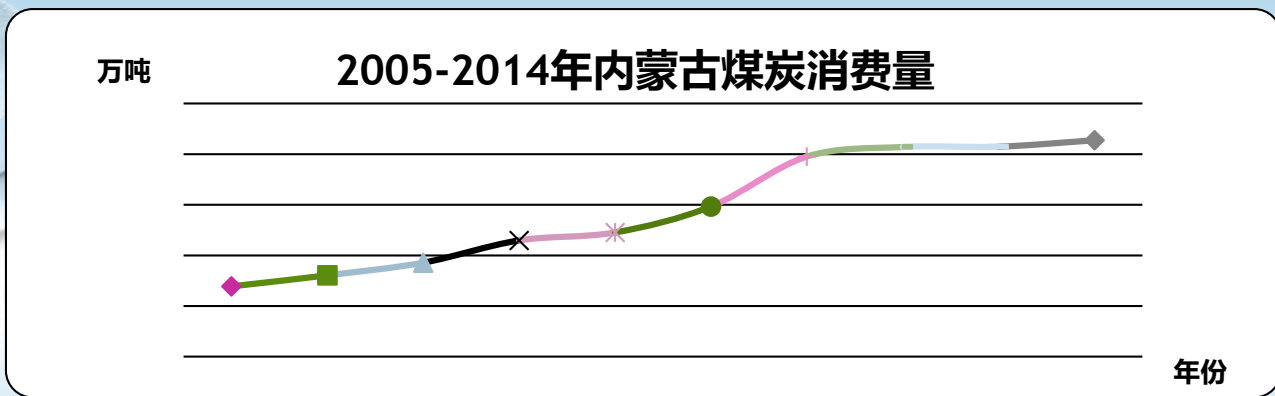




表 5：内蒙古煤炭的终端消费和中间消费（单位：万吨）

项目	1995	2000	2005	2010	2011	2012	2013	2014
终端消费	1512	1845	4472	6333	7650	7312	6954	7017
工业	935	1420	2888	2684	3833	2943	3684	3579
中间消费	2787	3864	9472	20671	27033	29309	27962	29449
发电	1883	2566	6277	13953	19186	20262	18440	19367
供热	276	366	808	1817	1784	2252	2253	2320
炼焦	60	126	1590	3010	3663	3832	4396	4732
制气			2	7	7	9	7	
洗选损耗							2475	2653
终端消费占比%	34.93	32.15	32.05	23.45	22.06	19.97	19.92	19.24
工业消费占比%	21.60	24.75	20.69	9.94	11.05	8.04	10.55	9.81
中间消费占比%	64.38	67.33	67.88	76.55	77.94	80.03	80.08	80.76
发电占比%	43.49	44.71	44.99	51.67	55.32	55.33	52.81	53.11

从中间转化和终端消费的结构看：内蒙古的煤炭消费结构已转向以中间加工消费为主火力发电的占比由44%上升到53%，是最大的煤炭一次消费部门，也是温室气体排放控制的最重要环节。

From the structure of intermediate transformation and final consumption: coal consumption structure of Inner Mongolia has shifted to the intermediate processing and consumption-based thermal power generation accounted for 44% to 53%, is the largest coal consumption sector, but also greenhouse gas emission control The most important part.



进入21世纪之后，煤炭消费向工业部门集中，1995年，工业部门的煤炭消费不到20%，2000年约为25%，2005年以后几乎占到了90%以上，远超全国的平均水平。

After entering twenty-first Century, coal consumption was concentrated in the industrial sector, in 1995, less than 20% of coal consumption in the industrial sector, in 2000 about 25%, after 2005 accounted for almost 90% of the above, far more than the average level of the country.

表 6：内蒙古各产业煤炭消费情况（单位：万吨）

年份	1995	2000	2005	2010	2011	2012	2013	2014
煤炭消费量	4329	5740	13954	27004	34684	36620	34916	36466
农业	58	75	128	272	302	385	463	504
工业	935	1420	12369	23355	30866	32252	33629	33028
建筑业	31	31	77	257	150	165	186	194
交通运输、仓储及 邮电通信	187	100	182	200	216	482	589	636
批发、零售和住宿 餐饮	66	38	187	1094	1063	1165	964	989
生活消费	144	143	833	1421	1692	1735	1730	318





表 9：内蒙古各盟市能源采矿占用损毁土地面积

盟市	能源采矿占用损毁土地（公顷）
呼和浩特市	670
包头市	1180.44
呼伦贝尔市	8039.13
兴安盟	809.43
通辽市	9213.16
赤峰市	7586.52
锡林郭勒盟	34382.86
乌兰察布市	0
鄂尔多斯市	57109.78
巴彦淖尔市	1264.82
乌海市	4098.55
阿拉善盟	3161.7
合计	127516.39

内蒙古当前能源采矿活动合计占用损毁土地12.75万公顷，占内蒙古所有采矿活动占用损毁土地面积（18.29万公顷）的9.7%，其中鄂尔多斯能源采矿占用损毁土地5.71万公顷，锡林郭勒盟占用损毁3.44万公顷，是煤炭采矿占用土地最大的两个地区。

Inner Mongolia's current energy mining activities totaled 127,500 hectares of damaged land, accounting for 9.7% of all mining activities in Inner Mongolia (182,900 hectares), of which 57,100 hectares were occupied by energy mining in Ordos, 34,400 hectares occupied by Xilingol League, is the two largest coal mining area land.



截至2014年底，内蒙古矿山固体废弃物累计积存量 119.36×10^8 吨，其中废石（土） 104.546×10^8 吨，占总积存量的87.58%；煤矸石 10.866×10^8 吨，占总积存量的9.10%；尾矿 3.37×10^8 吨，占总积存量的3.32%。矿山固体废弃物的大量堆存，不仅污染土壤、空气、地表水和地下水，而且易造成滑坡和泥石流等地质灾害。

As of the end of 2014, Inner Mongolia mine solid waste accumulation 119.36×10^8 tons, including waste rock (soil) 104.546×10^8 tons, the total accumulated stock 87.58%; 10.866×10^8 tons of coal gangue, the total accumulated stock 9.10%; 3.37×10^8 tons of tailings, the total accumulated stock of 3.32%. The stockpiling of mine solid waste, not only pollute the soil, air, surface water and groundwater, but also easy to cause the landslide and debris flow.



图7：内蒙古各盟市固体废弃物累计积存量



2. 内蒙古煤炭生产、消费及需求预测

Inner Mongolia coal production, consumption and demand forecast

基本原则：

Basic principle

➤ **生态红线原则**(Ecological red line principle)

以碳排放红线、大气红线和水资源红线作为制定内蒙古十三五期间煤炭控制目标的生态红线。

Red line of carbon emission, atmospheric red line and red line of water resources were taken as the ecological red line to form the coal control target during the 13th Five-Year Plan of Inner Mongolia.



➤ **合理性原则(Principle of rationality)**

协调内蒙古的经济发展、产业结构特征与生态红线约束之间的相互关系。

Coordinating the relationship between economic development, industrial structure and ecological red line constraints in Inner Mongolia.

➤ **差异性原则**

内蒙古地区地域辽阔、东西跨度大，不同地区之间的资源条件、气候条件、水资源条件、产业结构存在显著性的差异要根据不同地区特点分类实施确定差异化目标。

Difference principle

Inner Mongolia is a vast region with large spans between east and west. There are significant differences in resources, climate, water resources and industrial structure among different regions.



2.1 内蒙古“十三五”期间经济增长情境下的煤炭需求分析

Analysis of coal demand and economic growth in the context of Inner Mongolia "13th Five-Year" period

GDP年均增速7.5%和单位GDP能耗下降15%的目标计算出2020年内蒙古总能耗为：37811.11万吨标准煤。

GDP average annual growth rate of 7.5% and unit GDP energy consumption decreased by 15% of the target calculated in 2020 Inner Mongolia total energy consumption is: 378.1111 million tons of standard coal

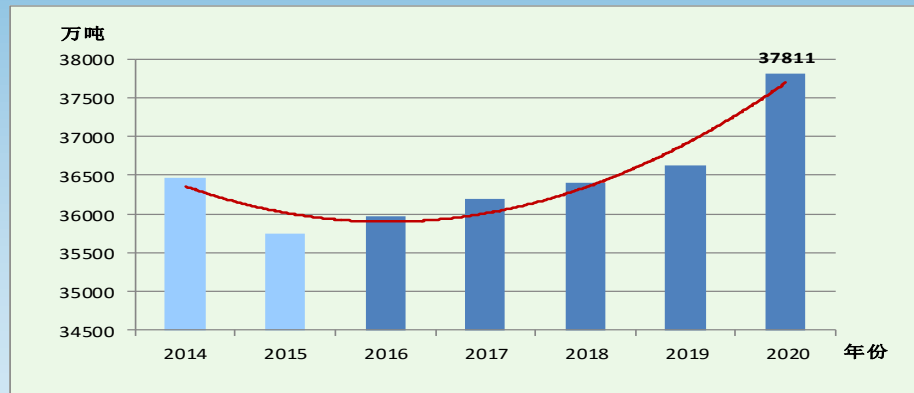


图10：基准情境下十三五期间内蒙古煤炭消费需求



按照十三五期间非化石能源占能源供给总量的15%的标准，预测出2020年内蒙古煤炭消费量：**31715.29万吨**

According to the 13th Five-Year non fossil energy accounted for the total energy supply of 15%, predict 2020 Inner Mongolia coal consumption demand: 317.1529 million tons

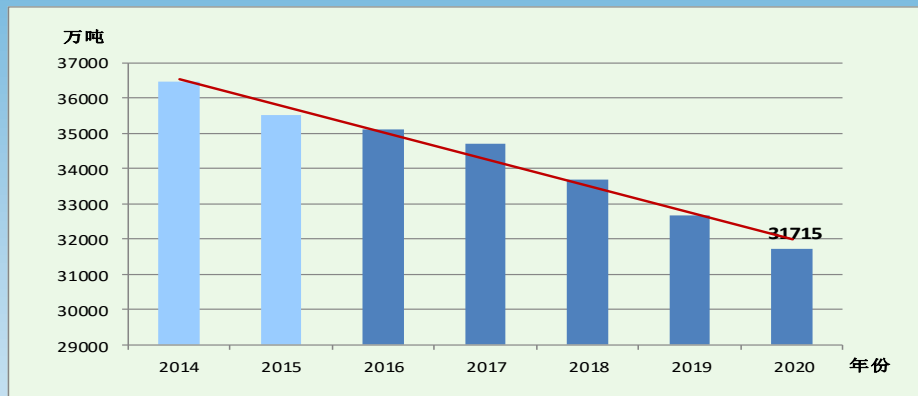


图11：煤控情境下十三五期间内蒙古区内煤炭消费量预测



2.2大气红线约束下内蒙古煤炭需求预测

根据大气红线控制煤炭消费主要是通过控制工业能源中煤炭的使用量来减少二氧化硫、氮氧化物和烟尘等污染物的排放。根据计算出的内蒙古工业增加值的二氧化硫排放弹性，按照十三五期间二氧化硫排放降低15%的红线约束和工业能源消费及内蒙古工业十三五规划当中的工业年均增速，计算出在大气红线约束下内蒙古2020年煤炭消费的消费需求为31262.11万吨。

According to the red line control of coal consumption is mainly controlled by the use of coal in industrial energy consumption to reduce emissions of sulfur dioxide, nitrogen oxides and soot and other pollutants. According to the calculated Inner Mongolia industrial sulfur dioxide emissions increase elasticity, reduce industrial emissions of sulfur dioxide in 13th Five-Year the average annual growth rate of 15% of the red line constraints and industrial energy consumption and industrial planning of Inner Mongolia in 13th Five-Year, calculated in the atmosphere under the constraints of Inner Mongolia red 2020 coal consumption demand of 312.6211 million tons.



2.2大气红线约束下内蒙古煤炭需求预测

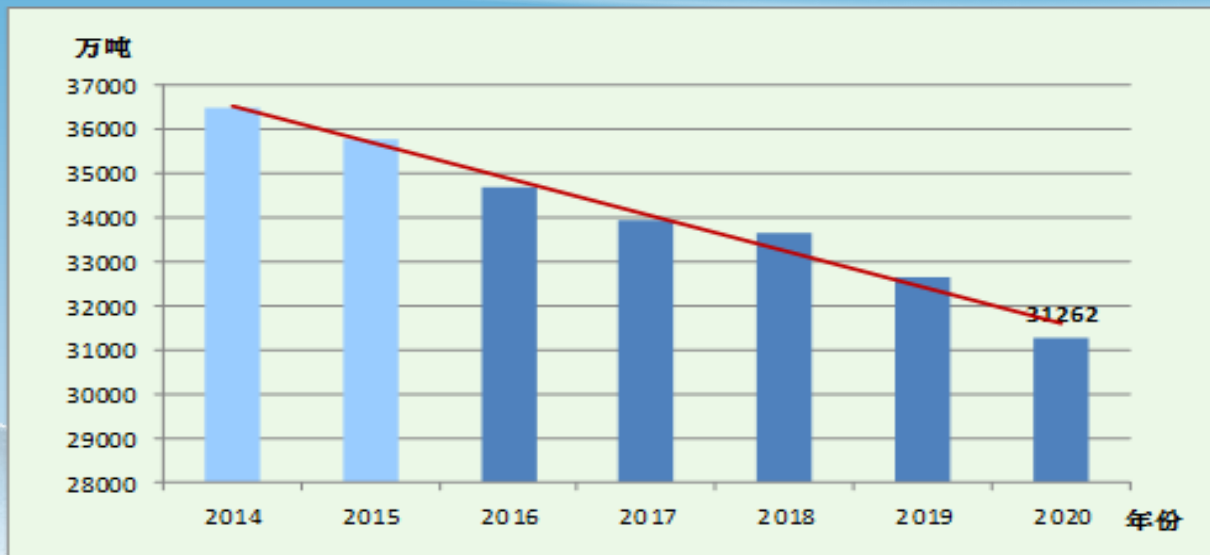


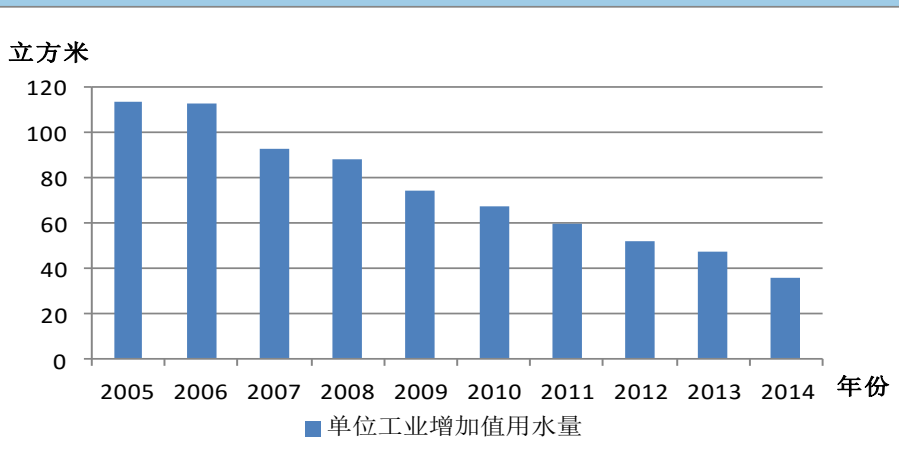
图13：大气红线约束下内蒙古十三五期间区内煤炭消费需求

Inner Mongolia coal demand forecast under the constraint of atmospheric red line



2.3 水资源红线约束下内蒙古煤炭消费需求的预测

内蒙古自治区水资源分布不均衡，总体上是西部缺水严重，东部相对充足。用水结构当中农业用水占了绝大部分，工业用水年平均占11.14%，2014年工业用水占用水总量的10.82%。



Forecast of coal consumption demand in Inner Mongolia under the constraint of water resources

The distribution of water resources in the Inner Mongolia Autonomous Region is not balanced, and the water shortage is serious in the west, and the eastern part is relatively abundant. Water use structure which accounted for the vast majority of agricultural water, industrial water accounted for an average of 11.14% in 2014, 10.82% of total industrial water consumption in.



与煤炭相关的水资源消耗主要是在煤炭开采和洗选环节，2014年用与煤炭开采和洗选的额定用水量是12.16亿立方米。如果按照额定复用率计算的话，2014年的水资源损耗量为0.95亿立方米。

Coal-related water is mainly consumed in the coal mining and washing process in 2014 with the coal mining and washing of the rated water consumption is 1.216 billion cubic meters. If calculated according to the rated multiplexing rate, the water loss in 2014 is 0.095 billion cubic meters.



2005年内蒙古单位工业增加值的用水量是每万元113.51立方米，而到了2014年下降到了每万元35.90立方米。按照2020年每万元工业增加值用水量控制在19立方米，根据分配给各盟市的用水总量制定各盟市相应的煤炭控制目标。

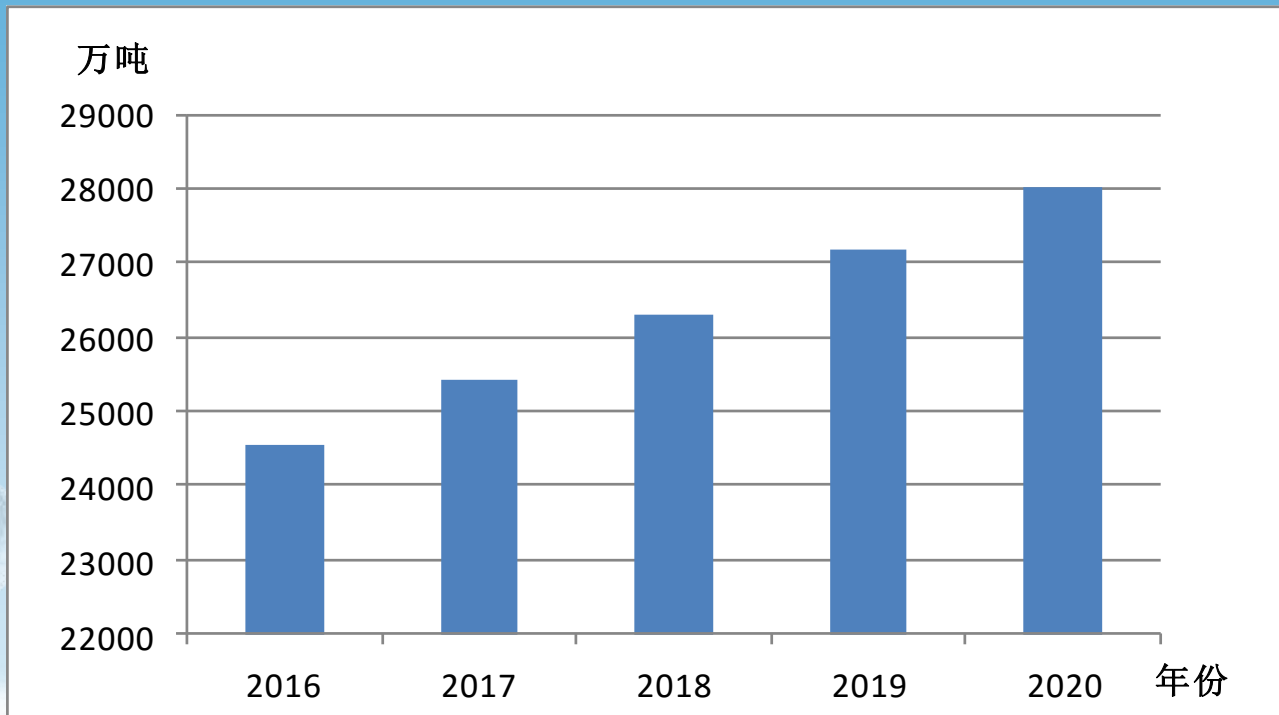
Inner Mongolia unit of industrial added value of water consumption is 113.51 cubic meters per ten thousand in 2005, while in 2014 fell to 35.90 cubic meters per ten thousand. According to 2020 per ten thousand yuan of industrial added value of water control in the 19 cubic meters, according to the total amount of water allocated to the city of the union to develop the corresponding coal control target.





根据协整分析得出的能源消费弹性预测出十三五期间的能源需求，按照2020年碳排放强度比2005年下降45%的约束条件，结合内蒙古十三五规划中经济增长的目标和能源结构调整的目标预测出2020年内蒙古煤炭需求量为**28016万吨**。

According to the elasticity of energy consumption predicted by cointegration analysis, the energy demand during the 13th Five-Year period is forecasted. According to the constraint of reducing the carbon emission intensity by 45% in 2005 and the economic growth target and energy structure in Inner Mongolia's plan in 13th Five- Year to predict the target of Inner Mongolia coal demand of 280.16 million tons in 2020.





2.4 碳排放约束条件下内蒙古煤炭消费需求

Coal Consumption Demand in Inner Mongolia under Carbon Emission Constraints

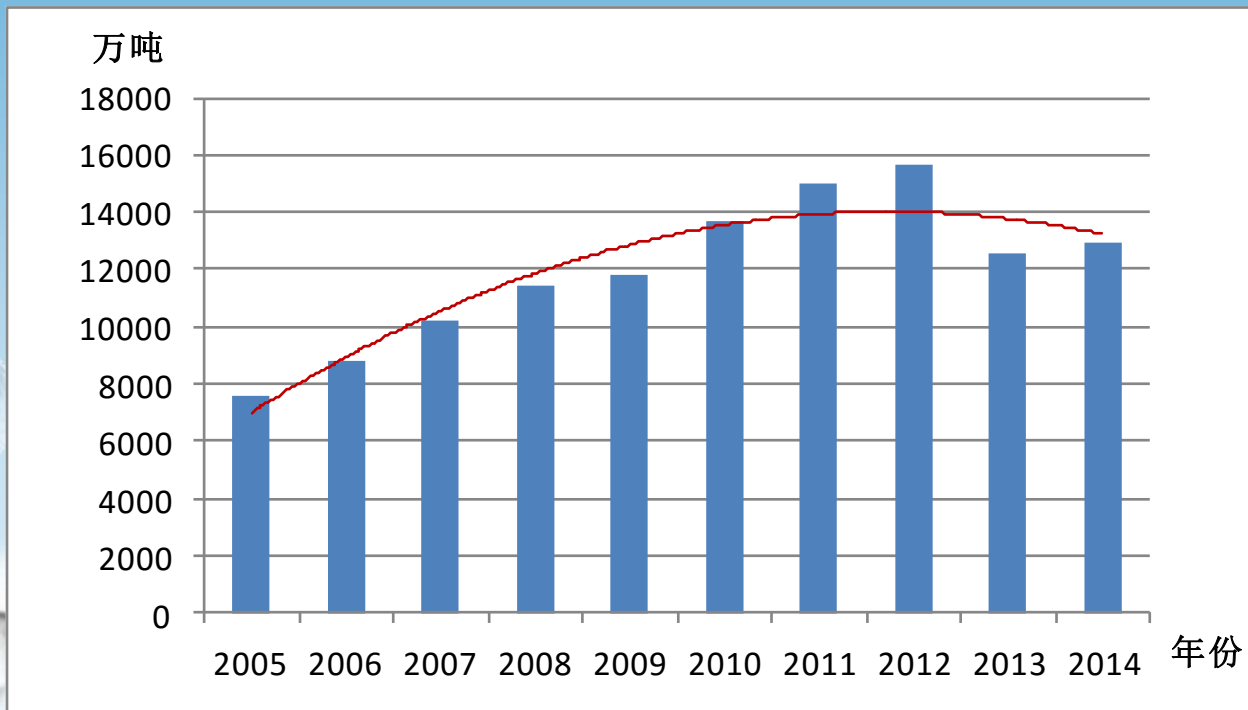
按照IPCC的各类碳排放系数计算出2005年到2014年能源消费情境下内蒙古的碳排放从2005年的7590.03万吨上升到2012年的峰值为15662.49万吨，从2013年开始下降到12973.87万吨。测算出按照当年价计算单位GDP的碳排放强度为1.4610吨/万元，高于全国的平均水平1.2吨/万元。

According to the various types of carbon emission coefficient of IPCC calculated from 2005 to 2014, energy consumption in Inner Mongolia under the situation of carbon emissions from 75.9030 million tons in 2005 rose to a peak of 156.6249 million tons in 2012, starting from 2013 down to 129.7387 million tons. Calculated in accordance with the current annual price of carbon emissions per unit GDP intensity of 1.4610 tons / ten thousand, higher than the national average of 1.2 tons / ten thousand.



2.4 碳排放约束条件下内蒙古煤炭消费需求

Coal Consumption Demand in InnerMongolia under Carbon Emission Constraints





不同经济增长和生态红线约束下内蒙古煤炭需求分析

Analysis of Inner Mongolia Coal Demand under the Constraint of Different Economic Growth and Ecological Red Line

表 10：不同情境约束下 2020 年内蒙古煤炭需求

情境	约束条件	2020 年煤炭需求量（万吨）
经济增长	单位 GDP 能耗下降 15%	25540
大气红线	二氧化硫排放降低 15%	27135
碳排放红线	单位 GDP 碳排放比 2005 年下降 45%	28016
水资源红线	每万元工业增加值用水 19 立方米	各地区确定



3. 内蒙古煤炭控制的目标和实现途径

Goal and Realization Way of Inner Mongolia Coal Control

3.1. 内蒙古2020年煤控目标：

Inner Mongolia coal control target in 2020

在资源环境生态的红线约束下，依据全国煤炭和内蒙古煤炭消费需求分析，确立内蒙古煤控目标。通过煤控的减量化、清洁化和替代途径，采取煤炭生产和消费双控方案，实现煤控目标。

The Inner Mongolia coal control target was established under the red line constraint of resource and environment ecology, according to the analysis of the coal consumption demand of the national coal and Inner Mongolia. Through the coal control of the reduction, clean and alternative ways to take coal production and consumption of dual control program to achieve coal control targets.



3.1.内蒙古2020年煤控目标：

Inner Mongolia coal control target in 2020

2020年内蒙古煤控目标：9.5亿吨

Inner Mongolia 2020 coal control target

总能耗：2.2亿吨标煤

Total energy consumption

非化石能源比重：15%

The ratio of Non-fossil energy

减煤目标：1.5亿吨煤

The goal of Coal reduction



3.2. 内蒙古煤控的实现途径

Realization Way of Inner Mongolia Coal

3.2.1 煤炭减量化(Reduction of coal) :

➤ **全国煤控实施带来内蒙古煤炭外运量减少**：基准情境下2020年内蒙古煤炭外运量将达到7.04亿吨，节能情境下为6.29亿吨，2°C情境下为5.89亿吨。

The implementation of the national coal control to bring Inner Mongolia coal transport volume reduction: the benchmark scenario in 2020 Inner Mongolia coal transport capacity will reach 0.704 billion tons, 0.629 billion tons under the energy-saving context, 2 °C 0.588 billion tons.



3.2.1 煤炭减量化(Reduction of coal) :

➤ **内蒙古煤炭消费减量化**：① **直接节能**：通过节能措施来推进煤炭消费减量化，节约煤炭消费2200万吨以上。其中通过电力节能减少煤炭1200万吨，燃煤锅炉节能节约燃煤930万吨；② **非直接节能**：抑制高耗能产业过快增长，淘汰规模小和过剩的电力产能，严格控制过剩产能产品。

The reduction of Inner Mongolia coal consumption : ① **direct energy**: through energy-saving measures to promote the reduction of coal consumption, saving more than 22 million tons of coal consumption. Of which 12 million tons of coal by electricity to reduce energy conservation, coal-fired boilers save 9.3 million tons of coal-fired energy saving; ② **non-direct energy-saving**: inhibition of excessive growth of high energy-consuming industries, out of small-scale and surplus power capacity, and strictly control the excess capacity products



3.2.1 煤炭减量化(Reduction of coal) :

➤ **内蒙古煤炭生产过剩产能化解**：通过有序退出、减量置换、资源整合、兼并重组、优化升级等途径，有效化解过剩产能，减少煤炭生产。内蒙古力争用3-5年时间化解煤炭行业过剩产能约1.79亿吨，其中引导推出产能4959万吨，引导减量化生产1.29亿吨。

Inner Mongolia coal production excess capacity to resolve: through an orderly exit, reduction replacement, resource integration, mergers and acquisitions, optimization and other ways to effectively resolve excess capacity, reduce coal production. Inner Mongolia strive to use 3-5 years to resolve the excess capacity of the coal industry overcapacity of about 1.79 tons, of which to guide the introduction of production capacity of 49.59 million tons, to guide the production of reduced production of 0.129 billion tons.



3.2.2 煤炭清洁化利用(Clean utilization of coal) :

➤ **煤炭洗选可有效实现节能减排**：每洗选1亿吨原煤，可排除灰分1300万吨，硫分35万吨，减少二氧化硫排放49万吨，排除煤矸石1800多万吨。

Coal washing can effectively achieve energy-saving emission reduction: each washing of 100 million tons of raw coal, can rule out 13 million tons of ash, sulfur 0.35 million tons, reducing sulfur dioxide emissions by 0.49 million tons, excluding more than 18 million tons of coal gangue.



3.2.2 煤炭清洁化利用(Clean utilization of

coal) :

➤ **发展超低排放燃煤发电技术和碳捕集、利用和封存技术**：加快燃煤电站节能减排改造步伐，有效放松排放对煤炭消费的约束，同时燃煤电厂效率可从35%提升到45%。大幅降低燃煤电厂的碳及污染物排放。

The development of ultra-low-emission coal-fired power generation technology and carbon capture, utilization and storage technology: to accelerate the pace of energy-saving emission reduction of coal-fired power plants to effectively relax emission constraints on coal consumption, while coal-fired power plant efficiency from 35%. Greatly reduce the carbon-burning power plant emissions and pollutants.



3.2.2 煤炭清洁化利用(Clean utilization of coal) :

➤ **推广应用高效节能环保型锅炉，加快淘汰落后锅炉**：目前中国在用燃煤工业锅炉的平均热效率偏低，与设计热效率相差10%-15%，与先进国家同类锅炉相差15%-20%，节能潜力巨大。

To promote the use of energy efficient and environmentally friendly boiler to speed up the elimination of backward boiler: At present, the average thermal efficiency of China's coal fired industrial boilers is low, and the thermal efficiency of the design is 10%-15%, which is similar to that of the advanced countries, and the energy saving potential of 15%-20% is great.



3.2.3 煤炭替代

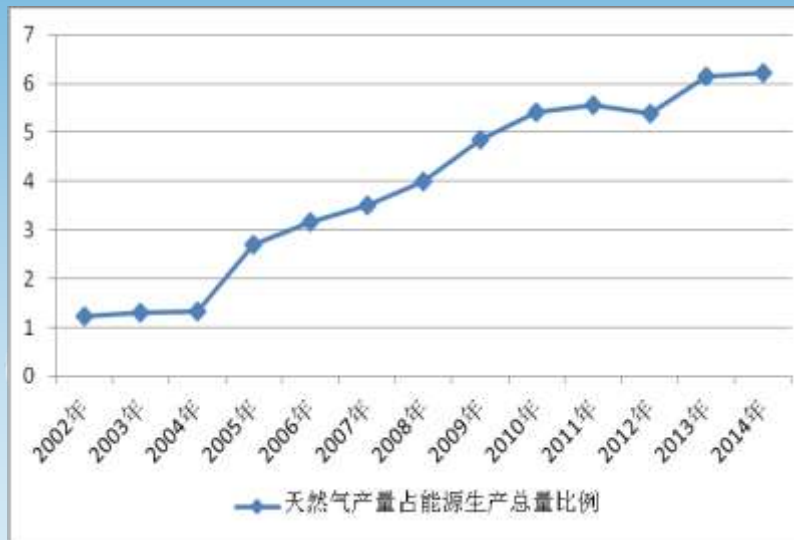
Coal substitution

内蒙古能源消费中，煤炭的消费比例从2005年的90.44%下降到2014年的81.73%，石油从2005年的8.6%下降到2014年的7.48%，天然气从2005年的0.78%上升到2014年的3.27%，其他能源消费从2005年的0.17%上升到2014年7.52%。

Inner Mongolia, energy consumption, the proportion of coal consumption dropped from 90.44% in 2005 to 81.73% in 2014, oil from 8.6% in 2005 to 7.48% in 2014, natural gas increased from 0.78% in 2005 to 2014 3.27%. Other energy consumption increased from 0.17% in 2005 to 7.52% in 2014.



3.2.3 煤炭替代 Coal substitution





3.2.3 煤炭替代

Coal substitution

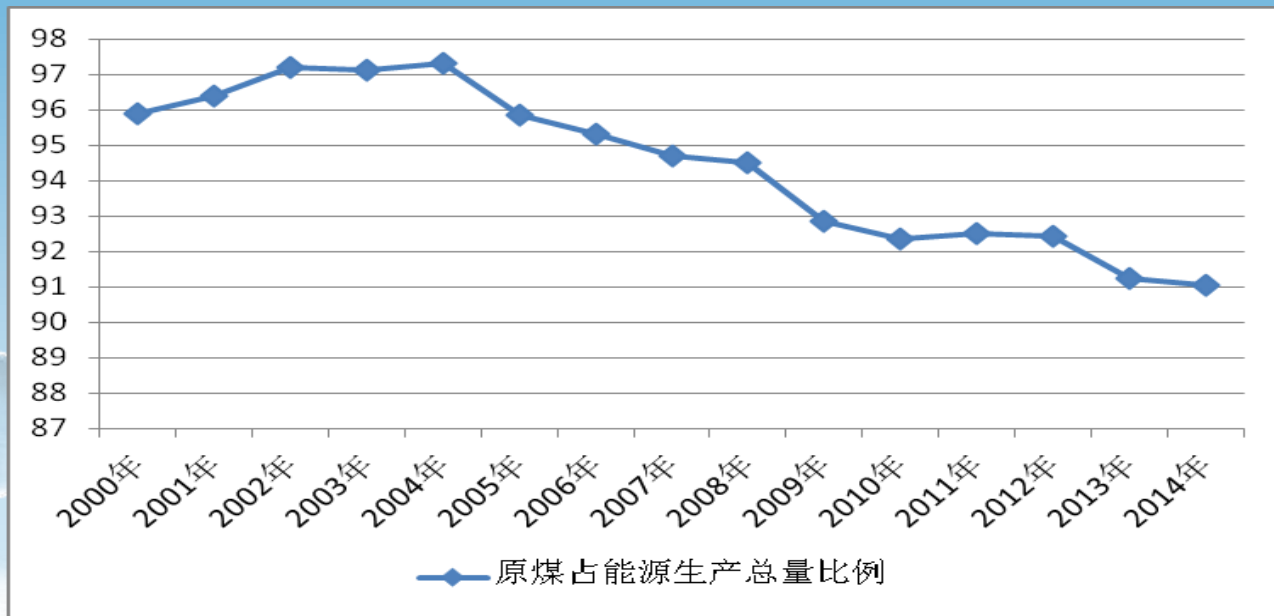
依据当前的速度趋势内蒙古2020年原煤生产占能源生产总量为87%，2050年为70%，2020年原煤消费占总消费量的78%，2050年达到50%。因此2020年达到全国煤控目标煤炭比重54.8%有相当难度。

According to the current trend of energy production in Inner Mongolia in 2020 accounted for 87% of total energy production, 70% in 2050, coal consumption in 2020 accounted for 78% of total consumption in 2050 to 50%. So in 2020 to reach the national coal-targeting target of 54.8% of the proportion of coal is quite difficult.



3.2.3 煤炭替代

Coal substitution





3.2.3 煤炭替代

Coal substitution

➤ 天然气替代(Natural gas substitution) :

内蒙古天然气资源主要集中于鄂尔多斯的苏里格气田，探明储量8017亿立方米，2014年生产307亿立方米，258亿立方米外运，当前内蒙古天然气也以外运为主，且外运增长速度快于区内消费的增长速度，短时间内实现区内天然气快速替代煤炭压力巨大。

Natural gas resources in Inner Mongolia are mainly concentrated in the Ordos Sulige gas field, proven reserves of 801.7 billion cubic meters, 2014 production of 30.7 billion cubic meters, 25.8 billion cubic meters Sinotrans, Inner Mongolia is also Sinotrans mainly natural gas, and Sinotrans growth rate Faster than the growth rate of consumption within the region, how to achieve rapid replacement of natural gas in a short period of time have huge pressure.



3.2.3 煤炭替代

Coal substitution

➤ **可再生能源替代：内蒙古当前可再生能源主要是风能和太阳能，由于位置和气候的特殊性在开发太阳能和风能方面具有良好的区位优势。**

Renewable energy alternatives: the current renewable energy in Inner Mongolia is mainly wind and solar energy, due to the special location and climate in the development of solar energy and wind energy has a good geographical advantage.

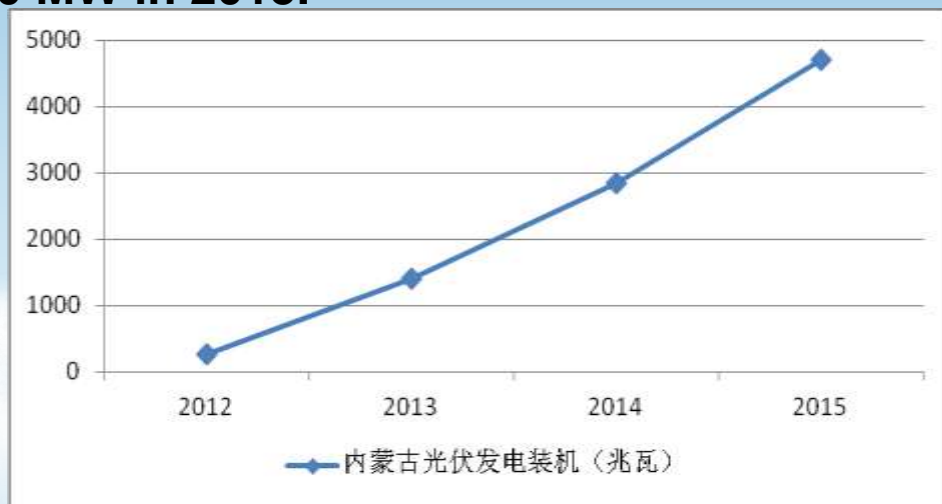


3.2.3 煤炭替代

Coal substitution

➤ 内蒙古太阳能光伏发电装机快速发展，并网容量从2012年的272兆瓦快速增长到2015年4710兆瓦。

Inner Mongolia solar photovoltaic power generation installed capacity of rapid development, and grid capacity from 272 MW in 2012 with rapid growth to 4710 MW in 2015.





3.2.3 煤炭替代

Coal substitution

➤ 内蒙古风力发电每年新增装机容量同火力发电相当。有些年份甚至高于火力发电。2015年风力发电量407.9亿千瓦时，占到内蒙古当年总发电量的10.4%。

Inner Mongolia, the annual installed capacity of wind power generation with considerable thermal power. Some years even higher than thermal power. Wind power generation in 2015 was 40.79 billion kwh, accounting for 10.4% of total electricity generation in Inner Mongolia.





4. 内蒙古控制煤炭生产与消费的政策建议

Policy Proposal for Controlling Coal Production and Consumption in Inner Mongolia

4.1 加强行业管理，积极稳妥化解过剩产能

Strengthening industry management, actively and securely to resolve excess capacity.

4.2 加快煤炭企业纵向重组，推进煤电用一体化发展

Speeding up the coal enterprise vertical restructuring, promoting the integration of coal and electricity development

4.3 积极发展新能源产业，减少碳排放

Actively develop new energy industry, reduce carbon emissions



4. 内蒙古控制煤炭生产与消费的政策建议

Policy Proposal for Controlling Coal Production and Consumption in Inner Mongolia

4.4 进一步降低煤炭企业成本，完善煤炭企业兼并重组的配套政策

To further reduce the cost of coal enterprises, and improve the supporting policies of coal enterprises mergers and acquisitions

4.5 国家应采取差别化去产能政策

Countries should take differentiated to capacity policies



4. 内蒙古控制煤炭生产与消费的政策建议

Policy Proposal for Controlling Coal Production and Consumption in Inner Mongolia

4.6 借助一带一路化解煤炭过剩产能

Along with The Belt and Road Initiative to resolve excess coal production capacity

4.7 大力发展战略性新兴产业，促进产业结构优化升级

Vigorously develop the strategic emerging industries, and promote the optimization and upgrading of industrial structure