中国碳市场（发电行业）概况与配额分配方法

Introduction on Power Sector Engagement in China's ETS and Allowance Allocation

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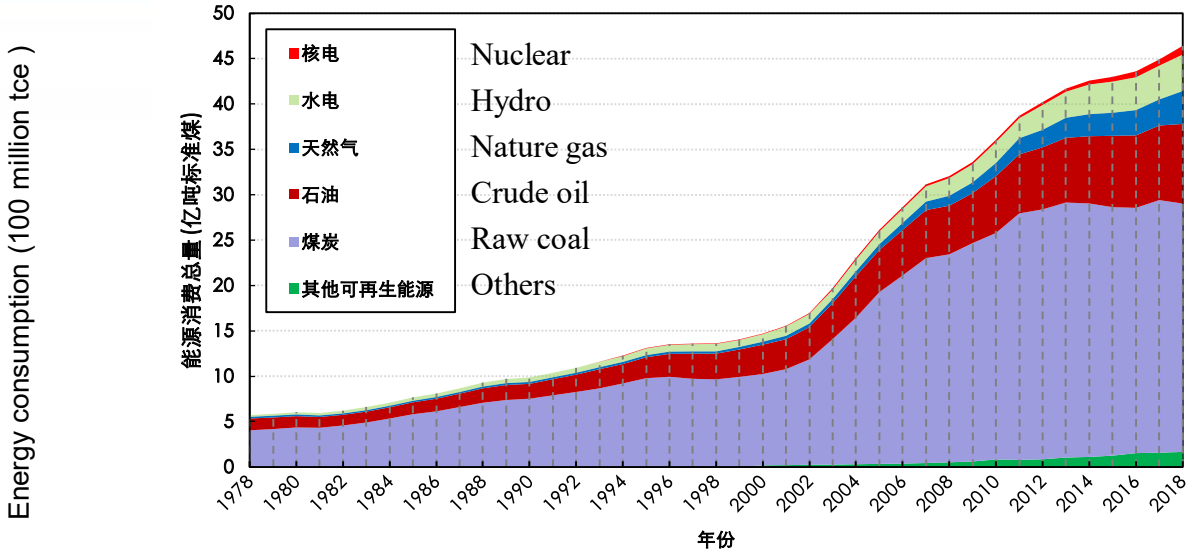
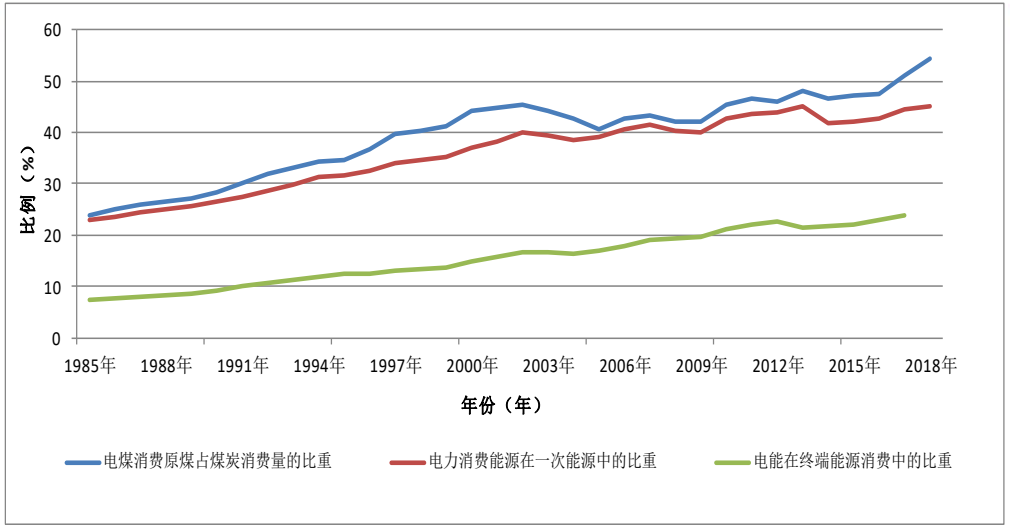
2020.10.14

能源电力特点1：消费以煤为主 趋于峰值 比例下降 电煤比重低

Energy and power characteristics 1: coal dominated consumption; intend to peak; decrease in proportion; low proportion of coal used in generation



Total Energy Consumption and Structure in China 1978-2018



The proportion of coal, power generation and electricity consumption in coal, primary energy and terminal energy respectively

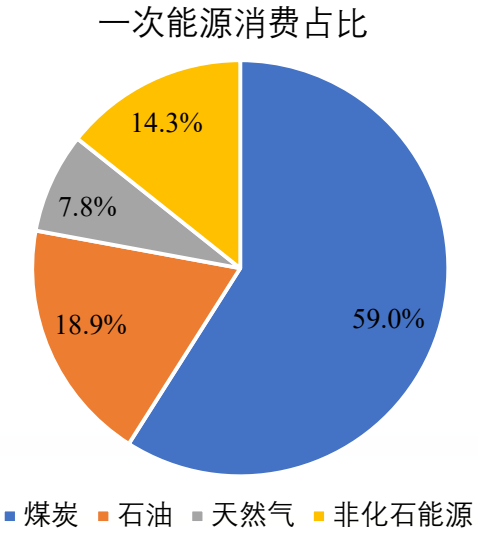
- 2019年能源消费总量48.6亿吨标准煤，煤炭消费量占能源消费总量的57.7%(比1978年降低13个百分点）

  Total energy consumption reached 4.86b tons of coal equivalent in 2019, coal consumption accounts for 57.7% in total energy consumption (13 percentage points lower than 1978)

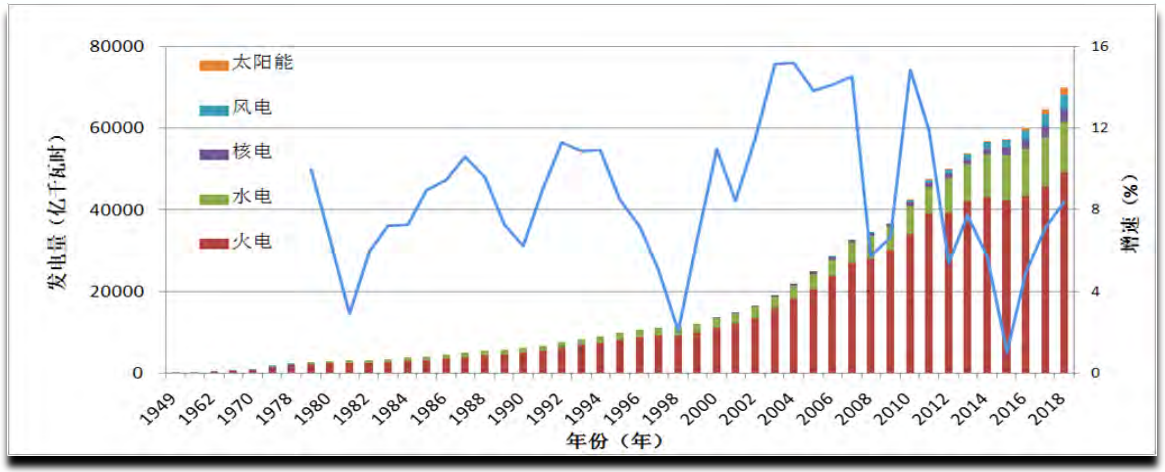
- 煤炭消费量近几年几乎未增长 Coal consumption has barely increased in recent years
- 非化石能源在一次能源消费中占比提高至15.3%

  Non-fossil energy increased to 15.3% in primary energy consumption
- 石油对外依存度达70%，天然气达45% Oil dependence is 70% and natural gas is 45%
- 电煤长期以来占煤炭消费量的50%左右，且占比会不断提升

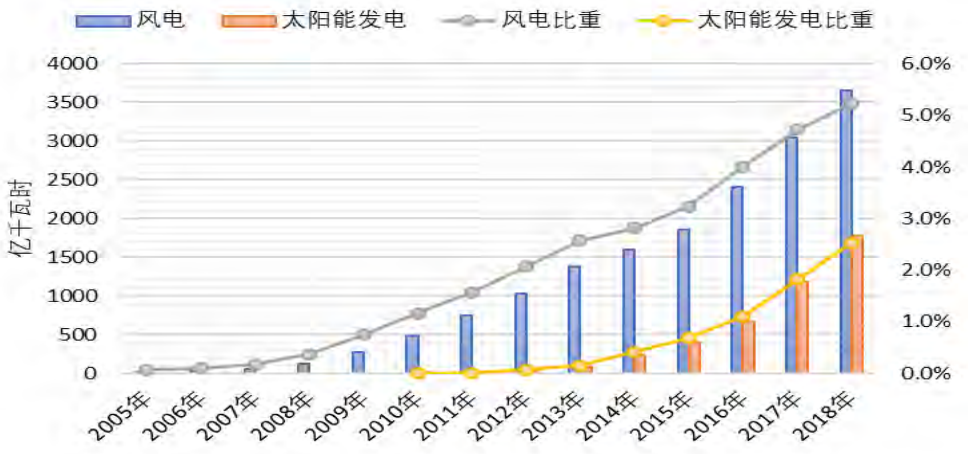
  50% of coal consumed in power generation for a long period, and the proportion will continuously increase



能源电力特点2：电力持续快速发展 非化石能源比重逐步提高
Electricity's continuously rapid development; proportion of non-fossil energy is gradually increasing



新中国成立以来主要年份各电源发电量及增速
Power generation and growth rate of each power source in major years



◆2019年年发电量达7.32万亿千瓦时，与1949比增长近1703倍，平均增长率分别为11.2%

In 2019, the annual power generation reached 7.32 trillion kWh, which was nearly 1703 times higher than that in1949. The average growth rate was 11.2%.

◆2010年前，火电发电量长期占比75%～83%；煤电发电量占比约75%。

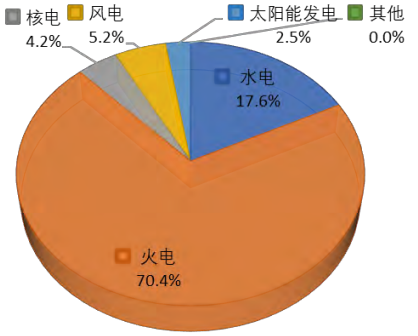
Before 2010, thermal power generation usually accounts for 75%-83%, among which 75% are coal-fired power.

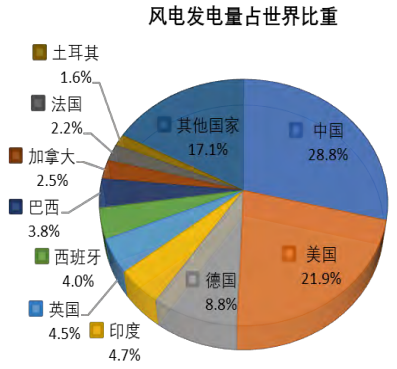
◆2019年，煤电发电量占比62.3%（装机约10.04亿千瓦）。

In 2018, coal-fired power generation accounted for 62.3% of total generation (capacity about 1004GW).

◆2019年，非化石能源装机（含生物质发电）占40.8%，发电量占比31.1%。

In 2019, non-fossil fuel(incl. biomass) capacity accounted for 40.8% of total capacity, and its generation was 31.1% of total generation.

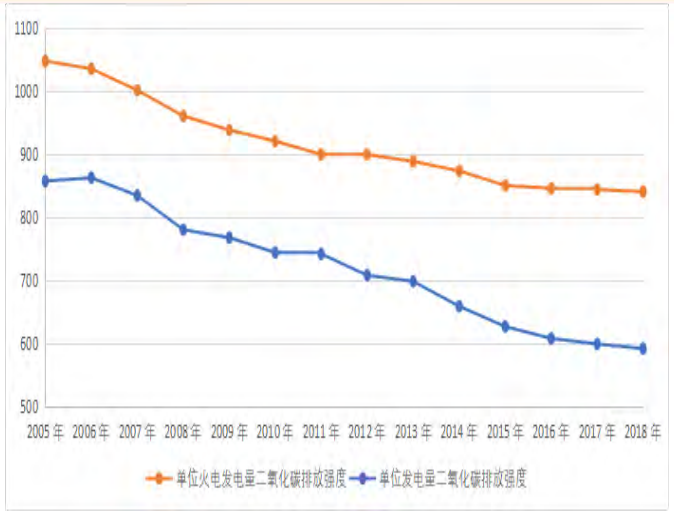


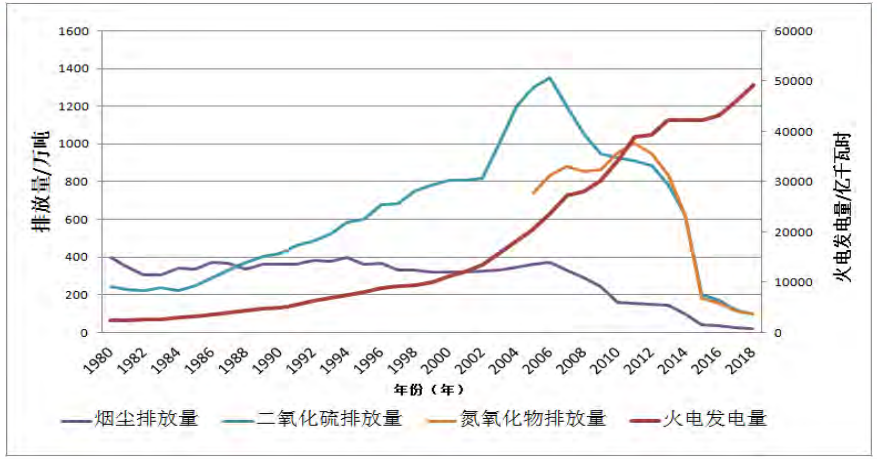


➢2019年，中国风电、太阳能发电装机容量分别占世界的34. 9%、32. 6%

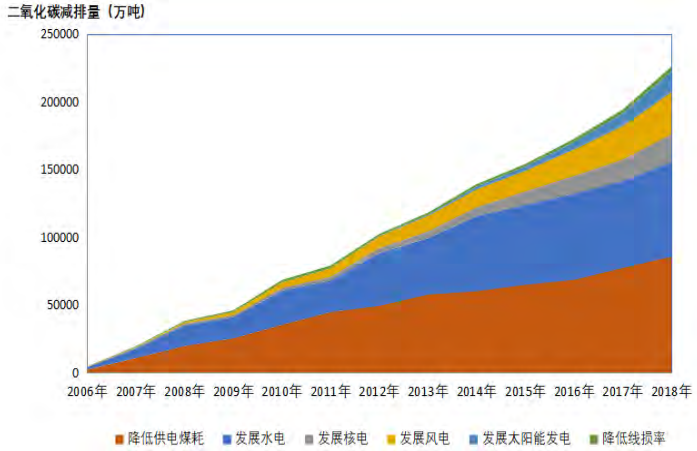
➢In 2019, installed capacity of China's wind power and solar power accounted for 34. 9%、32. 6% of the world respectively.

能源电力特点3：煤电清洁低碳发展成效显著
Remarkable results on coal-fired generation's low-carbon development





2019年3项污染物排放强度之和为0.42克/千瓦时



◆ 1978年火电和全电量碳强度1312 g/kWh和1083 g/kWh， 2019年降低到838 g/kWh和577 g/kWh，分别降低了36. 1%、46. 7% 。

In 1978, thermal power and overall carbon intensity were 1312 g/kWh and 1083 g/kWh, which decreased to 838 g/kWh and 577 g/kWh in 2018, respectively, by 36. 1% and 46. 7% %.

◆ 以2005年为基准年， 2006-2019年，通过发展非化石能源、降低供电煤耗和线损率等措施，电力行业累计减少二氧化碳排放约159. 4亿吨。其中，供电煤耗降低对电力行业二氧化碳减排贡献率为37%，非化石能源发展贡献率为61%。

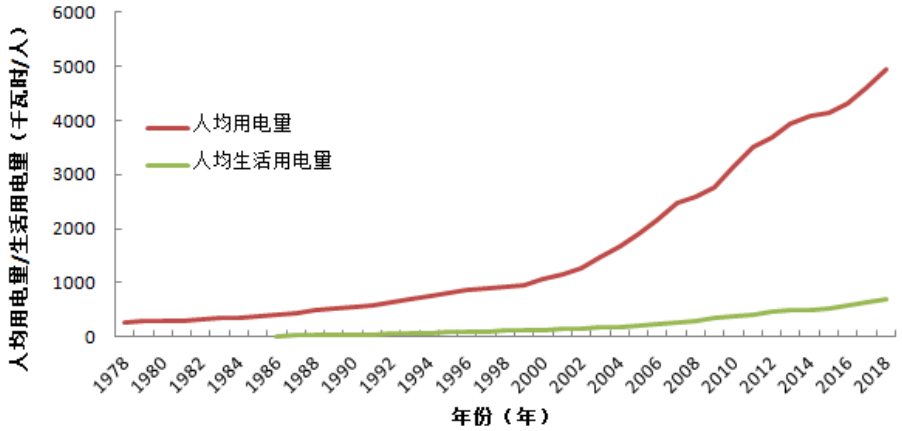
◆ **With 2005 as the base year, 2006-2019, through the development of non-fossil energy, reducing coal consumption and line loss rate of power supply, the power industry has reduced carbon dioxide emissions by about 15.9 billion tons. Among them, the reduction of coal consumption by power supply contributed 37% to the carbon dioxide emission reduction of the power industry, and the contribution rate of non-fossil energy development was 61%.**

◆ 2014年OECD国家，每千瓦时电量二氧化碳排放为408克、美国为473克、世界平均493克，均低于我国，主要原因是我国煤电比重高。

In the OECD countries in 2014, the carbon dioxide emissions per kWh were 408 grams, the United States was 473 grams, and the world average was 493 grams, which was lower than that of China. The main reason was that China had a high proportion of coal fired power.

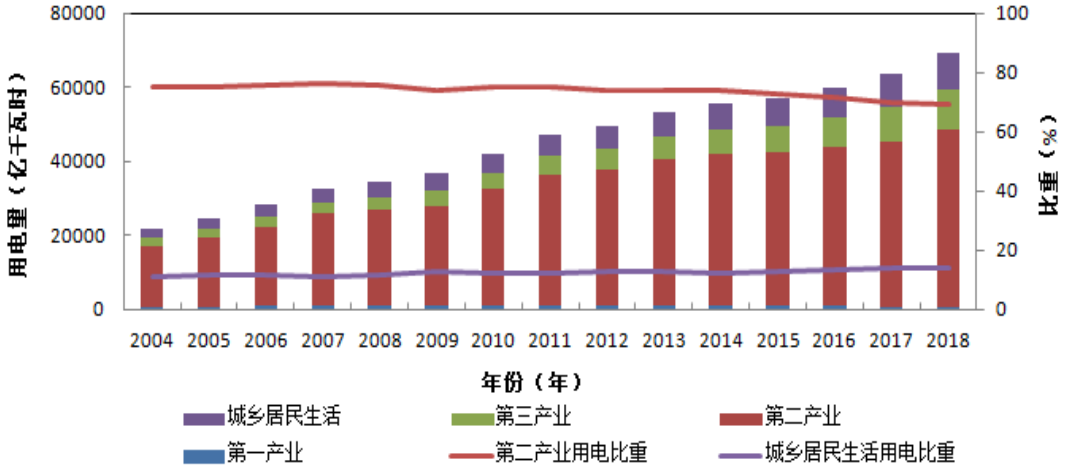
能源电力特点4：用电结构具有显著的发展中国家特点

Power structures have significant characteristics of developing countries



典型国家人均用电量和人均生活用电量比重

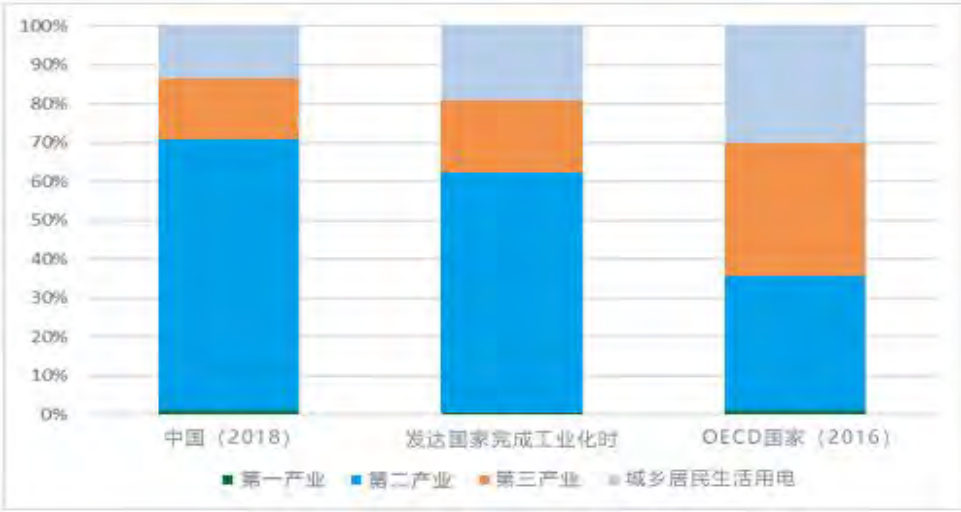
Percentage of average electricity consumption and average household electricity consumption in a typical country



各产业用电量和用电比重

Electricity consumption and electricity proportion of each industry

年度	1990年			2000年			2014年		
	PCCE	人均生活用电量	比重（%）	PCCE	人均生活用电量	比重（%）	人均用电量	人均生活用电量	比重（%）
美国USA	11691	3696	**31.6**	13659	4222	**30.9**	12962	4440	**34.3**
日本JPN	6842	1539	**23.4**	7970	2031	**25.4**	7829	2155	**27.5**
法国FRA	5975	1607	**26.8**	7260	2124	**29.3**	6955	2258	**32.5**
中国CHN	540	41	**7.6**	1067	132	**12.4**	4102	526	**12.3**



2015年	2016年	2017年	2018年	2019年	2020年	2030年	2050年	2060年
能源消费总量（亿吨标准煤）								
Total energy consumption (100 million tons of standard coal)								
43	43.6	44.9	46.4	48.6	50以下 (48左右)	60以下		
非化石能源消费比重 **Non-fossil energy consumption**								
12.10%	13.30%	13.80%	14.30%	15.30%	15%	20%左右	展望50%以上	
单位国内生产总值二氧化碳排放**Carbon emission for per unit of GDP**								
		↓5.1% (比2016年)	↓4.0% (比2017年)	↓2.6% (比2018年)	↓18% (比2015年)	↓60%-65% (比2005年)		
			↓45.8% (比2005年)		↓40%-50% (比2005年)			

碳中和

Carbon neutraliza-tion

◆《碳交易市场交易管理办法》

The Measures for the Administration of Carbon Trading Market Transaction

碳排放权交易实施细则，详细规定各个环节的实施程序、资格要求、主体责任等。

It is the implementation rules for carbon emission trading which specified the implementation procedures, qualification requirements, and main responsibilities of each stakeholders.

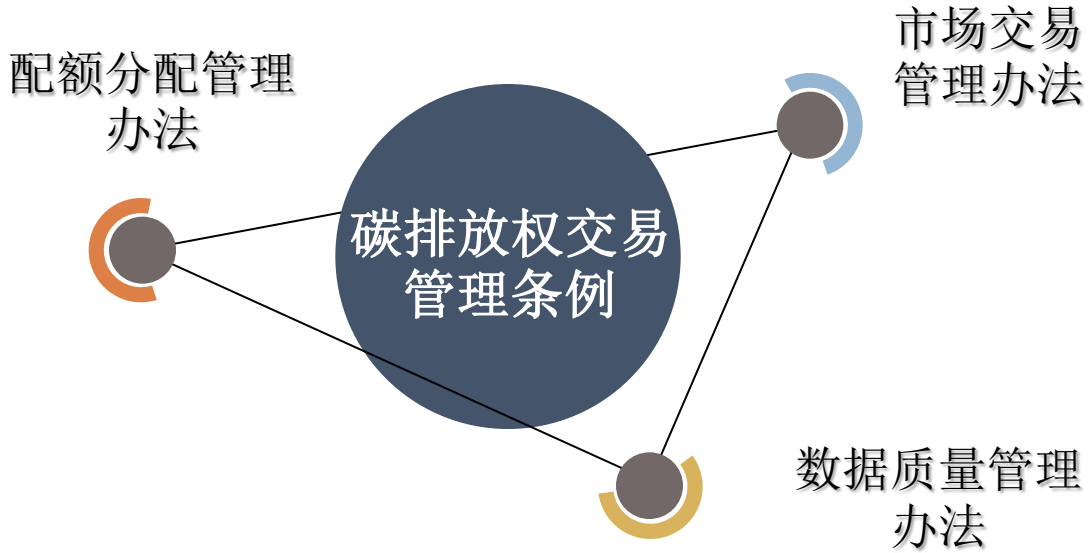
◆ 相关技术标准

Related technical standards

碳排放核算、报告、核查等具体工作的技术标准。

Technical standards for specific tasks such as carbon accounting, reporting, and verification.

构建“1+3”的政策法规体系
“1+3” Policies’ system



发电行业配额分配原则
Principle of quota allocation in power generation industry

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Principle & Goals

- **通过配额分配实现对燃气机组、超超临界、热电联产等高效率低排放机组的正向激励**
  The quota allocation could provide a positive incentives to the gas units, ultra-supercritical units and cogeneration units
- **充分考虑相对落后的机组在国民经济和电力系统中的地位，配额发放不宜过紧，以给予一定生存空间，逐步淘汰**
  The quota allocated to backward units should not be too tight, so as to give enterprises a living space and gradually phase out backward units
- **促进电力占终端能源消费比重提高，鼓励以电代煤，以电代油**
  To increase the share of electricity in terminal energy consumption, and encourage the substitution of electricity for coal and oil
- **促进电煤占煤炭消费比重的提高，特别是加强散煤替代**
  To increase the share of thermal coal in coal consumption, Strengthen the replacement of bulk coal

哪些机组纳入全国碳市场（发电行业）
Included units

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分配配额+履约

Allocation and compliance

火力发电机组（4411）

thermal power units

✓ **热电联产机组（4412）**

cogeneration units

✓ **自备电厂（特殊燃料机组除外）**

owned power plant

暂不分配配额、暂不履约

No allocation and compliance

✓ **纯生物质发电机组**

Pure biomass generating set

✓ **仅使用自产废气、尾气、煤气的发电机组，包括混烧自产二次能源热量占比超过10%的化石燃料燃烧发电机组**

Generating sets that only use their own waste gas, tail gas and gas

✓ **燃油机组、整体煤气化联合循环机组（IGCC）、内燃机组**

Oil-burning units, Integrated Gasification Combined Cycle(IGCC), internal combustion units

✓ **特殊燃料机组（如煤层气、石油伴生气、油页岩、油砂、可燃冰等）发电机组**

Special fuel-burning units (such as CBM, casing-head gas, oil shale, oil sands, flammable ice, etc)

NOTE: Pure heating facilities without generating capacity will not be included

配额分配方法——基准值法

Quota allocation method -- benchmarking method

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第一步 STEP 1

- 样本选取并按照分配方案进行分类

Samples are selected and classified according to the distribution scheme

第二步 STEP 2

- 各类样本按照供电排放强度由低到高的顺序进行排列

All kinds of samples are arranged in the order of power supply emission intensity from low to high

- 按上述排列顺序，选取供电量之和占样本总供电量一定比例的机组，计算其供电加权平均碳排放强度作为该类机组基准值的参考值

In that order, Select some units whose total power supply accounts for a certain proportion of the total power supply of the sample. the average carbon emission intensity weighted by power supply is calculated as the benchmarking value

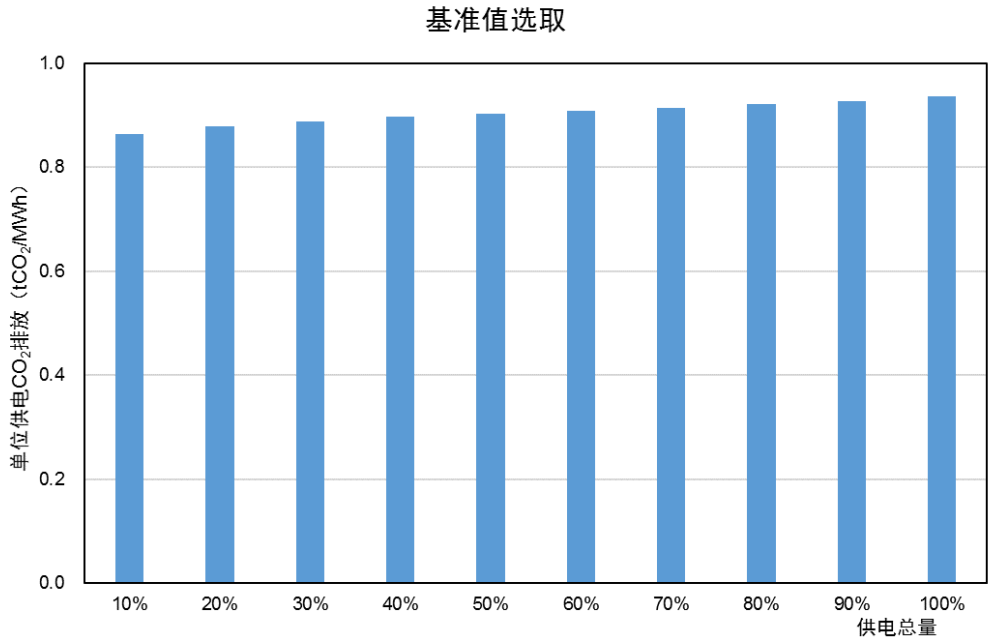
第三步 STEP 3

- 根据各类机组不同方案下的减排量及减排率确定基准线

The base line is determined according to the emission reduction and emission reduction rate of various units under different schemes

$$\text{样本供电碳排放强度} = \frac{\text{样本当年供电排放量}}{\text{样本当年总供电量}}$$

$$\text{power supply carbon emission intensity} = \frac{\text{power supply emissions in Current year}}{\text{total power supply emissions in Current year}}$$



基准值
benchmarking value

- 综合考虑《全国碳排放权交易市场建设方案（发电行业）》中基础建设期、模拟运行期、深化完善期的安排，根据“配额总量适度从紧、价格合理适中”的总体要求提出配额分配方案
- Taking into account the arrangement of the basic construction period, simulated operation period and deepened improvement period in the National Carbon Emission Trading Market Construction Plan (Power Generation Industry), the quota allocation scheme is proposed according to the overall requirements of "moderately tight quota quantity and reasonable and moderate price"
- 通过配额试算充分听取企业意见
- We will fully listen to the opinions of enterprises through trial calculation of quotas

方案一 PLAN A

基准线分类 Classification	供电基准值 tCO_2/MWh	供热基准值tCO_2/GJ
常规燃煤机组 Conventional coal-fired unit	1.015	0.135
非常规燃煤机组 Unconventional coal-fired units	1.120	
燃气机组 Gas-fired unit	0.382	0.059

方案二 PLAN B

基准线分类	供电基准值 tCO_2/MWh	供热基准值 tCO_2/GJ
300MW等级以上常规燃煤机组 Conventional coal-fired units of 300MW or above	0.989	0.135
300MW等级及以下常规燃煤机组 Conventional coal-fired units of 300MW or below	1.068	
非常规燃煤机组 Unconventional coal-fired units	1.120	
燃气机组 Gas-fired unit	0.382	0.059

常规燃煤机组配额分配方法
Method of quota allocation for conventional coal-fired units

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机组的CO_2排放配额计算公式为：
Quota calculation formula

机组供电CO_2配额
Quota for power supply

机组供热CO_2配额
Quota for heat supply

机组CO_2配额总量：
Total quota

$$A = A_e + A_h$$

$$= Q_e \times B_e \times F_l \times F_r + Q_h \times B_h$$

机组供电量
Power supply

供电排放基准
Emission baseline for power supply

冷却方式修正系数
Correction factor of cooling mode

供热量修正系数
Correction factor of heating quantity

机组供热量
Heat supply

供热排放基准
Emission baseline for heat supply

冷却方式修正系数：
Correction factor of cooling mode

air cooling: 1.05

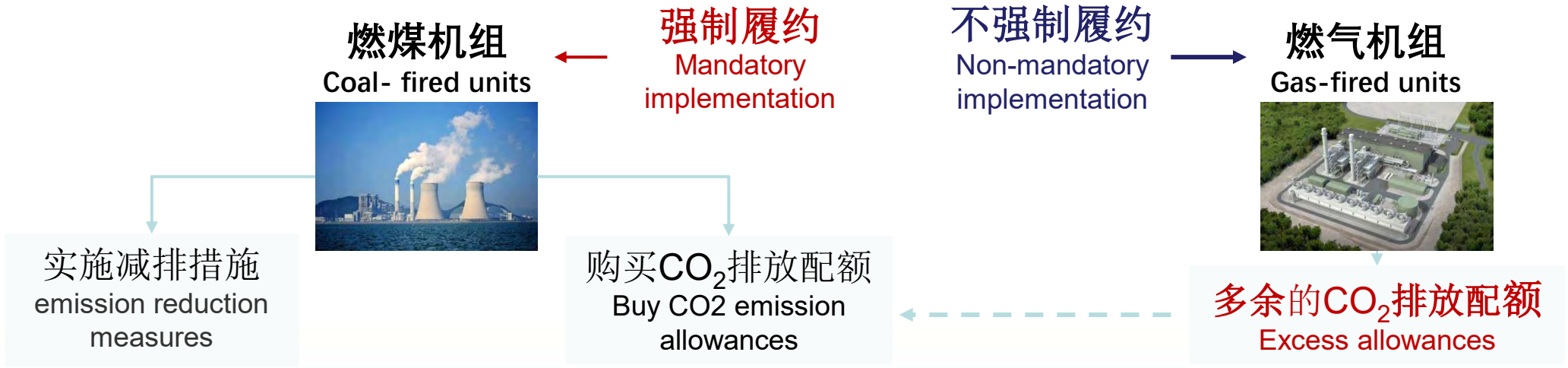
water cooing: 1

供热量修正系数：
Correction factor of heating quantity

1- 0.23× Heating ratio

履约管理
Compliance Management

- 燃煤机组必须严格遵守CO_2排放限值要求，履行自身的碳减排责任和义务
- Coal-fired units must strictly comply with the requirements of CO2 emission limit and fulfill their own responsibilities and obligations for carbon emission reduction
  - 实施减排措施 Implementing emission reduction measures；
  - 在碳排放权交易市场上购买CO_2排放配额 Buy CO2 emission allowances in the carbon emission trading market；
- 配额履约缺口上限值为企业碳排放量的20%
- The upper limit of the compliance gap is 20% of the enterprise's carbon emissions
- 鼓励燃气机组按CO2排放限值要求进行生产，暂不强制要求企业对其所拥有的燃气机组履行碳减排责任和义务
- Encourage the production of gas-fired units according to the requirements of CO2 emission limit, and do not force enterprises to fulfill the responsibility and obligation of carbon emission reduction for their owned gas-fired units
  - 燃气机组多余的配额可以到碳排放权交易市场上出售
  - Excess allowances for gas-fired units can be sold on the carbon market



对碳市场建设的思考-需要解决主要问题

Consideration on the Construction of Carbon Market-Major Problems Need to be Solved

- 发现合理碳价，逐步扩大碳市场交易品种和交易范围，促进低成本减碳；

Find reasonable carbon price; gradually expand the trading varieties and trading scope of the carbon market; promote low-cost carbon reduction.

- 试点碳市场存在成交低迷、流动性差、碳价过低、履约期效应等问题；

The carbon trading pilots' problems include low turnover, poor liquidity, low carbon prices, and the effect of the compliance period.

- 电厂能效水平不断提高，碳减排贡献巨大，但未来减碳空间有限，配额分配对企业影响很大；
The energy efficiency level of power plants is continuously improving, which contribute a lot to carbon emission reduction. However, in the future, carbon reduction space is limited, and allocation will have great impact on enterprises.

- 企业管理成本和交易成本较高，核查方式有待进一步改进.

Enterprise management costs and transaction costs are high, and the verification method needs further improvement.

谢 谢！

Thanks！




中国电力企业联合会

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