

中国煤电发展情况

国家能源局

国家电力规划研究中心

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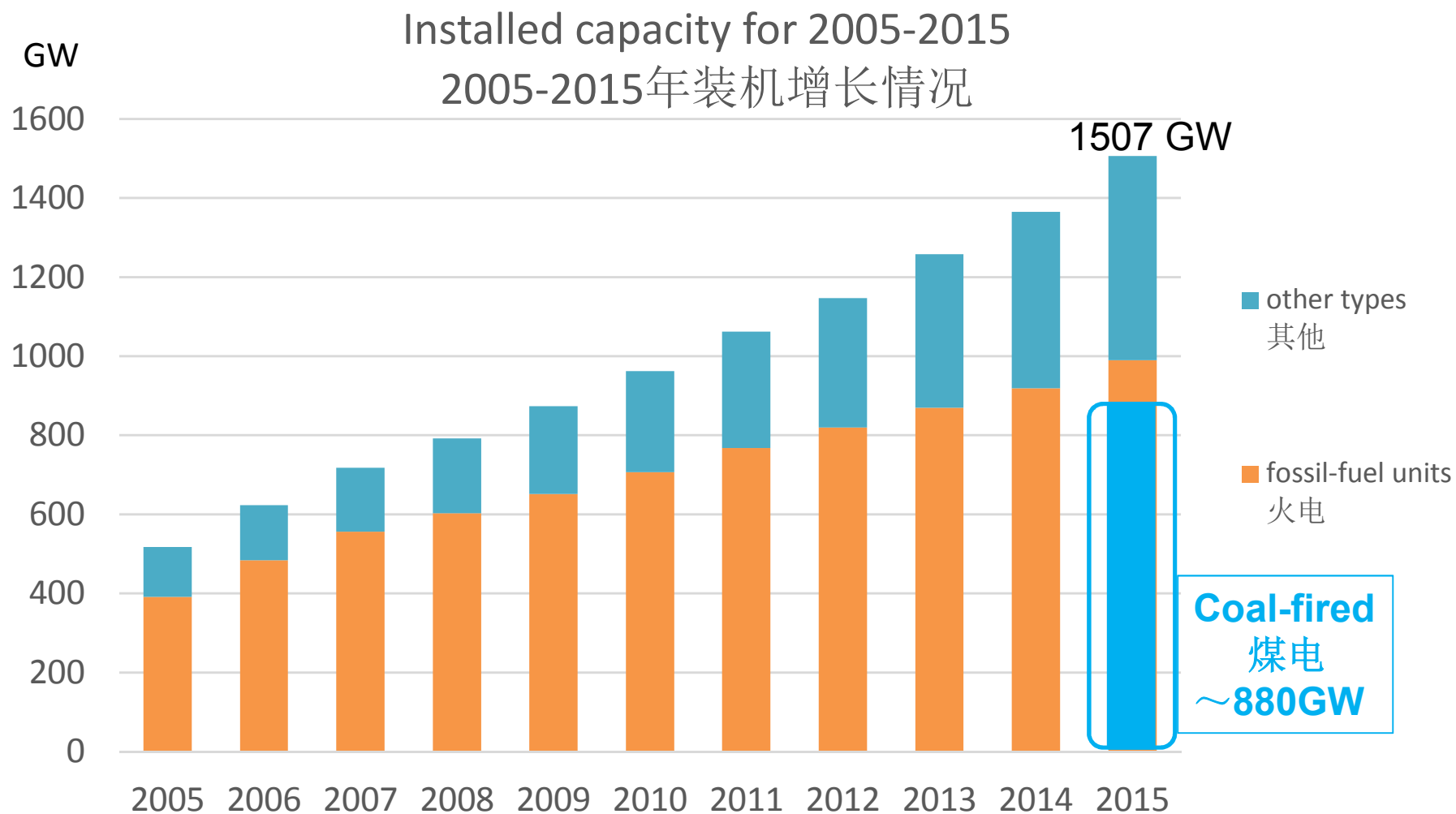
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China's power generation and coal-fired units

中国电力概况和煤电发展情况



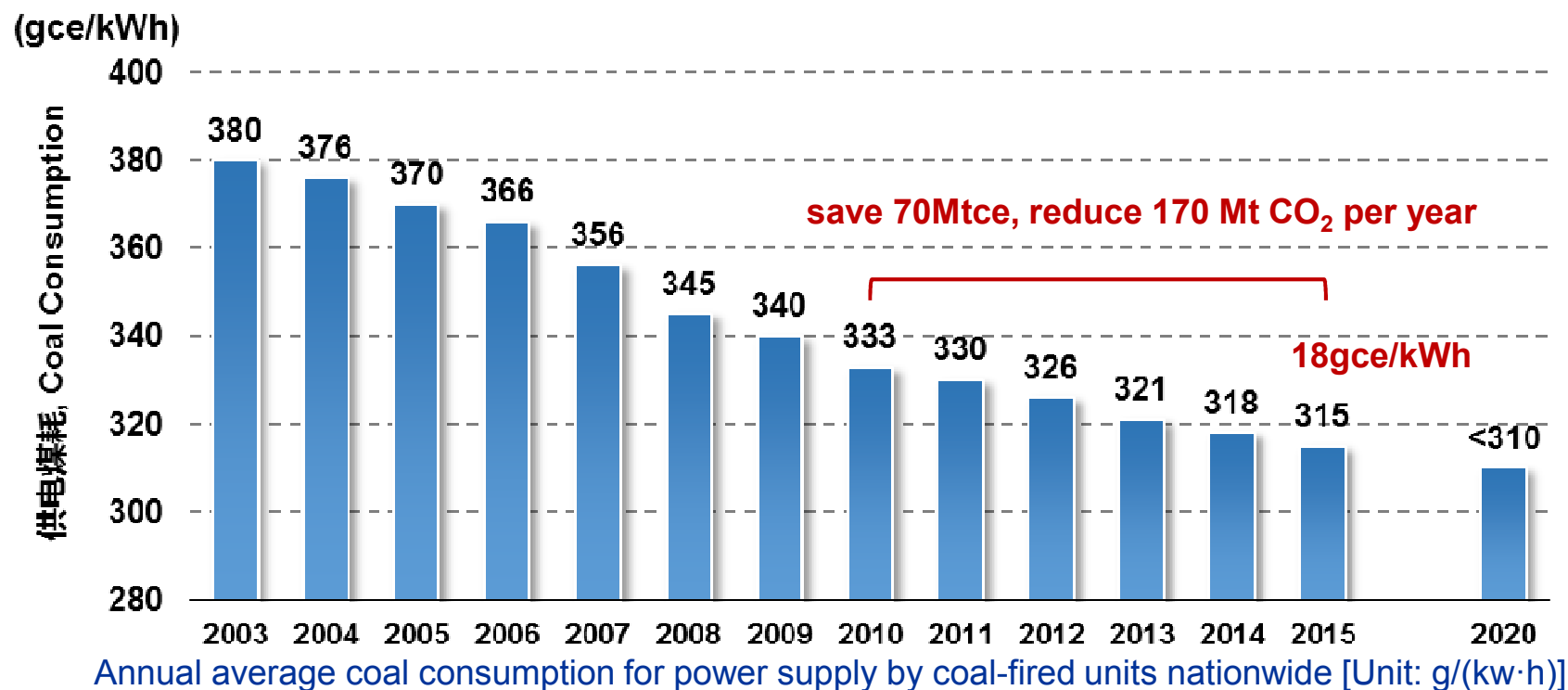
China's power generation and coal-fired units

中国电力概况和煤电发展情况

Development of coal-fired power generation technology 煤电效率达到新水平

- Owing to eliminating backward capacity and upgrading of coal-fired power plants, the average coal consumption keeps decreasing. By the end of 2015, 315gce/kWh, has reached world-class levels.

持续推进煤电机组淘汰落后产能和节能改造升级，供电煤耗持续下降。2015年降至315克标煤/千瓦时，达到世界先进水平。十二五期间每年节约标煤7000万吨，减排二氧化碳1.7亿吨。



中国煤电机组平均供电煤耗的逐年变化趋势

China's power generation and coal-fired units 中国电力概况和煤电发展情况

Double Reheat USC Cycles
二次再热技术



China's power generation and coal-fired units

中国电力概况和煤电发展情况

SC CFB 超临界循环流化床

Plant	Unit NO.	Capacity	Date
Baima, Sichuan 四川白马		600MW	2013.4.14
Guojin, Shanxi 山西国金	#1	350MW	2015.9.18
Hequ, Shanxi 山西河曲	#1	350MW	2015.9.28
Hequ, , Shanxi 山西河曲	#2	350MW	2015.11.13
Huadian Shuozhou 华电朔州	#1	350MW	2015.11.3
Huadian Shuozhou 华电朔州	#2	350MW	2015.12.14
Huamei, Xuzhou 徐州华美	#1	350MW	2016.1.31
Huamei, Xuzhou 徐州华美	#2	350MW	2016.2.27
Hepo, Shanxi 山西河坡	#1	350MW	2016.1.30
Hepo, Shanxi 山西河坡	#2	350MW	2016.7.15
Total		3750MW	

Largest SC CFB in the world
世界最大超临界CFB

- So far, China has 10 SC CFB units under operation, total capacity 3750MW.
截至目前，中国已投运10台超临界流化床机组，总装机3750MW。

China's power generation and coal-fired units 中国电力概况和煤电发展情况

IGCC 整体煤气化联合循环



- Capacity: 265MW
发电功率：265MW
- Power supply efficiency: 41%
供电效率：41%
- Coal consumption rate: 255.19g/kWh
发电煤耗：255.19g/kWh
- Efficiency of gasify furnace: 95%
气化炉热效率：95%
- Efficiency of cold gas: 84%
冷煤气效率：84%
- Carbon transformation rate: 99.2%
碳转化率：99.2%

In 2015, accumulated operating hours: 5500h; cumulative generation: 12.02×10^8 kWh

2015年累计运行超过5500小时，累计发电12.02亿千瓦时

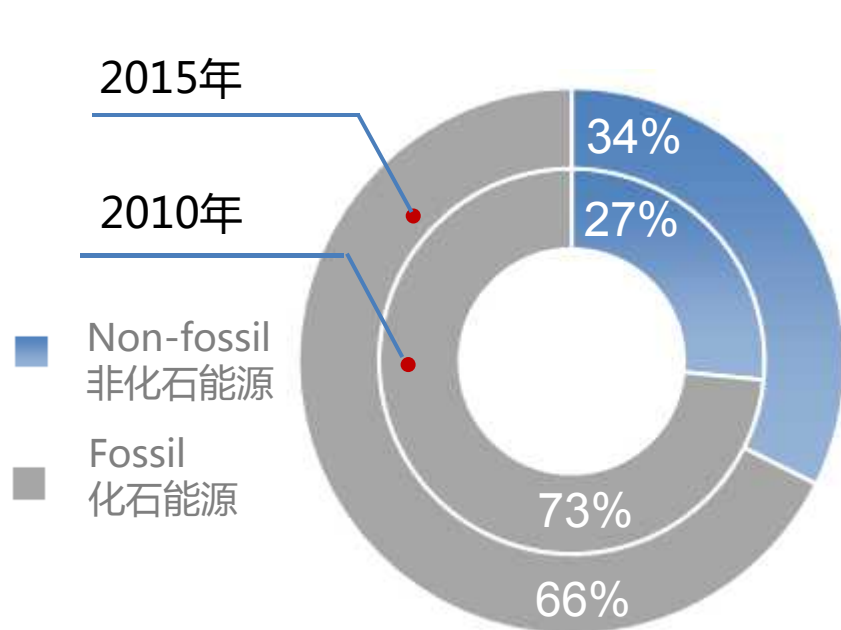
As of Aug 17 2016, the first continuous operation of the gasifier has been up to 117 days.

截至2016年8月17日，气化炉首次连续运行首次达到117天。

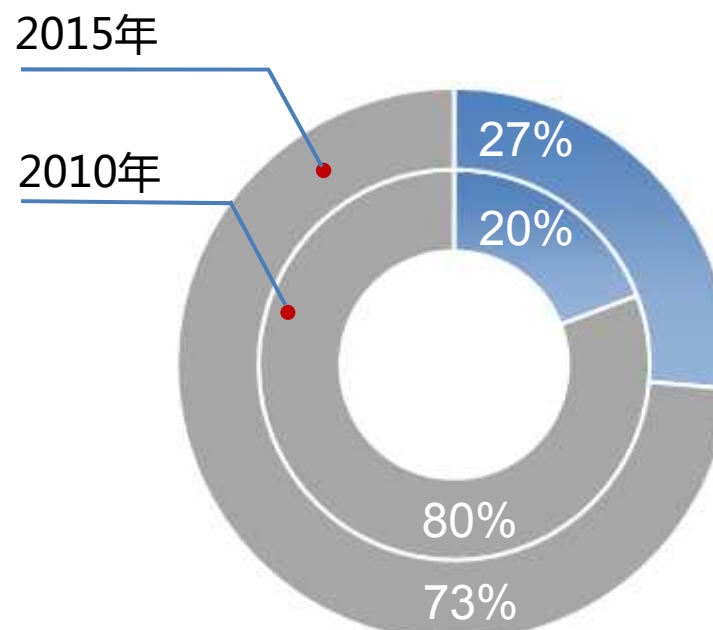
China's power generation and coal-fired units

中国电力概况和煤电发展情况

Recently, China's electrical structure was continuous optimized
近年来，中国电力结构持续调整优化



Structure of installed electricity capacity of
2010 and 2015
2010年和2015年电力装机构成对比



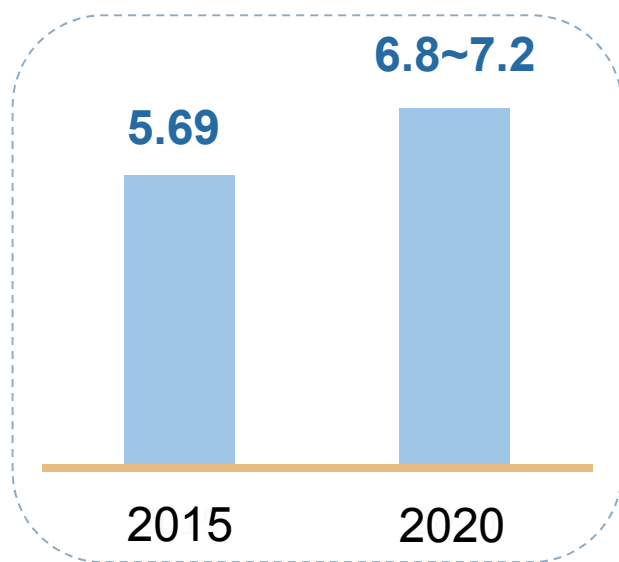
Comparisons of electricity production of
2010 and 2015
2010年和2015年发电量对比

China's power generation and coal-fired units

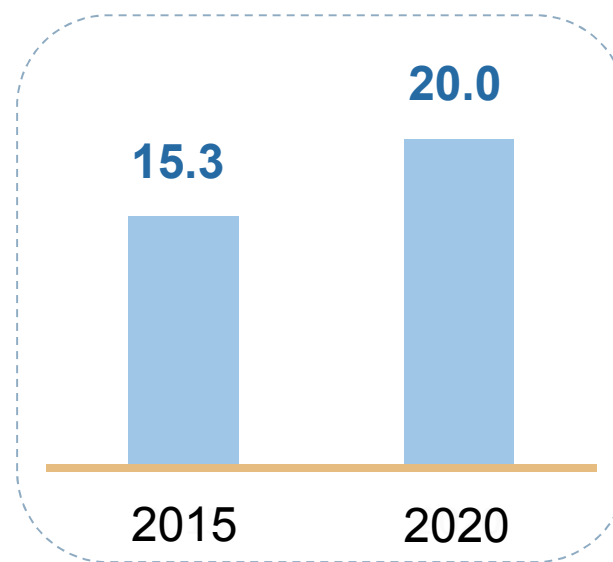
中国电力概况和煤电发展情况

13th Five-Year Plan for power development 十三五电力规划

- 2020 Target: the total power consumption 6.8~7.2 trillion kWh, the total installed capacity 2 billion kW.
生产能力目标：2020年，全社会用电量6.8~7.2万亿千瓦时，总装机20.0亿千瓦。



用电量(万亿千瓦时)
(年均增长3.6~4.8%)
Total Power Consumption (10¹² kWh)
Average annual growth 3.6~4.8%



总装机(亿千瓦)
(年均增长5.5%)
Total Power Capacity (100 GW)
Average annual growth 5.5%

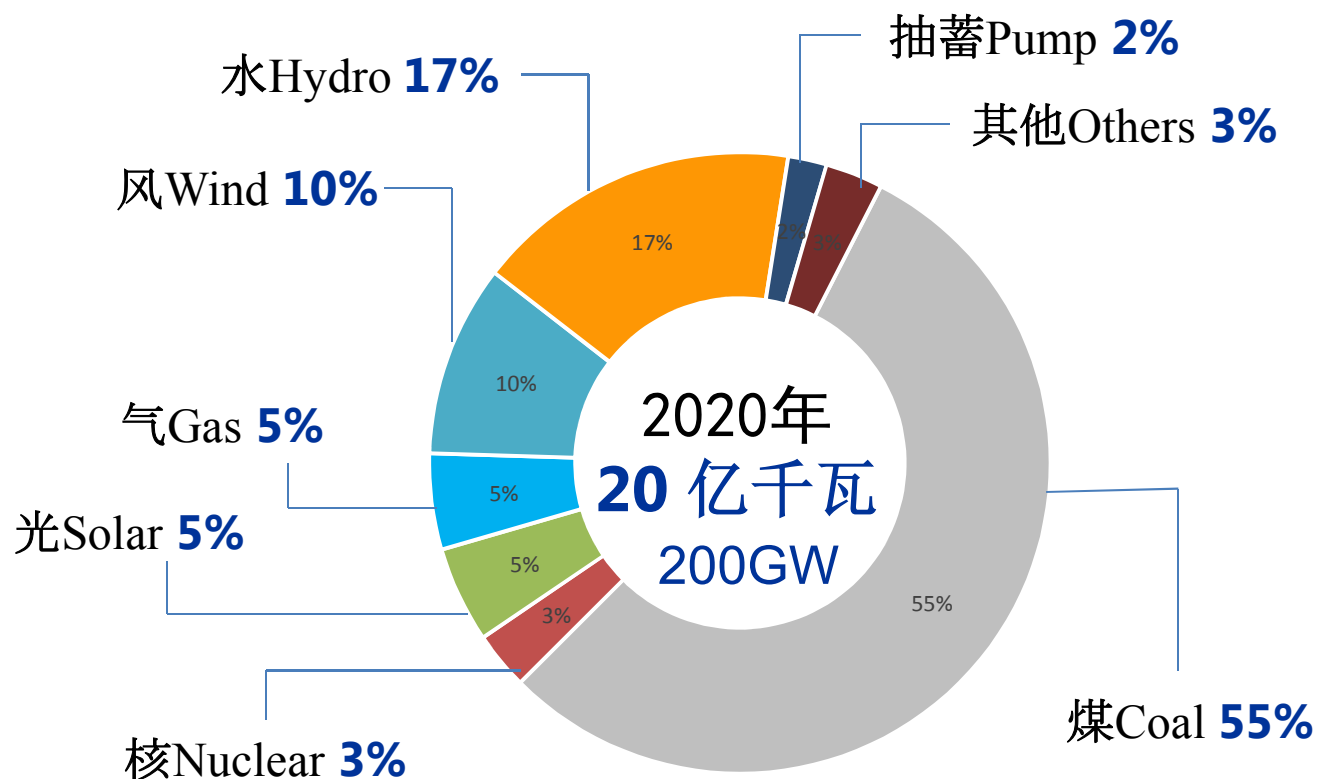
China's power generation and coal-fired units

中国电力概况和煤电发展情况

13th Five-Year Plan for power development 十三五电力规划

- By 2020, the coal power capacity will be controlled within 1.1 billion kilowatts, and the non-fossil energy power capacity will reach 770 million kilowatts, accounting for 39%.

2020年，煤电装机力争控制在11亿千瓦以内；非化石能源发电装机达到7.7亿千瓦左右，占比约39%。



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Relevant policies of coal-fired power generation

近期煤电相关政策

In order to control the environment pollution and honor the solemn commitment to implement carbon emission reduction, China issued series of policy, and these measures promote clean and efficient development of coal-fired power generation.

中国政府为了控制环境污染，并兑现实施碳减排的庄严承诺，连续出台了一系列的有关煤电的政策文件，有力促进了煤电的清洁高效发展。



《Full implementation of ultra low emission and energy saving transformation of coal-fired power plants》
《全面实施燃煤电厂超低排放和节能改造工作方案》

《Notice on promoting of an orderly development of China's Coal-fired power plants》
《关于促进我国煤电有序发展的通知》

《 Notice on canceling a number of coal power projects do not have approval conditions》
《关于取消一批不具备核准建设条件煤电项目的通知》

《 Notice on further regulation of coal-fired power planning and construction》
《关于进一步调控煤电规划建设的通知》

《 Notice on further eliminating backward production capacity of Coal-fired power industry 》
《关于进一步做好煤电行业淘汰落后产能工作的通知》

《Regulations of combined heat and power generation》
《热电联产管理办法》

Relevant policies of coal-fired power generation

近期煤电相关政策

Full implementation of ultra low emission and energy saving transformation of coal-fired power plants

全面实施燃煤电厂超低排放和节能改造工作方案

- Nationwide, conditional coal-fired power plants achieve ultra low emission
具备条件的燃煤机组要实施超低排放改造。
 - ≥ 300 MW, excluding CFB and “W” flame boiler units
 - Eastern region: before 2017
 - Middle region: before 2018
 - Western region: before 2020
- Nationwide, non-conditional coal-fired power plants achieve emission standard (2011)
不具备改造条件的机组要实施达标排放治理。改造机组容量约1.1亿千瓦。
- Shut down low energy-efficiency units.
落后产能和不符合相关强制性标准要求的机组要实施淘汰。
- Co-ordinate transformation of energy-saving and ultra-low emissions
要统筹节能与超低排放改造。

Relevant policies of coal-fired power generation

近期煤电相关政策

Instruction of promoting the development of China Coal-fired power plants
关于促进我国煤电有序发展的通知

Establish risk early warning mechanism

建立风险预警机制

Strictly control the scale of coal-fired power plants

严控煤电总量规模

Orderly promote the construction of coal-fired power plants

有序推进煤电建设

Control additional units strictly
严控新增装机



Optimize existing units
做优存量装机



Promote the structural optimization
促进煤电结构优化

Relevant policies of coal-fired power generation

近期煤电相关政策

Notice on Further eliminating backward production capacity of coal-fired power industry

关于进一步做好煤电行业淘汰落后产能工作的通知

- Units with small capacity and long operation time
- 容量小，服役时间长的机组

- Retrofitted units with coal consumption rate still higher than the permission limit
- 改造后供电煤耗仍达不到限额的机组

- Units with pollutant emission not match the standard
- 污染物排放不符合国家环保要求的机组

During the 13th Five-Years,
eliminate backward coal-fired
power units about 20GW

全国“十三五”期间力争淘汰落后煤电机组约2000万千瓦

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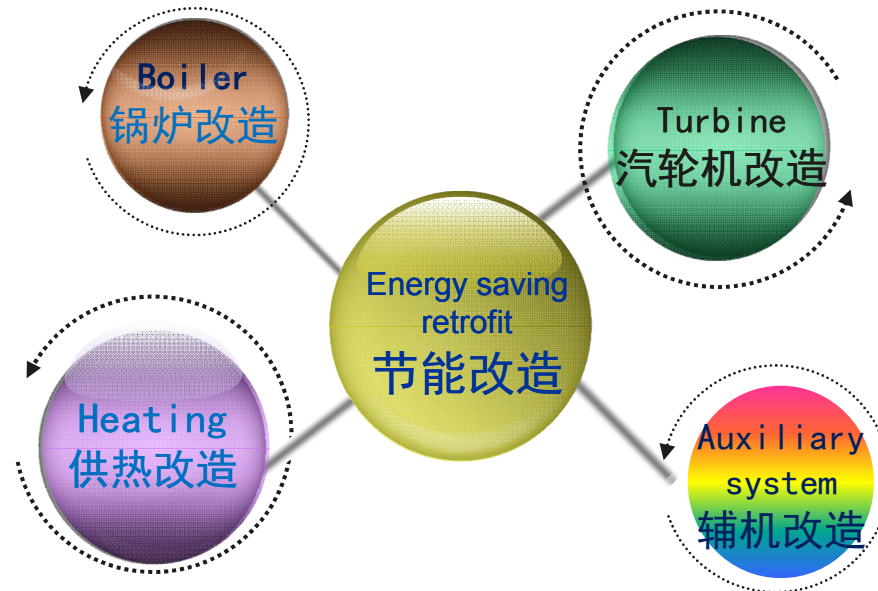
Prospective 发展展望

Energy saving retrofit of coal-fired power plants

节能改造

China's coal power has experienced rapid growth, and has accumulated a very rich comprehensive upgrade experience in different unit types.

中国煤电装机经历了快速增长的跨越式发展，机组类型多，运行水平参差不齐，积累了十分丰富的综合升级改造经验



2020

During the 13th Five-Years, the energy saving retrofit units will be **340GW**.
“十三五”期间，预计全国将累计实施**节能改造3.4亿千瓦**

Prospective 发展展望

Energy saving retrofit of coal-fired power plants

节能改造

Energy efficiency improvement
and upgrading technology
煤电提效升级技术

Rise of steam parameters
提高机组蒸汽参数

Optimization of the heat regenerative system
优化回热系统

Cold end optimization of circulation water
循环水冷端优化

Optimization of four key pipings' design
优化四大管道设计

Recovery and utilization of flue gas waster heat;
increase of heat supply
烟气余热回收利用; 增加供热

Sealing system optimization for air preheater
优化空预器密封

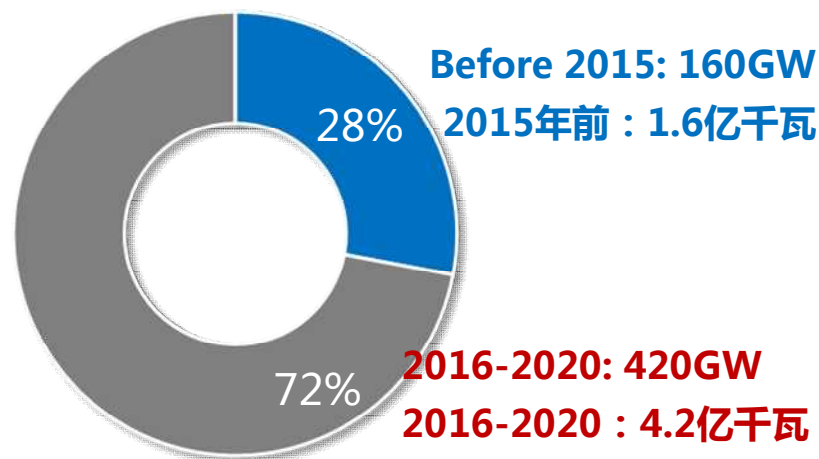
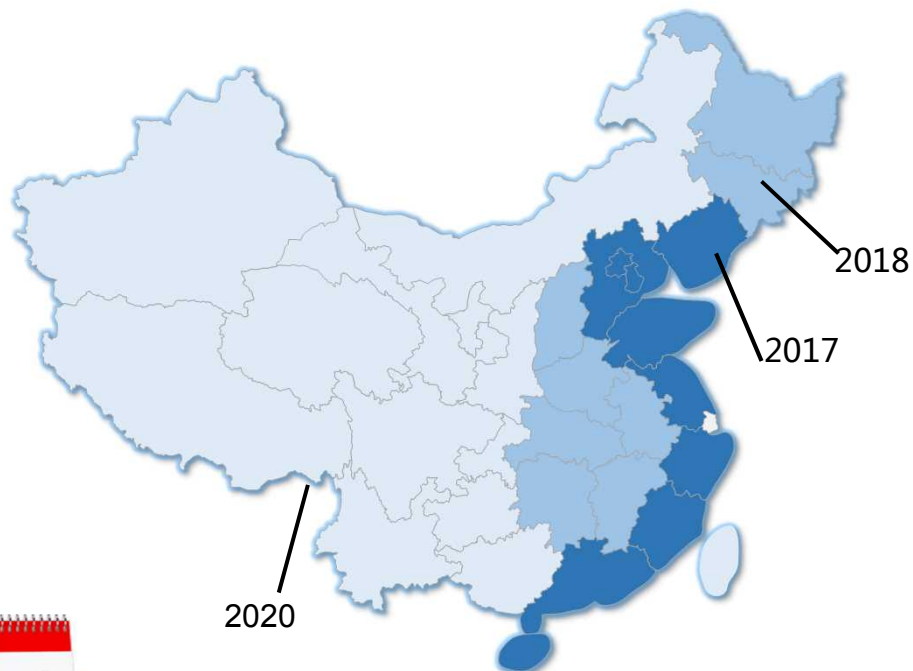
Optimization of steam turbine flow path
汽轮机通流优化

Prospective 发展展望

Ultra low emission retrofit of coal-fired power plants 超低排放改造

< Full implementation of ultra low emission and energy saving transformation of coal-fired power plants >: total capacity of ultra low emission retrofit: 580 GW

《全面实施燃煤电厂超低排放和节能改造工作方案》提出2020 年前完成改造5.8亿千瓦。



During the 13th Five-Years, the ultra low emission retrofit units will be **420GW**.
“十三五” 期间，预计全国将累计实施**超低排放改造4.2亿千瓦**

Prospective 发展展望

Ultra low emission retrofit of coal-fired power plants

超低排放改造

Ultra-low Emission of Coal-fired Flue Gas

Dust: 10mg/Nm³ SO₂: 35mg/Nm³ NO_x: 50mg/Nm³ based on 6%O₂

Dust removal device
除尘装置

- ❑ ESP 电除尘器
- ❑ ESP with high-frequency electric source/rotation electrode
电除尘器+高频电源/旋转电极
- ❑ Low Low temperature
低低温电除尘器
- ❑ WESP (70%~80%)
湿式电除尘器

Desulfurizer
脱硫装置

- ❑ FGD with pallet
托盘脱硫吸收系统
- ❑ FGD with Spin exchange coupling device
旋汇耦合脱硫吸收系统
- ❑ FGD with double tower double
双塔双循环脱硫吸收系统

Dust removal device
脱硝装置

- ❑ LNB
低NO_x燃烧器
- ❑ SCR
选择性催化还原系统

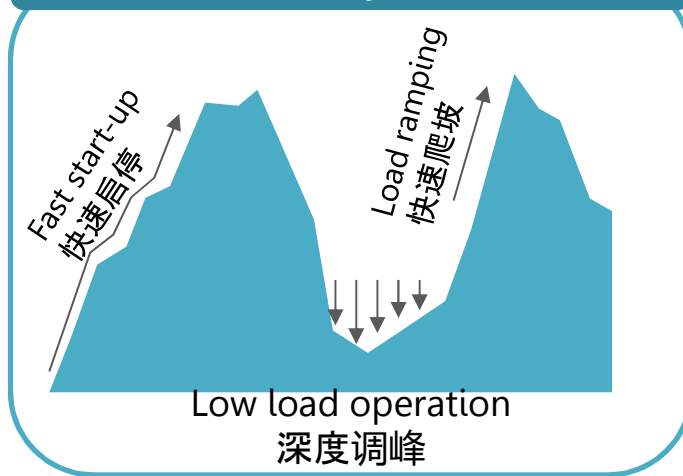
Prospective 发展展望

Retrofit to improve thermal power plant flexibility

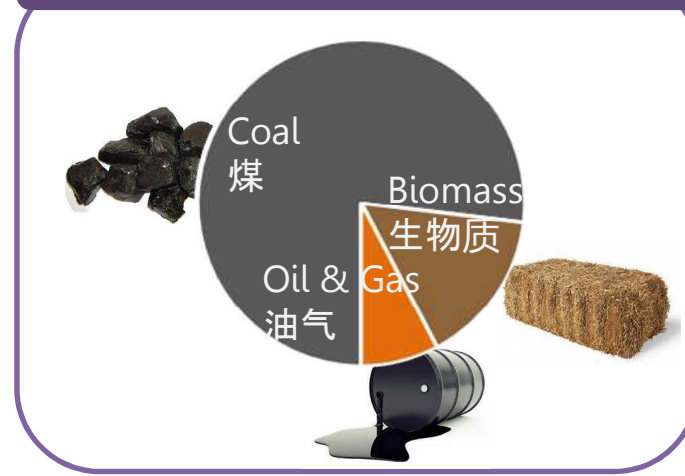
提升火电灵活性改造

Retrofit to improve thermal
power plant flexibility
提升火电灵活性改造

Load flexibility 运行灵活性



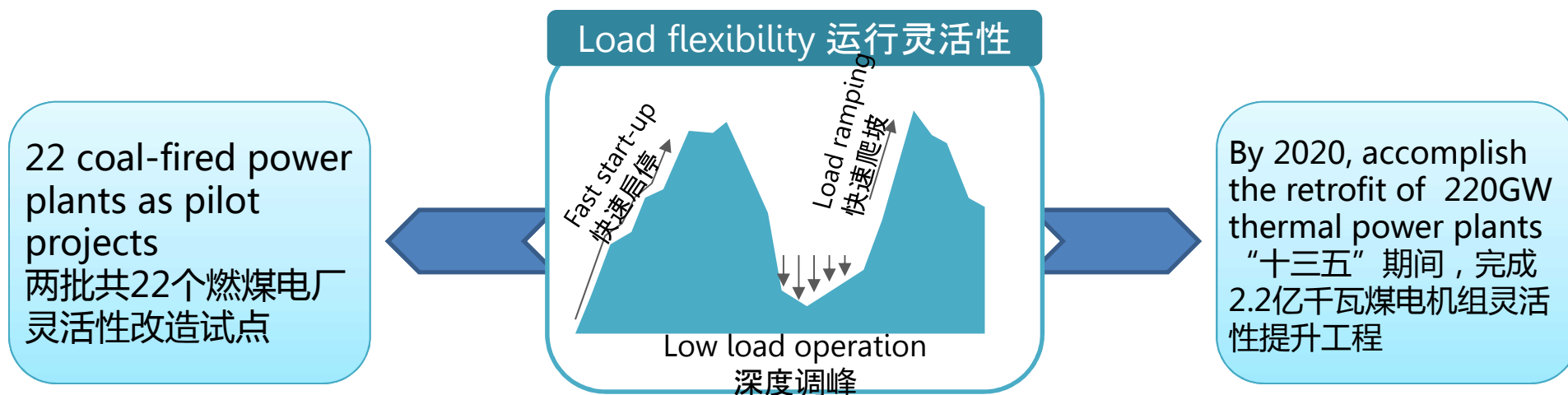
Fuel flexibility 燃料灵活性



Increase power generation absorption from new energy source
消纳更多新能源发电量

Prospective 发展展望

Retrofit to improve thermal power plant flexibility
提升火电灵活性改造



By
2020



热电联产机组灵活改造性规模 **1.33亿千瓦**

Flexibility retrofit of CHP plants reach 133 GW.

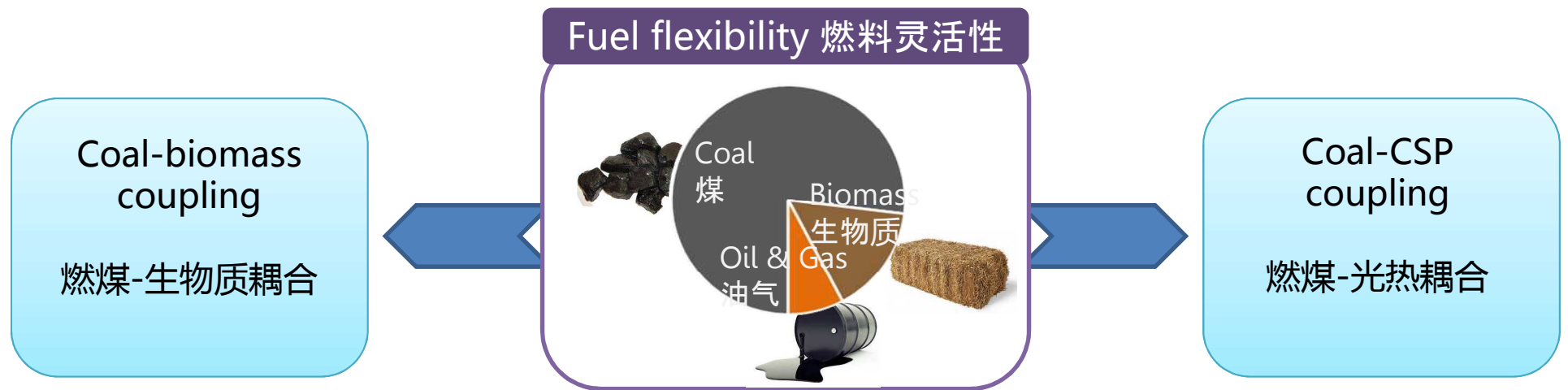


纯凝煤电机组灵活改造性规模 **8700万千瓦**

Flexibility retrofit of condensing coal power plants reach 87 GW.

Prospective 发展展望

Retrofit to improve thermal power plant flexibility
提升火电灵活性改造



Prospective 发展展望

Retrofit to improve thermal power plant flexibility

提升火电灵活性改造

- Thermal power unit peak load regulation capacity increased by 20 % capacity , the minimum technical output of 40 % - 50 % **热电机组增加20%额定容量调峰能力，最小技术出力达40%-50%**

- Condensing unit increased by 15 % -20 % of the rated capacity load capacity ,the minimum technical processing for 30-35 % **纯凝机组增加15%-20%额定容量调峰能力，最小技术出力达30-35%**

- Reach to the international advanced level, the minimum technical output of condensing unit reach 20%~25%. **力争达到国际先进水平纯凝最小出力20-25%**

- Keeping tight control over heating transformation of pure condensing units in regions with system peaking difficulties **系统调峰困难地区，严格控制现役纯凝机组供热改造**

- Installing heat storage device according to the demands of relevant regulations.
- **按照国家有关规定要求安装蓄热装置**

Prospective 发展展望

Load flexibility

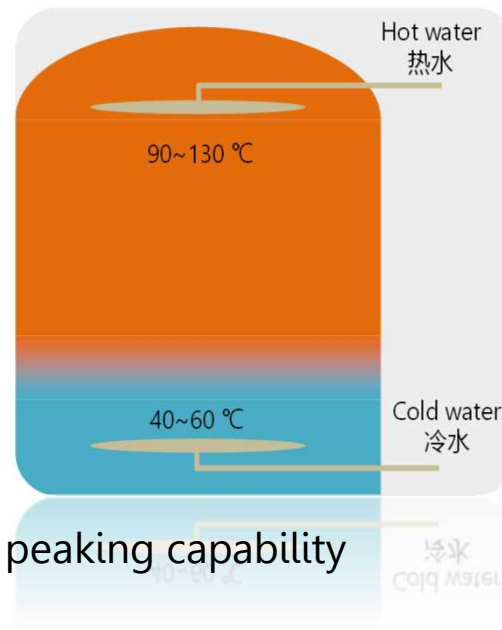
运行灵活性

Overall progress of pilot projects 试点工程总体进展

- Retrofit schemes has been basically determined 改造方案已基本确定
- Most projects are in the design phase 多数项目处于设计阶段
- Some are in the project implementation phase 个别项目进入工程实施阶段

Main solutions 主要方案

- Install thermal storage device to achieve thermoelectric decoupling
增设蓄热系统，实现热电解耦
- Install electric boiler
增设电锅炉
- Boiler and turbine retrofit to increase peaking capability
锅炉、汽机本体改造，实现深度调峰



Thanks for your attention!