# 中国电力发展现状和发展展望

# China's Power Development Status and Outlook

2025年9月

September 2025

I

## 发展现状

## Development Status

II

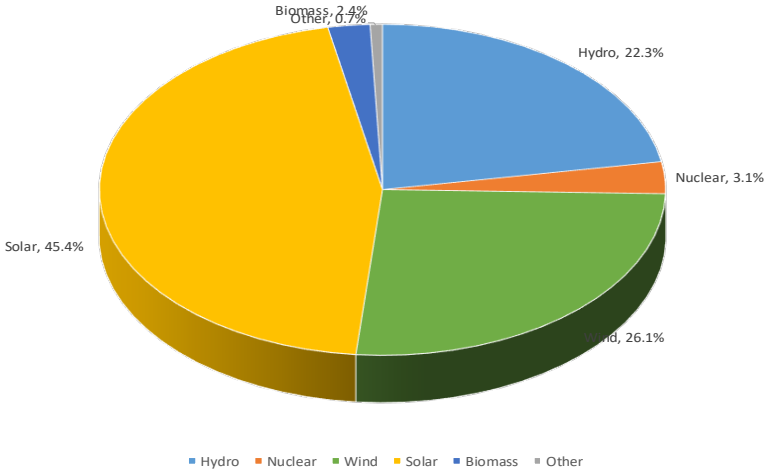
## 发展展望

## Development Outlook

# (I)电力供应结构持续优化
# Power supply structure is optimized continuously

截至2024年底，中国大陆发电装机容量33.5亿千瓦，其中非化石能源发电装机19.5亿千瓦，占比58.2%；风、光发电累计装机14.1亿千瓦，提前6年实现习近平主席在气候雄心大会上承诺的“到2030年中国风电、太阳能发电总装机容量达到12亿千瓦以上”目标。

By the end of 2024, the installed power generation capacity in mainland China reached **3,350 GW,** of which the installed power generation capacity of non-fossil energy was **1,950 GW**, accounting for **58.2%**. The cumulative installed power generation capacity of wind and solar energy was **1,410 GW**, achieving the goal promised by President Xi Jinping at the Climate Ambition Summit six years ahead of schedule, which is "by 2030, the total installed power generation capacity of wind and solar power in China will reach over 1.2 billion kilowatts".




截至2024年底非化石能源装机构成情况

Composition of non-fossil power generation capacity (as of the end of 2024)

**58.2%**

Proportion of installed power generation capacity of non-fossil energy in the country's total installed capacity

**520 GW**

Grid-connected installed power generation capacity of wind power

**890 GW**

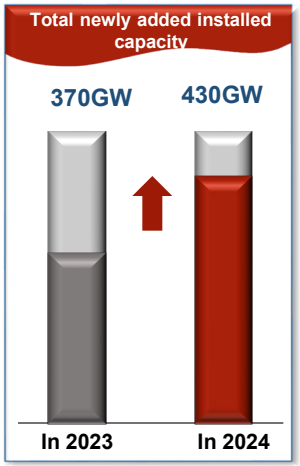
Grid-connected installed power generation capacity of solar power

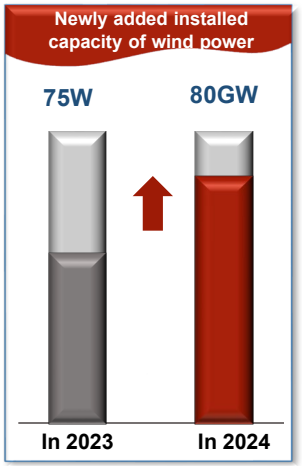
**440 GW**

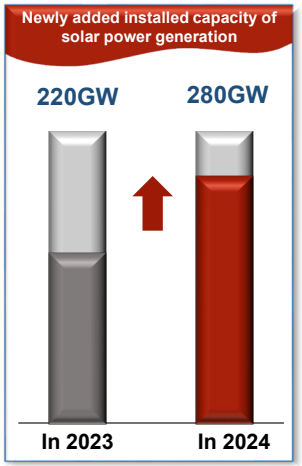
Grid-connected installed power generation capacity of hydropower

2024年，全年新增发电装机容量4.3亿千瓦，再创历史新高。其中，新增风光装机3.6亿千瓦，占全球新增风光装机的63%。

In 2024, the newly added installed power generation capacity was **430 GW**, reaching a new historical high. The newly added installed capacity of wind and solar power was **360 GW**, accounting for **63%** of the global newly added installed capacity of wind and solar power.



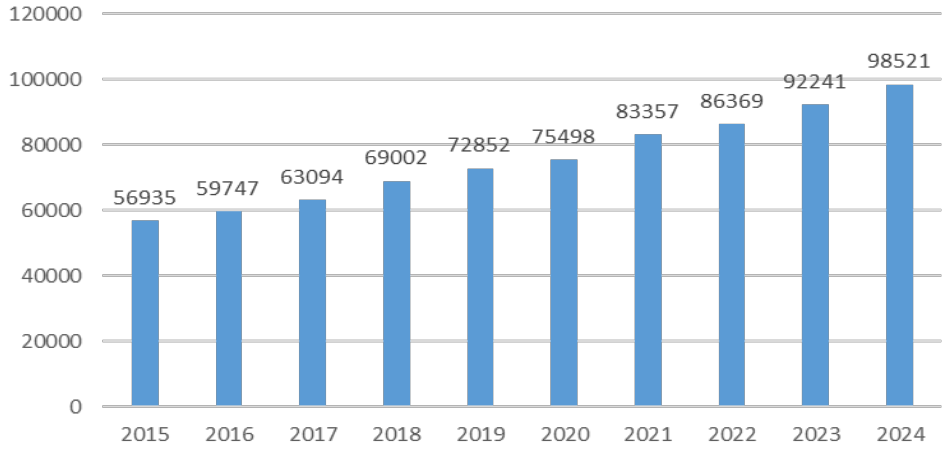




Comparison of newly added installed power generation capacity in 2023 and 2024

# (II)电力消费方式发生深刻变革
# Power consumption undergoes profound changes

2024年，中国大陆全社会用电量约9.85万亿千瓦时，占全球的比重超过30%。2020年~2024年，全社会用电量年均增长7.0%，电力消费弹性系数连续几年均大于1.0。

In 2024, the electricity consumption in mainland China was **9850 TWh**, accounting for over **30%** of the global electricity consumption. The growth rate of electricity consumption is **7.0%** on average from 2020 to 2024, which is more than GDP growth rate.



当前，中国电能占终端能源消费比重提升至29%，人均用电量接近7000千瓦时/人，处于全球前列。新能源汽车产销量分别达1288.8万辆和1286.6万辆，连续10年位居全球第一。

Currently, China's electricity accounts for **29%** of the total final energy consumption, and the electricity consumption per capita is close to **7,000 kWh**, being at the forefront of the world. The production and sales of new energy vehicles reached **12.888 million** and **12.866 million** respectively, ranking first in the world for 10 consecutive years.




# (III)技术创新带动成本大幅下降
# Technological innovation drives a significant cost reduction

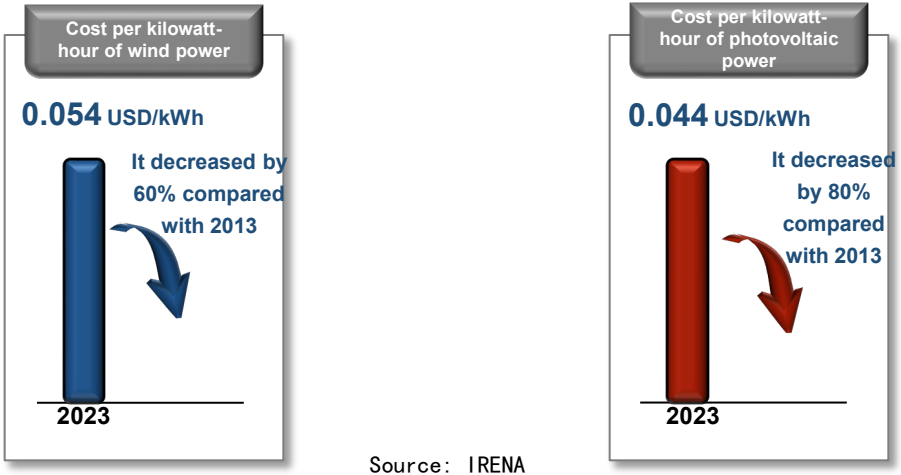
全球最大的26兆瓦级海上风电机组顺利下线，晶硅-钙钛矿叠层电池光电转换效率达到34.6%，刷新世界纪录；新一代核电、特高压输电等领域装备技术不断突破。

The world's largest **26-megawatt** offshore wind turbine have rolled off the production line. The photoelectric conversion efficiency of the crystalline silicon-perovskite tandem battery reached **34.6%,** thus breaking the world record. The equipment technologies in fields such as new-generation nuclear power and ultra-high voltage power transmission continue to make breakthroughs.



风电、光伏发电开发成本较十年前分别下降了60%和80%，光伏组件、风力发电等装备和关键零部件出口200多个国家和地区，约占全球市场份额的70%。过去十年，中国对全球非化石能源消费增长贡献度超过40%，为推动世界能源绿色低碳转型贡献了中国力量。

The development costs of wind power and photovoltaic power generation have decreased by **60%** and **80%** respectively compared with ten years ago. Equipment and key components such as photovoltaic modules and wind power generation are exported to more than 200 countries and regions, accounting for about **70%** of the global market share. In the past decade, China's contribution to the growth of global non-fossil energy consumption has exceeded **40%**, and it has contributed Chinese strength to promoting the green and low-carbon transformation of the world's energy.

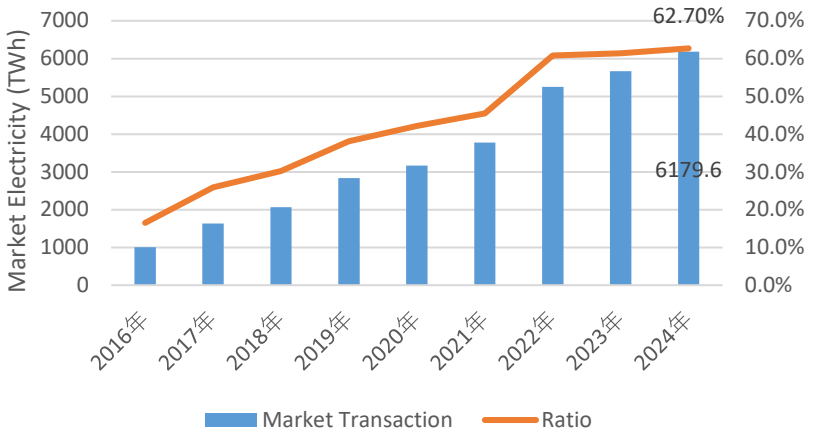



Source: IRENA

# (IV)体制机制改革激发市场活力
# Institutional and mechanism reform stimulates market vitality

2024年，中国大陆市场交易电量约6.18万亿千瓦时，占用电量比重达到62.7%。目前已有六个省级现货市场和省间现货市场转入正式运行，中长期、辅助服务市场实现全覆盖。全年核发绿证47.34亿个，交易绿证4.46亿个；各电力交易中心累计完成绿色电力交易电量2336亿千瓦时。

In 2024, the electricity market transactions reached **6180 TWh,** accounting for **62.7%** of total consumption. Currently, six provincial and inter-provincial spot markets have been officially put into operation, the long-term trading and ancillary service markets have been full coverage. **4.734 billion** green electricity certificate were issued and **446 million** were traded, **233.6 TWh** green electricity were transacted in all power exchange centers.





中国碳排放权交易市场于2021年7月启动上线交易，是全球覆盖温室气体排放量最大的市场，并逐渐从发电行业扩大至钢铁、水泥、铝冶炼等行业。截至2024年底，中国全国碳市场配额累计成交量达6.3亿吨，累计成交额超430亿元。

The national carbon market started online trading on July 2021, which is the world’s largest emissions trading system, and gradually expanded from power to steel, cement, aluminum industries. Till the end of 2024, the total trading volume had reached **630 million tonnes**, with turnover of **RMB43 billion**.


2024年中国全国碳排放权交易市场成交量及成交价格情况

Transaction volume and price of China's national carbon market in 2024

I

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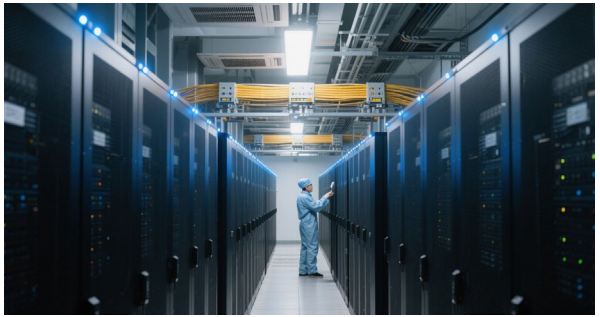
# (I)中国电力需求还将保持持续增长
# China’s electricity demand will maintain sustained growth

未来中国经济仍将保持中高速增长，工业、交通、建筑等领域将提高电力消费比重，实现减污降碳；算力基础设施、新能源汽车、电制氢等将成为拉动电力需求增长的新动能。预计未来10年，中国全社会用电量年均增加超5000亿千瓦时。

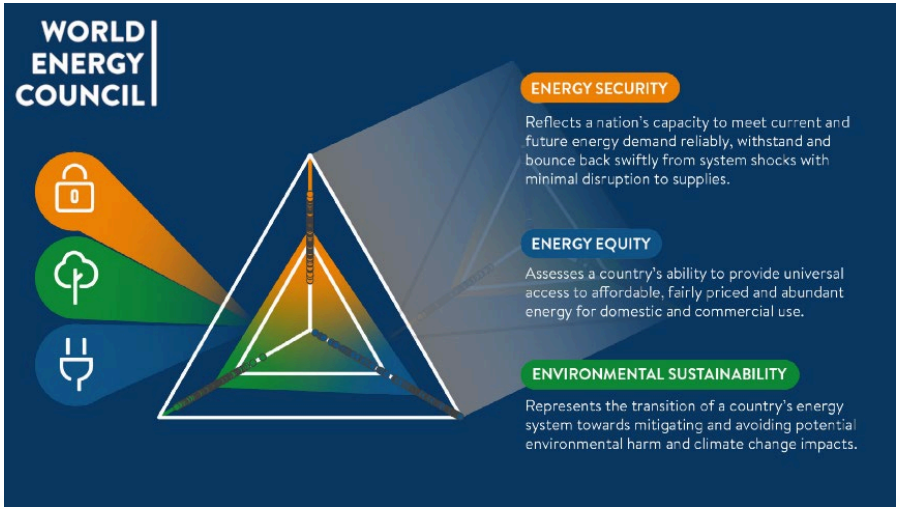
China’s economy will continue to maintain a medium growth rate, and industry, transportation, and construction will increase the electricity consumption to achieve pollution and carbon reduction. Computing infrastructure, new energy vehicles, and hydrogen production by electrolysis will be new growth drivers. The annual average increase of electricity consumption will exceed **500 TWh** in the next ten years.



# (II)能源电力低碳转型任务艰巨
# Green and low-carbon transition of energy is a formidable task

中国要实现2030年非化石能源消费比重达到25%的目标，每年非化石能源消费占比要提高1个百分点，任务艰巨。同时，还要处理好保障能源安全、能源可负担性、环境可持续性之间的平衡，积极稳妥推进安全降碳。

To achieve the goal of making non-fossil energy consumption account for 25% by 2030, the proportion of non-fossil energy consumption needs to be increased by 1 percentage point every year, which is an arduous task. In the meanwhile, it is necessary to handle the balance among **energy security**, **energy equity**, and **environmental sustainability**, and actively and steadily promote safe carbon reduction.



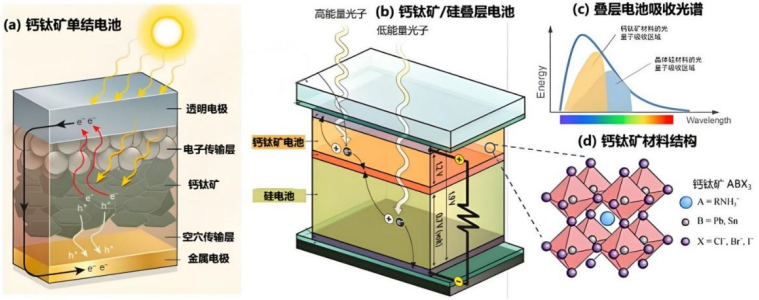
# (III)绿色低碳转型推动能源电力产业技术新革命
# Green and low-carbon transition promotes new technological revolution

## 高效新能源发电技术
## High efficiency green energy technology

### 新型高效太阳电池产业化关键技术
### New type PV cell technology

研发低成本钙钛矿电池，钙钛矿叠层电池等新兴技术，若该技术实现突破，预计可大幅提升光伏发电效率，有效缓解系统调峰压力，节省硅料成本、节约建设用地 。

R&D of low-cost perovskite PV cell technology can significantly increase PV power efficiency, reduce silicon material costs and save construction land.




钙钛矿电池结构示意图
Schematic diagram of perovskite cell structure

### 海上风电全产业链核心技术
### Offshore wind technology

加强深远海浮式风电平台关键技术创新及应用，推动海上低频输电技术、新一代超大型直驱和半直驱机型海上风电机组等技术攻关应用，更好满足东部地区新增绿电消费需求。

R&D of far-reaching offshore wind power platform, low-frequency transmission, new generation offshore wind turbines can meet the new demand for green electricity in east coast region.

漂浮式风电平台“明阳天成号”

26兆瓦级海上风力发电机

大容量海上风电机组
Large capacity offshore wind turbine

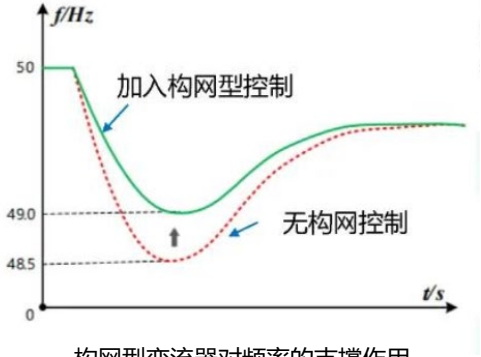
# 新能源可靠替代技术
# Safe and reliable green energy technology

面向新能源资源富集的弱送端电网，加强新能源主动支撑和构网型新技术应用
Strengthen the application of grid-forming technology

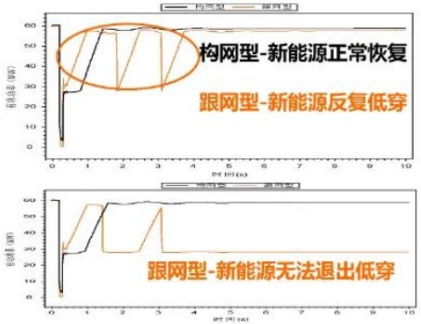
破解新能源主动支撑能力不足造成的消纳受限问题，提升新能源电站系统友好性能，保障沙戈荒地区大型新能源基地稳定高效外送。
Enhance the friendly performance of the new energy power system and ensure stable and efficient transmission.

选取新能源高比例接入，同步支撑能力不足，因稳定约束存在弃风、弃光现象的局部电网作为示范点
Synchronous and stability support for decreasing wind and solar curtailment

部署自同步电压源型新能源发电设备及组网运行控制、复杂网源工况下新能源发电系统主动感知与自适应控制等关键技术，显著提升系统电压频率协调控制能力，协同保障系统安全稳定运行和新能源高效利用。
Synchronous technology, control and active sensing technology can improve system's voltage and frequency.




构网型变流器对频率的支撑作用
Frequency support of Grid-Forming Inverter




构网控制可有效避免新能源反复进出低穿
Grid-Forming Control Technology

# 新一代煤电技术
# New-generation coal power technology

聚焦煤电降碳转型、高效调节和快速响应，系统部署开展新一代煤电升级专项行动，从清洁降碳、安全可靠、高效调节、智能运行四个方面构建煤电技术指标体系，并分类指导现役机组改造、新建机组建设和示范项目推进。

Carry out a special action to upgrade the new generation of coal-fired power generation focusing on carbon reduction, safe and reliable, energy-saving and flexible load regulation, and intelligent operation, guiding the transformation of existing units, the construction of new units, and the promotion of demonstration projects.

**清洁降碳 Carbon reduction**

采用降碳措施后，度电碳排放水平应较2024年同类煤电机组降低10%—20%。

**高效调节 Energy saving and flexible load regulation**

超超临界、湿冷设计工况供电煤耗不高于270克/千瓦时；深度调峰最小发电出力20%；负荷变化速率在50%及以上、30%—50%负荷区间分别达到4%、2%额定负荷/分钟；具备安全可靠启停调峰能力。

新一代煤电试点示范技术要求

**安全可靠 Safe and reliability**

保供期申报出力达标率99%；保供期非计划停运次数0.3次/台年。

**智能运行 Intelligent operation**

实现全负荷工况（含干湿态转换点及以下）负荷调节自动控制，无人工干预完成AGC指令占比不低于95%。

## 煤电低碳化改造技术
## Low carbon transformation of coal power

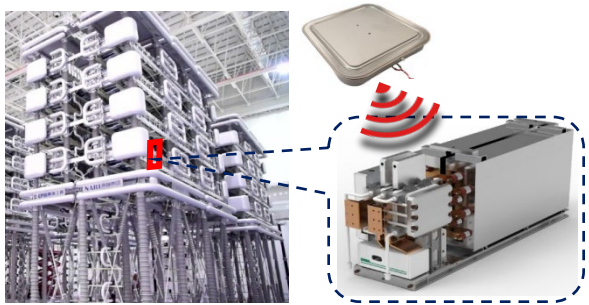
通过生物质掺烧、绿氨掺烧等源端减碳技术，以及碳捕集利用与封存（CCUS）等末端固碳技术，统筹推进存量煤电低碳化改造和新建煤电低碳化建设，探索煤电低碳化发展新路径。

Promote low carbon transformation of coal power through technologies such as biomass cofiring, green ammonia cofiring and carbon capture, utilization and storage (CCUS), exploring new paths for coal-fired power plants.

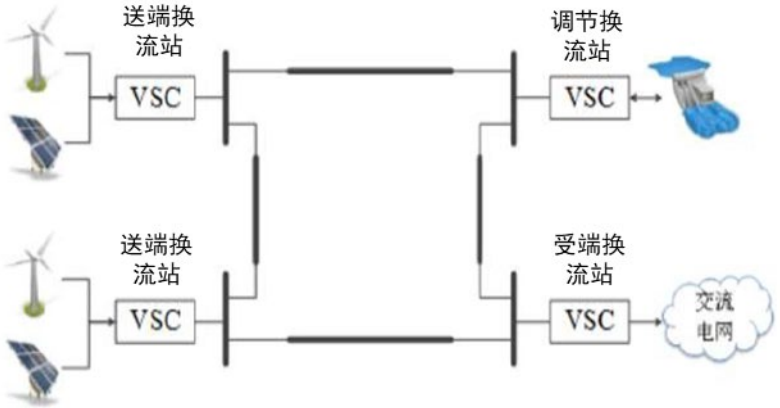
# 柔性直流输电技术 VSC-HVDC

未来沙戈荒基地外送，距离负荷中心距离远，且无常规电源支撑，传统的交直流技术无法满足新能源基地外送需求。柔性直流输电技术可满足纯新能源孤岛送出场景，改善受端电压稳定性，而且功率调节灵活，在送受端之间分担新能源的调峰需求。

Given that large wind power and photovoltaic bases in sandy areas, rocky areas will be far from the load center, with no conventional power support, the LCC-HVDC technology may not satisfy the needs of power transmission. The VSC-HVDC technology can meet the requirements of power transmission from pure new-energy islands, improve the voltage stability of the receiving end, and flexibly regulate power to share the peak shaving demands for renewable energy between the transmission and receiving ends.



VSC-HVDC Converter Valve




Schematic diagram of the topological structure of four-terminal VSC-HVDC power grid system

# (IV)协同推进市场建设和机制革新
# Collaboratively promote market construction and mechanism innovation

## 加快建设全国统一电力市场
## Accelerate on unified national electricity market system

《全国统一电力市场发展规划蓝皮书》提出要建立“统一开放、竞争有序、安全高效、清洁低碳、治理完善”的全国统一电力市场，实现全国统一基本规则、统一技术标准、统一运营监管。

The Blue Book of the Development Plan for the National Unified Electricity Market proposes to establish a "unified and open, safe and efficient, clean and low-carbon, and well governed" national unified electricity market, achieving unified basic rules, unified technical standards, and unified operational supervision.

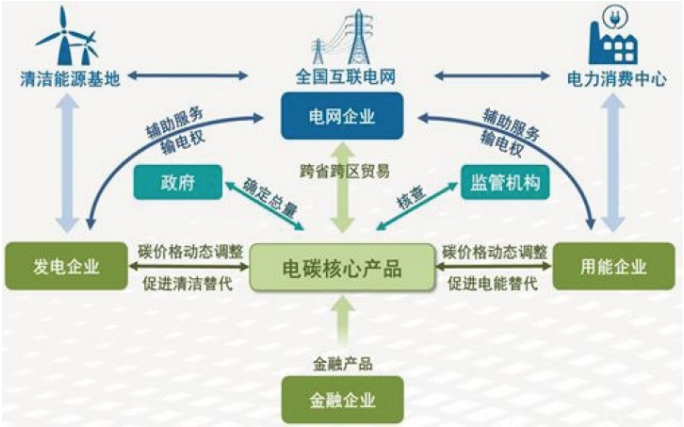

### 全国统一电力市场“三步走”战略

| 2025年 | 2029年 | 2035年 |
| --- | --- | --- |
| 初步建成 | 全面建成 | 完善提升 |

# 健全绿色电力消费激励机制
# Improve incentive mechanism for green electricity consumption

促进“电-碳-证”多市场协同，加强可再生能源超额消纳量、绿证、碳排放权、CCER之间的衔接，健全不同环境权益产品体系间的流通规则、核算方式和价格传导机制；打造国际广泛认可的绿色能源认证标准体系。

Promote the multi-market synergy of “electricity-carbon-certificate”, strengthen the connection between renewable energy consumption, green certificates, carbon emissions, and CCER. Build an internationally recognized green energy certification standard system.





国际绿色电力消费倡议组织(RE100)已宣布无条件认可中国绿证

RE100's unconditional acceptance of the China’s Green Electricity Certificates (GECs)

中国电力企业联合会作为中国电力行业企事业单位的联合组织，愿与国际同行一道，加强交流合作，共同为推动全球能源转型、应对气候变化作出积极贡献！

As the joint organization of China power industry enterprises and institutions, China Electricity Council (CEC) is willing to strengthen exchanges and cooperation with international counterparts, and make positive contributions to promoting global energy transformation and addressing climate change together!

中国电力企业联合会
CHINA ELECTRICITY COUNCIL

谢 谢！

Thanks！