电力规划设计总院
China Electric Power Planning & Engineering Institute

碳达峰和碳中和背景下中欧能源技术创新合作展望

Outlook for China-Europe Energy Technology Innovation Cooperation in the Context of Carbon Neutrality

电力规划设计总院

China Electric Power Planning & Engineering Institute

徐小东

XU Xiaodong

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1. 中国能源行业概况 Overview of energy industry in China

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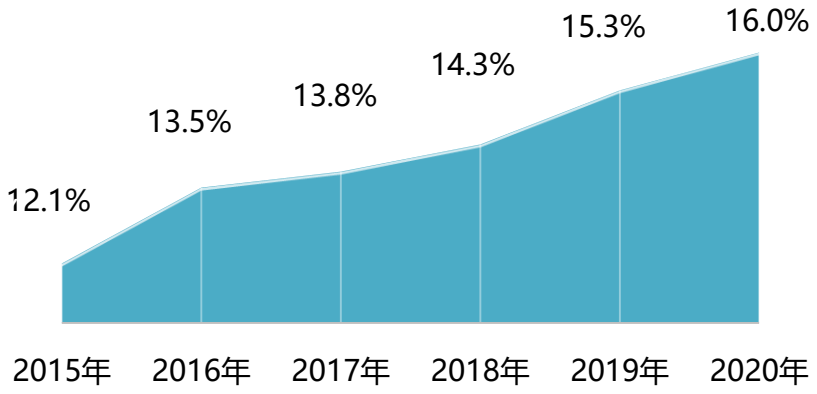
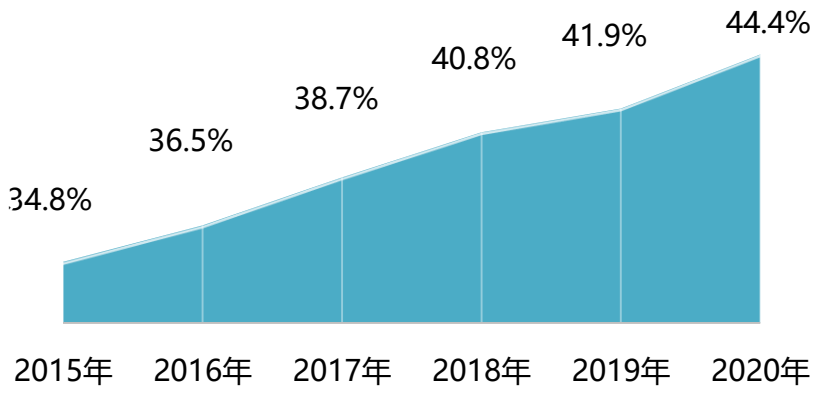
中国正在大力推动能源转型与非化石能源发展。2020年，中国非化石能源消费量占比接近16%，较2015年提升近4个百分点；非化石能源发电装机占比超过44.4%，较2015年提高9.6个百分点。

China is vigorously promoting energy transition and non-fossil energy development. In 2019, China's non-fossil energy consumption accounted for 16%, an increase of 4 percentage points from 2015; non-fossil energy installed capacity accounted for more than 44.4%, an increase of 9.6 percentage points from 2015.

2015-2020非化石能源占比
Proportion of non-fossil energy in 2015-2020



2015-2020非化石电源装机占比
Proportion of non-fossil power installed capacity in 2015-2020



2. 中国能源转型战略目标 China's energy transition goals

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2020年9月22日，习近平主席向世界承诺，中国将采取更加有力的政策和措施，二氧化碳排放力争于2030年前达到峰值，努力争取2060年前实现碳中和。2020年12月12日，习近平主席在气候雄心峰会上，宣布中国国家自主贡献一系列新举措。

On Sep.22, 2020, President Xi Jinping solemnly proposed at the UN General Assembly meeting that China will increase its NDC, adopt more powerful policies and measures, and strive to reach its peak carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060.

Carbon dioxide emissions per unit of GDP will drop by more than 65% from 2005

Non-fossil energy will account for 25% of primary energy consumption

The forest stock volume will increase by 6 billion cubic meters over 2005

Total installed capacity of wind power and solar power will reach over 1.2 billion kilowatts.

3. 中国能源转型措施 China's energy transition measures

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2021年1月19日，中国国家发改委提出六个重点工作方向来积极推动实现碳达峰和碳中和目标：一是大力调整能源结构，二是加快推动产业结构转型，三是着力提升能源利用效率，四是加速低碳技术研发推广，五是健全低碳发展体制机制，六是努力增加生态碳汇。

On Jan.19, 2021, the National Development and Reform Commission of China proposed six key directions to actively promote the achievement of carbon neutral goals, which includes vigorously adjusting the energy structure, accelerating the transformation of the industrial structure, focusing on improving energy efficiency, accelerating low-carbon technologies, improving the low-carbon development system, and striving to increase the ecological carbon sink.

4. 中国能源转型总体趋势 China's energy transition trend

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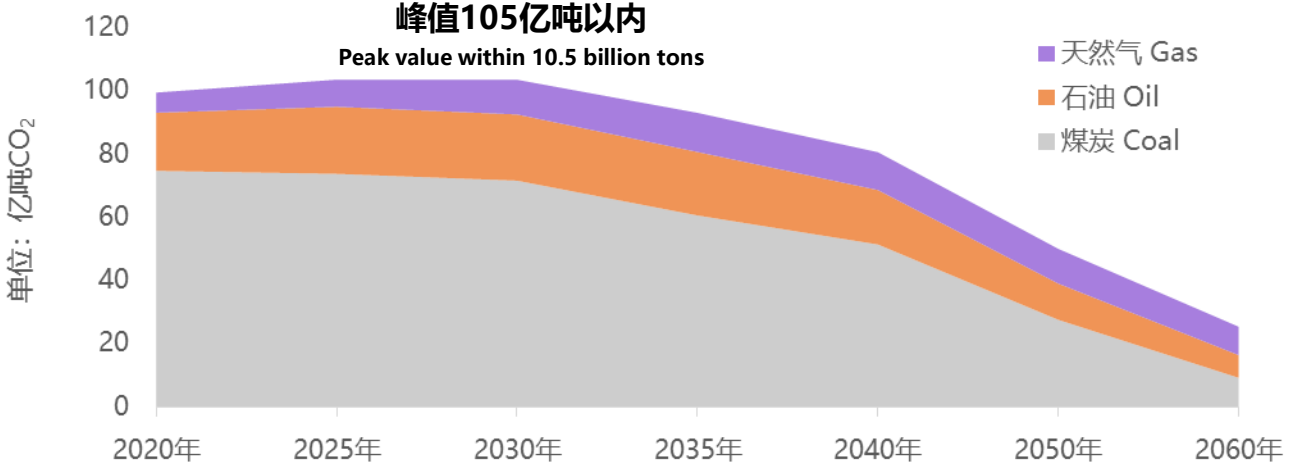
为了实现“30•60”的目标，在达峰的同时还应尽可能减小峰值，力争控制在105亿吨以内，并2030年后要快速下降，保守估计2060年下降到20~30亿吨，进一步考虑生态碳汇和碳捕捉等的减碳效应，实现碳中和。

In order to achieve the goal of "30•60", while reaching the peak, we should also minimize the peak. Also, we should strive to control it within 10.5 billion tons, and further decline rapidly after 2030. It is estimated that it will drop to 2 to 3 billion tons in 2060. At the same time, we must further consider the carbon reduction effects of ecological carbon sinks and carbon capture to achieve carbon neutrality.



2060年：

碳排放20~30亿吨

农林业碳汇约10亿吨

碳捕捉与封存10~20亿吨

In 2060:

2~3 billion tons of carbon emissions

1 billion tons agroforestry carbon sink

1~2 billion tons of carbon capture and storage

4. 中国能源转型总体趋势 China's energy transition trend

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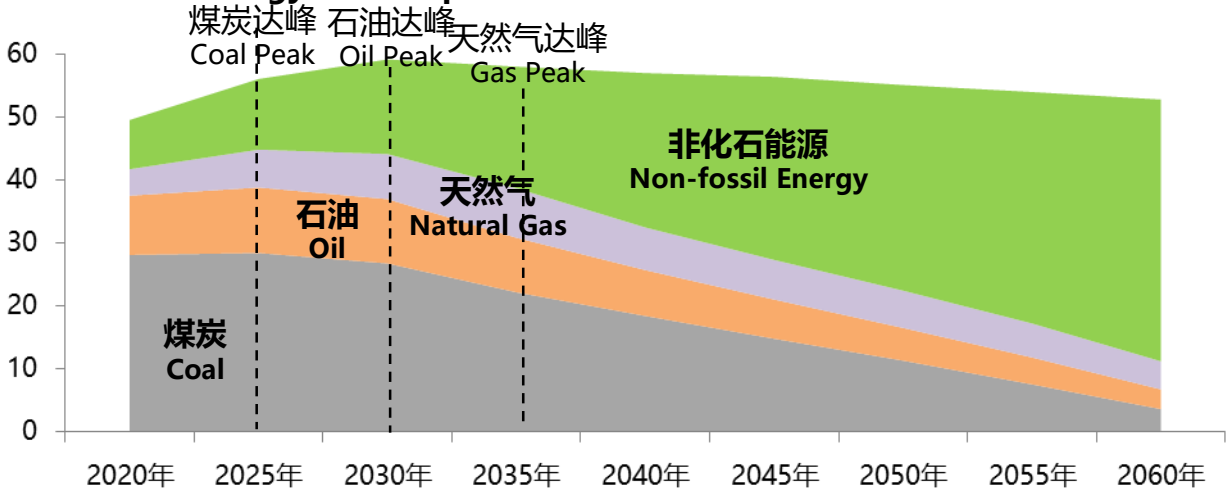
为了实现“30•60”的目标，中国化石能源消费将会陆续达峰，并逐渐下降，煤炭消费将会在2025年左右达峰，石油和天然气预计分别在2030年和2035年左右达峰。非化石能源消费比重将会持续提高，到2060年，非化石能源消费比重将达到80%以上。

In order to achieve the "30•60" target, China's fossil energy consumption will gradually peak and decline. Coal consumption will peak around 2025, and oil and natural gas are expected to peak around 2030 and 2035, respectively. The proportion of non-fossil energy consumption will continue to increase. By 2060, the proportion of non-fossil energy consumption will reach over 80%.



4. 中国能源转型总体趋势 China's energy transition trend

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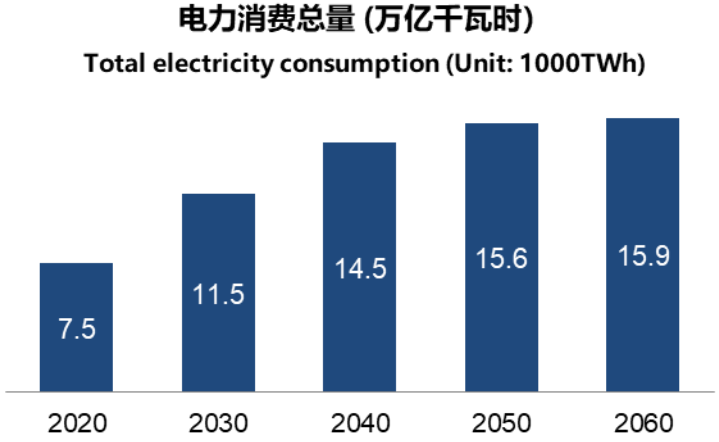
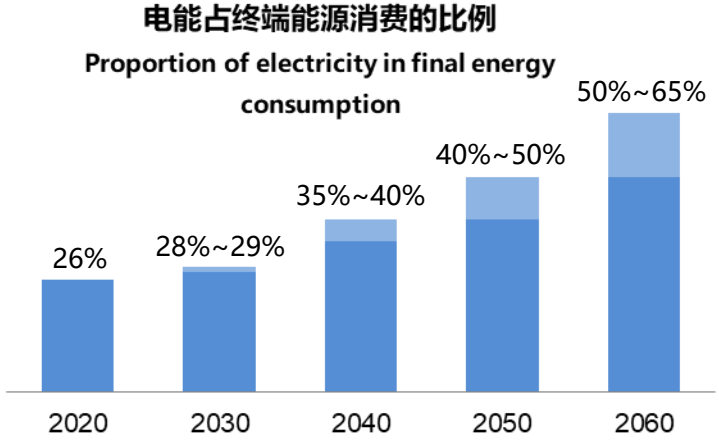
践行“30•60”战略，能源是主战场，电力是主力军。这要求我国实现更高水平电气化，支撑煤炭、石油、天然气尽早达峰。电力消费将会持续增长，到2050年，将达到15万亿千瓦时，电能占终端能源的消费比重将提高至50%左右。

To implement the "30•60" strategy, energy is the main battlefield while electricity is the main force. This requires our country to achieve a higher level of electrification and support coal, oil, and natural gas to peak as soon as possible. Electricity consumption will continue to grow, reaching 15 trillion kWh by 2045. The proportion of electricity in the final energy consumption will increase to more than 50% by 2060.





4. 中国发电领域转型路径 China's power generation transition path

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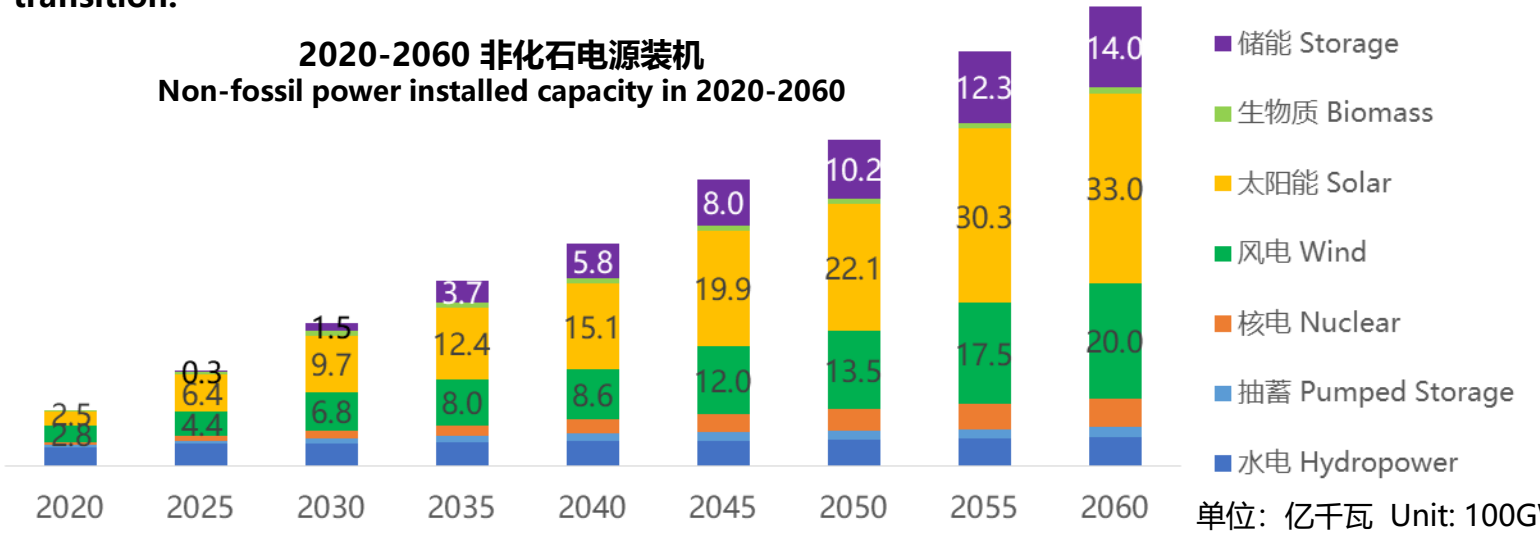
“30•60”战略将推动绿色能源的快速发展，绿色电源将成为我国主体电源，至2030年，非化石能源装机将达到23亿千瓦，占比超过60%；至2060年，非化石能源装机将达到65亿千瓦，占比将超过95%。

The “30•60” strategy forces the transition of economic development mode, and our country's power consumption will have lower energy consumption. Starting from the "14th Five-Year Plan", green power will become the main power source in our country, and carbon reduction will become the overall trend of coal power transition.



5. 中国电网领域转型路径 China's power grid transition path

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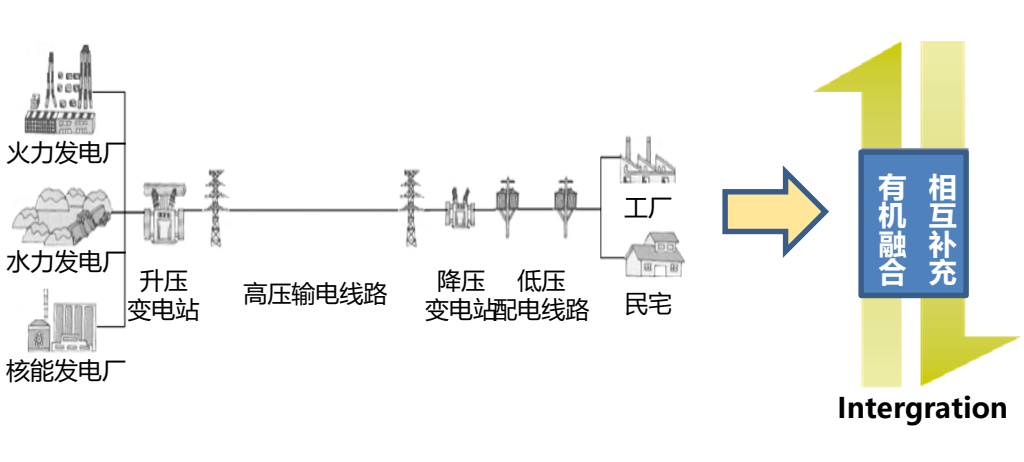
为实现“30•60”目标，需要推动电网的进一步优化，构建新一代电力系统，以适应高比例可再生能源的接入，电网形态将更加多元，大电网、微电网、分布式电网有机互补，新能源一体化开发外送、源网荷储一体化就近利用等模式将成为未来发展重点。

In order to achieve the "30•60" goal, it is necessary to promote the further optimization of the grid and build a new generation of power system to adapt to the access of a higher proportion of renewable energy. The grid form will be more diversified, large grid, micro grid, and distributed grid will complement each other. Multiple integrated development modes will become the focus of future development.



6. 中国用电领域转型路径 China's power consumption transition path

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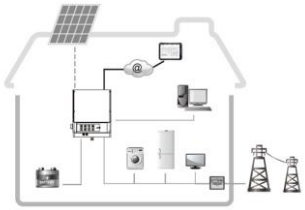
“30•60”战略驱动用电模式由单向流动转变为源网荷储双向互动模式。“十四五”期间，中国将加强需求侧响应，加快电动汽车、储能、可中断负荷规模化发展，持续加大清洁取暖、港口岸电、工业电锅炉等多种形式的电能替代，用电形式将呈现多样化特征。

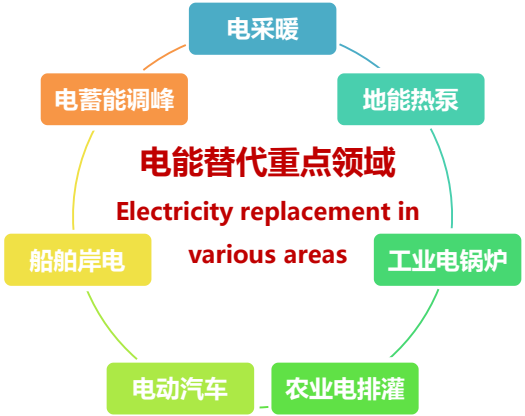
The “30•60” strategy drives the transition of the electricity consumption model from one-way flow to a two-way flow of source, network, load and storage. During the “14th Five-Year Plan”, China will strengthen demand-side response, accelerate the large-scale development of electric vehicles, energy storage, and interruptible loads, and continue increase the replacement of various forms of electricity such as clean heating, port shore power, and industrial electric boilers, and the forms of electricity consumption will show diversified characteristics.

电动汽车
Electric vehicle



可中断负荷
Interruptible loads

电采暖
Electric heating



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1. 加快能源低碳转型面临的主要技术挑战

Key technical challenges to accelerate the low-carbon energy transition

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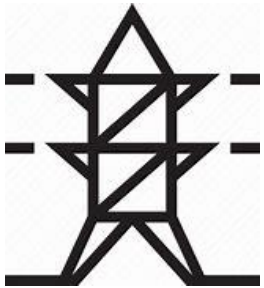
加快能源低碳转型需要对现存的能源消费和利用方式进行重塑，这在消费、供给、输送、存储、市场机制等环节均面临着一定的技术挑战，需要开展技术创新，以提供高效的解决方案。

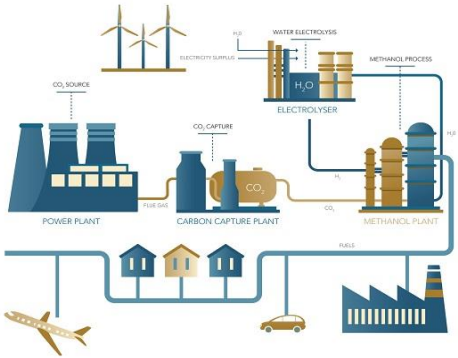
Accelerating low-carbon energy transition requires the remodeling of existing energy consumption and utilization modes, and faces certain technical challenges in the aspects of consumption, supply, transmission, storage and market mechanism, etc., so technological innovation is needed to provide efficient solutions.

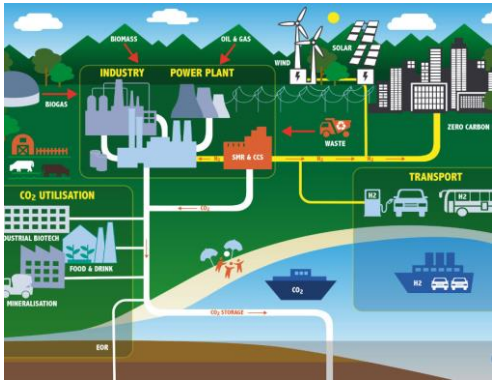


2. 消费环节的关键技术领域 Key technologies on consumption

在消费环节 在交通领域，聚焦长距离大规模运输设施的去碳化需求，开展氢能交通、交通电气化等领域的技术创新；在工业领域，发展碳捕捉和利用、工业流程电能和氢能替代等技术，在建筑领域，研究低碳绿色建筑相关技术，推动对现存的建筑物的低碳化改造。

Consumption In the transportation field, focus on the decarbonization needs of long-distance and large-scale transportation facilities, and carry out technological innovation in the fields of hydrogen energy transportation and transportation electrification; in the industrial field, develop technologies such as CCUS, industrial process power and hydrogen energy substitution, and in the field of construction, research on low-carbon green building-related technologies, and promote the low-carbon transformation of existing buildings.





3. 供给环节的关键技术领域 Key technologies on supply

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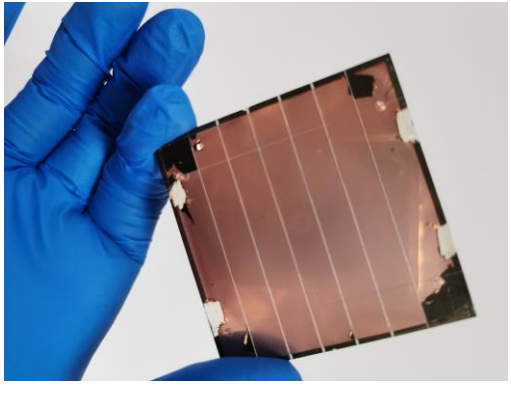
在供给环节 开发下一代高效光伏、深海风电、新型分布式风电，继续提升新能源发电的能源效率，推动可再生能源开发与生态环境更高程度融合，发展以碳捕捉和碳存储为基础的负排放技术，将供给侧打造成实现碳平衡的主要枢纽。

Supply Develop the next generation of high-efficiency photovoltaics, deep-sea wind power, new distributed wind power, continue to improve the energy efficiency of new energy power generation, promote a higher degree of integration of energy development and the ecological environment, and develop negative emission technology based on CCUS, turns the supply side into the main hub for achieving carbon balance.



4. 输送环节的关键技术领域 Key technologies on network

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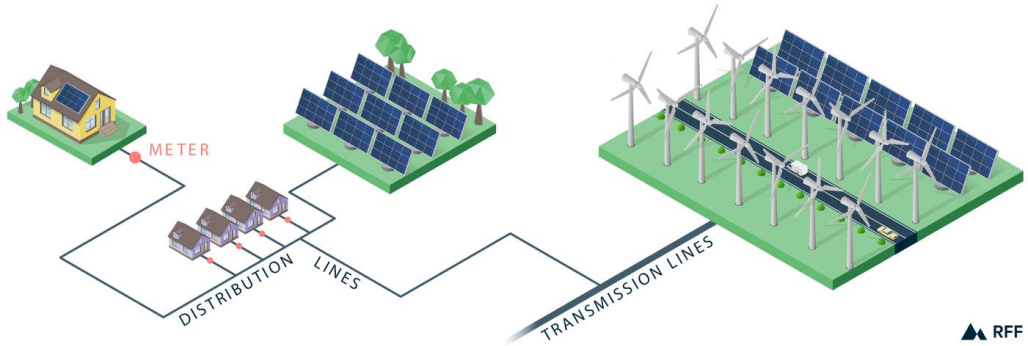
在输送环节 开发氢能的远距离输送技术，推动电力输送、热力输送和输气网络综合优化，为电、热、气之间的互转互济提供平台。

Network Develop long-distance hydrogen transportation technologies. Promote the integration and co-optimization of electricity network, heat network, and gas network so as to provide a platform for energy conversion among power, heat, and gas.



5. 存储环节的关键技术领域 Key technologies on storage

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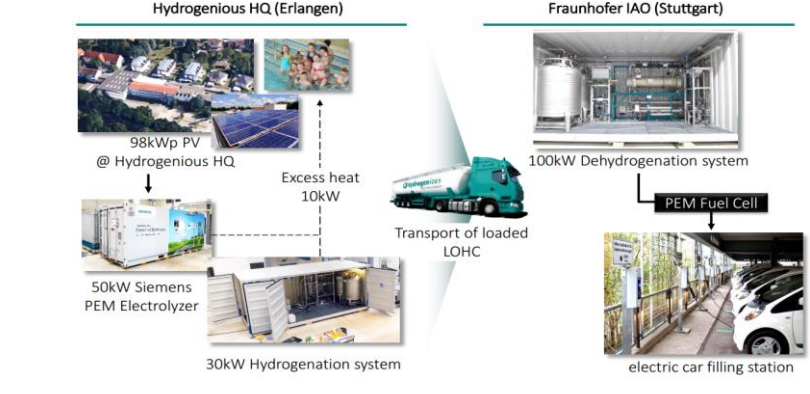
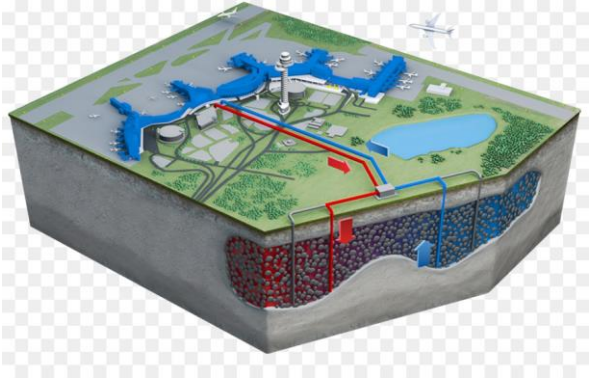
在存储环节 在电储能领域，继续研发高能量密度、高安全性的新一代电池；在储氢领域，研发高效率、高能量密度的新型储氢技术，适应更灵活的氢能运输；在储热领域，研究基岩、矿井等超大规模的储热技术，更好应对可再生能源和能源消费的季节性波动。

Storage In the field of electricity storage, continue to develop a new generation of batteries with high energy density and high safety; in the field of hydrogen storage, develop high-efficiency and high-energy density new hydrogen storage technologies to adapt to more flexible hydrogen energy transportation; in the field of heat storage , Research on ultra-large-scale heat storage technologies such as bedrock and mines to better cope with seasonal fluctuations in renewable energy and energy consumption.





6. 市场环节的关键技术领域 Key technologies on market

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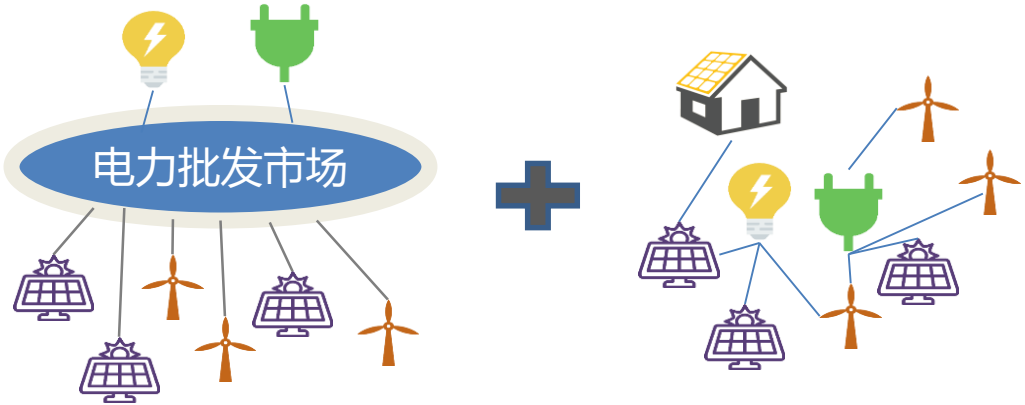
在市场环节 开展区块链分布式交易、分布式能源聚合等新兴的交易技术，以人工智能为基础，研发智能交易终端，以适应大量分布式能源接入；研究建立碳排放和能源一体化交易的技术支撑体系。

Market Carry out emerging transaction technologies such as block-chain distributed transactions and distributed energy aggregation, and develop smart transaction terminals based on artificial intelligence to adapt to a large number of distributed energy access; research and establish technical support for integrated carbon emissions and energy transactions system.

集中式
Centralized



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1. 合作基础 Cooperation foundation

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随着中国能源转型速度的加快，中欧能源创新合作不断深化，双边交流与企业业务往来日趋活跃，在以氢能、储能、电动汽车为代表的新兴能源技术领域，持续加大技术研发与应用合作，合作模式主要包括技术联合研发、合作开发项目、技术交流培训等。

As China's energy transformation speed is accelerated, China-Europe energy innovation cooperation continued to deepen, bilateral exchanges and enterprise business has become increasingly active, in a hydrogen and energy storage, electric vehicles as representative's emerging energy technologies, increasing technology development and application of cooperation, cooperation model mainly includes the technology joint research and development, cooperation, development projects, the training of technical communication etc.

1. 合作基础 Cooperation foundation

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技术合作：近年来，中欧双方企业与科研机构在海上风电、太阳能发电、燃料电池、储能等领域开展了大量技术研发合作，设立或联合成立了多个研发机构以开展深度的研究开发合作。

Technical cooperation: In recent years, enterprises and research institutions of China and Europe have conducted a large number of R&D cooperation in the fields of offshore wind power, solar power generation, solid oxide fuel cells and energy storage. A number of R&D institutions have been set up or jointly established to carry out in-depth research and development cooperation.

启迪中英海洋科技研究院
TUS-ORE CATAPULT RESEARCH CENTRE

STATE GRID
GEIRI EUROPE
全球能源互联网欧洲研究院

INESA 国际储能技术与产业联盟
International Energy Storage Alliance

远景全球风电技术创新中心
丹麦,锡尔克堡

1. 合作基础 Cooperation foundation

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项目合作：中欧双方企业在燃气发电、综合能源、海上风电、电力系统灵活性等领域开展了多个合作项目，为双方企业带来了实实在在的效益。

Projects cooperation: In recent years, Chinese and European companies have carried out many high-level technical cooperation activities in the fields of gas-fired power generation, integrated energy, offshore wind power, and power system flexibility, which have brought tangible benefits to companies on both sides.

广州增城H级重型燃机
Guangzhou Zengcheng H-class heavy gas turbine

国华东台50万千瓦海上风电项目
Guohua Dongtai 500mw offshore wind power project

华能英国门迪储能项目
Huaneng Minety Battery Energy Storage Project in the UK

2. 合作意向 Cooperation intention

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受国家能源局委托，电规总院收集整理了地方能源主管部门、能源企业、行业协会和研究机构等单位关于中欧能源技术创新合作的意向和建议。中方对欧合作意向主要包括氢能、智慧能源、综合能源系统、储能、可再生能源、低碳零碳技术等领域。

Entrusted by NEA, EPPEI collected and identified the requirements and suggestions for China-Europe energy technology innovation cooperation from local energy authorities, energy companies, industry associations, research institutions etc. The potential areas for cooperation include hydrogen energy, smart energy, integrated energy systems, energy storage, renewable energy, and low-carbon and zero-carbon technologies.

地方政府 Local governments:

- 北京市发展和改革委Beijing Municipal Commission of Development and Reform
- 河北省能源局 Hebei Energy Bureau
- 江苏省能源局 Jiangsu Energy Bureau
- 浙江省能源局Zhejiang Energy Bureau
- 福建省发展和改革委Fujian Provincial Development and Reform Commission
- 山东省能源局Shandong Energy Bureau
- 四川省能源局Sichuan Energy Bureau

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能源企业Energy companies:

- 中国石油天然气集团有限公司China National Petroleum Corporation (CNPC)
- 国家电网有限公司State Grid Corporation of China
- 中国南方电网有限责任公司China Southern Power Grid Co., Ltd.
- 中国华能集团有限公司China Huaneng Group Co., Ltd.
- 国家电力投资集团有限公司State Power Investment Corporation
- 中国长江三峡集团有限公司China Three Gorges Corporation Limited
- 国家能源投资集团有限责任公司China Energy Investment Corporation

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行业协会和研究机构 Industry associations and research institutions:

- 风能专委会 China Wind Energy Association
- 中国光伏行业协会China Photovoltaic Industry Association
- 中关村储能产业技术联盟China Energy Storage Alliance
- 中国氢能联盟China Hydrogen Alliance

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2. 合作意向 Cooperation intention

电规总院
China Electric Power Planning & Engineering Institute

智慧能源：智慧能源系统不仅可以实现不同能源品种的协调互补和智慧调度，还能大幅提高供能可靠性和能源利用效率，目前中国很多城市已将智慧城市建设列入未来发展规划，作为智慧城市的核心组成部分，智慧能源系统在未来将大有可为。中欧双方在5G+智慧能源、数字电网、虚拟电厂、储能云、区块链等方面具备合作潜力。

Smart energy: Smart energy system not only enables coordination and complementation and smart dispatch of different energy varieties, also greatly improves the reliability of energy supply and energy utilization efficiency. At present, many cities in China have included the development of smart city in their future development plans. As a core component of smart city, smart energy systems have a promising future. China and Europe have potential to cooperate in 5G+ smart energy, digital grid, virtual power plant, energy storage cloud, and blockchain.

2. 合作意向 Cooperation intention

电规总院
China Electric Power Planning & Engineering Institute

可再生能源：海上风电是中国“新基建”发展的重要领域之一，多地政府都编制了相应规划，大力推动海上风电发展，高效光伏也是中国能源转型的重点发展方向。中欧双方在海上风电的技术研发与装备制造，光伏电池研发、生物质综合利用等领域具备较大合作潜力。

Renewable energy: Offshore wind power is one of the important areas of China’s “New Infrastructure” development. Many local governments have compiled corresponding plans to vigorously promote the development of offshore wind power; As the key development direction in the future, high-efficiency PV is helpful for reducing industry costs and improving efficiency. China and Europe have potential to cooperate in the fields of offshore wind power technology research and development and equipment manufacturing, as well as PV power station projects and integration, PV cells and module equipment manufacturing, and biomass utilization.

2. 合作意向 Cooperation intention

电规总院
China Electric Power Planning & Engineering Institute

氢能：近年来，中国氢能产业发展迅速，投入力度不断加大。随着有关技术标准的出台和示范项目的开展，未来中国氢能市场发展空间广阔。中欧双方在可再生能源制氢等氢气制备、氢气储运、加氢站等关键技术、燃料电池技术等方面具备合作潜力。

Hydrogen energy: In recent years, the development of China's hydrogen energy industry continued to heat-up. With the introduction of relevant technical standards and the development of demonstration projects, China's hydrogen energy market has vast potential in the future. China and Europe have potential to cooperate in key technologies for hydrogen production such as key technologies for hydrogen generation from renewable energy, hydrogen storage and transportation, hydrogen refueling stations, and hydrogen-fueled solid oxide fuel cell technology.

2. 合作意向 Cooperation intention

电规总院
China Electric Power Planning & Engineering Institute

储能：储能是智能电网、高比例可再生能源系统、“互联网+”智慧能源的重要组成部分和关键支撑技术，是提升传统电力系统灵活性、经济性和安全性的重要手段。中欧双方在高安全性、高能量密度的新一代储能电池，跨季长时间尺度的大规模储冷储热技术等领域具备合作潜力。

Energy storage: Energy storage is an important component and key supporting technology of smart grids, renewable energy high-proportion energy systems, and "Internet+" smart energy. It is an important means to improve the flexibility, economy and safety of traditional power systems. China and Europe have potential to cooperate in the fields new-generation energy storage cells with high safety level and high energy density, and large-scale cold and heat storage technologies across seasons and long time span.

2. 合作意向 Cooperation intention

电规总院
China Electric Power Planning & Engineering Institute

低碳和零碳技术：为了实现碳中和目标，中国需要在电力和工业领域推动低碳和零碳技术，缓解化石能源使用带来的碳排放。中欧双方在碳捕捉与存储、制备液体燃料技术、化学链燃烧技术、负排放技术等领域具备合作潜力。

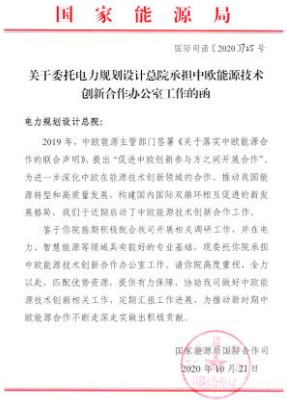
Low-carbon and zero-carbon technologies: In order to achieve the goal of carbon neutrality, China needs to promote low-carbon and zero-carbon technologies in the power and industrial sectors to alleviate carbon emissions from the use of fossil energy. China and Europe have potential to cooperate in the fields of carbon capture and storage, liquid fuel preparation technology, chemical chain combustion technology, and negative emission technology.

3.下一步工作计划 Work plan for the next stage

电规总院
China Electric Power Planning & Engineering Institute

受国家能源局委托，电力规划设计总院正承担中欧能源技术创新合作办公室的相关工作，下一步的工作内容将主要针对以下几个方面开展：举行专题技术交流活动、发布合作指引、推动示范项目、建设创新基地、开展能力建设以及探索建立创新合作基金。

Entrusted by the National Energy Administration, EPPEI is undertaking the relevant work of the China-EU Energy Technology Innovation Cooperation Office. The next step will mainly focus on the following aspects: technical exchange activities, release of guidelines for cooperation, promotion of demonstration projects, development of innovation bases, conduct capacity building activities, and explore to establish innovation cooperation fund.



国 家 能 源 局

国际司函〔2020〕75号

关于委托电力规划设计总院承担中欧能源技术创新合作办公室工作的函

电力规划设计总院：

2019年，中欧能源主管部门签署《关于落实中欧能源合作的联合声明》，提出“促进中欧创新参与方之间开展合作”，为进一步深化中欧在能源技术创新领域的合作，推动我国能源转型和高质量发展，构建国内国际双循环相互促进的新发展格局，我们于近期启动了中欧能源技术创新合作工作。

鉴于你院前期积极配合我司开展相关调研工作，并在电力、智慧能源等领域具有较好的专业基础，现委托你院承担中欧能源技术创新合作办公室工作，请你院高度重视，全力以赴，匹配优势资源，提供有力保障，协助我司做好中欧能源技术创新相关工作，定期汇报工作进展，为推动新时期中欧能源合作不断走深走实做出积极贡献。

国际能源局国际合作司

2020年10月21日

3.下一步工作计划 Work plan for the next stage

电规总院
China Electric Power Planning & Engineering Institute

经国家能源局同意，中欧能源技术创新合作办公室拟建立智慧能源、氢能、储能、风电、太阳能、清洁取暖等专项领域工作机制，并面向社会征集各领域的牵头单位，欢迎大家积极参与。

With the approval of the National Energy Administration, the China-EU Energy Technology Innovation Cooperation Office plans to establish a working mechanism in specific fields such as smart energy, hydrogen energy, storage, wind power, solar power, and clean heating, and recruit leading companies in each fields from the society. It is our honor to have your active participation.

电力规划设计总院文件

电规国际〔2021〕1号

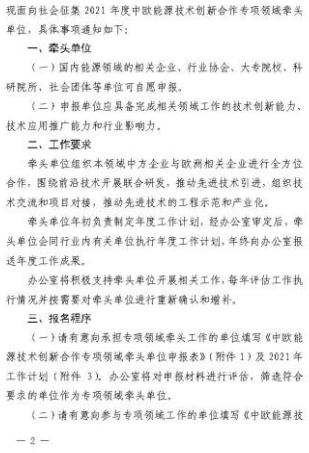
关于征集2021年度中欧能源技术创新合作专项领域牵头单位的通知

各有关单位：

按照《关于落实中欧能源合作联合声明》有关工作安排，受国家能源局委托，电力规划设计总院正在承担中欧能源技术创新合作办公室（以下简称“办公室”）的相关工作，负责中欧能源技术创新合作工作的总体统筹和协调。

为搭建中欧能源技术创新合作网络，推动中欧能源各领域技术创新合作走深走实，经国家能源局同意，办公室拟建立智慧能源、氢能、储能、风电、太阳能、清洁取暖等专项领域工作机制。

— 1 —



现面向社会征集2021年度中欧能源技术创新合作专项领域牵头单位，具体事项通知如下：

一、牵头单位

（一）国内能源领域的相关企业、行业协会、大专院校、科研院所、社会团体等单位可自愿申报。

（二）申报单位应具备完成相关领域工作的技术创新能力、技术应用推广能力和行业影响力。

二、工作要求

牵头单位组织本领域中方企业与欧洲相关企业进行全方位合作，围绕前沿技术开展联合研发，推动先进技术引进，组织技术交流和项目对接，推动先进技术的工程示范和产业化。

牵头单位年初负责制定年度工作计划，经办公室审定后，牵头单位会同行业内有关单位执行年度工作计划，年终向办公室报送年度工作成果。

办公室将积极支持牵头单位开展相关工作，每年评估工作执行情况并按需要对牵头单位进行重新确认和增补。

三、报名程序

（一）请有意向承担专项领域牵头工作的单位填写《中欧能源技术创新合作专项领域牵头单位申报表》（附件1）及2021年工作计划（附件3）。办公室将对申报材料进行评估，筛选符合要求的单位作为专项领域牵头单位。

（二）请有意向参与专项领域工作的单位填写《中欧能源技

— 2 —

术创新合作专项领域参与单位意向表》（附件2）。

（三）请于2021年2月5日前将上述材料发送至联系人邮箱。

联系人：王姝力 （电话：010-58388111/18810306820；
邮 箱：slwang@eppei.com）

附件：1. 中欧能源技术创新合作专项领域牵头单位申报表
2. 中欧能源技术创新合作专项领域参与单位意向表
3. 2021年中欧能源技术创新合作专项领域工作计划

电力规划设计总院
中欧能源技术创新合作办公室
2021年1月21日

— 3 —

欢迎扫描二维码关注

中欧能源技术创新合作公众号

Welcome to scan the QR code to follow the China-EU Energy Technology Innovation Cooperation Office Account