中欧绿色经济合作展望报告

Report on the Outlook of Sino-European Cooperation in the Green Economy

新华网欧洲公司&天府大数据国际战略与技术研究院　联合发布

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Abstract

发展绿色经济、推动节能减排、实现碳中和目标是全球经济发展的大趋势。中国与欧洲都已制定了绿色发展的总体目标，新技术的应用和市场需求必将推动中国与欧洲各国经济更高质量的提升。发展绿色经济、实现碳中和目标更需要各国敞开心怀、以开放合作的态度，学习引进各国的技术与发展经验。

中国大力推进生态文明建设，推动绿色发展，美丽中国建设迈出重大步伐，中华大地正展现出天蓝地绿水清的亮丽新景象。图为云南大理洱海及周边村落景观。（2022年5月26日摄，无人机照片）

作为世界上最大的发展中国家，中国正大力推进生态文明建设，明确提出“推进绿色发展、循环发展、低碳发展”，“建设美丽中国”。这不仅是对生态文明重要性理论认识的升华，也表明了走绿色发展之路已经成为中国坚定不移的战略选择。

2021年10月12日，万众瞩目的《生物多样性公约》缔约方大会第十五次会议（COP15）领导人峰会上，习近平主席发

中欧绿色经济合作的机遇与前景。

序言

Foreword

菲利普·马里亚尼

索菲亚-昂蒂波利斯基金会，法国索菲亚-昂蒂波利斯科技园区首席执行官

《中欧绿色经济合作展望报告》清楚地描绘了中欧绿色经济发展与合作面临的挑战和有趣的机遇。

欧洲的许多公司已经向更具使命的经营活动转型。欧盟已将其目标写入法律，即到2030年将净排放量基于1990年的水平减少55%，并在2019年就承诺要成为第一个碳中和的大陆。中国也相似的做出了净零排放的承诺。然而，这将需要数万亿美元投资于绿色和低碳产业以及对转型战略的理解。

投资清洁技术创新已成为全球向净零目标过渡的关键。没有生态创新，解决重大环境问题将非常具有挑战性且代价高昂。培育、促进和加速创新对于有效的中长期共同应对气候变化具有决定性作用，并可能带来针对气候和可持续发展机会的新举措。

在位于法国南部的欧洲领先的索菲亚-昂蒂波利斯科技园区，我们自70年代以来一直处于绿色经济的前沿，并通过国际倡议来实现我们的目标。例如自2016年以来我们与中国的合作，以及最近与青岛高科技园区通过开发创新和变革性清洁技术的项目。我们目前的目标是在绿色创新实践中发挥关键作用。如何做到?我们通过为环境初创企业创造有利条件，通过促进使用人工智能，将公司与绿色创业项目市场联系起来，通过投资可持续移动性和智能车辆；加强科学研究，提升技术能力，扩大国际合作等方式来实现。

对日常问题的绿色解决方案的需求已成为许多社区的优先事项。专家表示，在经济增长和环境福祉之间建立良性关系可以减少生产和消费对环境的影响。因此，我们比以往任何时候都更有责任，要在今天就着眼于未来，促进合作以推动多边倡议。我坚信，欧洲和中国之间的创新伙伴关系将为可持续增长创造新的模式。

石勇

国务院参事，国际欧亚科学院院士，发展中国家科学院院士，中国科学院虚拟经济与数据科学研究中心主任，中国科学院大数据挖掘与知识管理重点实验室主任，天府大数据国际战略与技术研究院院长

“碳达峰”与“碳中和”是中国绿色发展的必由之路。数字化、智能化是发展绿色经济、实现双碳目标的重要方向，在基建、能源、交通、金融与制造业等诸多领域，中欧都正在形成数字技术赋能发展、绿色理念引导创新的新气象。在绿色经济转型和应对全球气候变化进程中，中欧双方在技术、资金和产业等方面都具有高度互补性，具备转型合作的先决优势。

《中欧绿色经济合作展望报告》对中欧绿色经济合作转型所需的关键要素、关键环节和关键领域进行了客观的分析研判，从中欧合作主导产业与能源消费、绿色经济政策对比、主要合作领域、典型案例与前景分析入手，重点阐释了中欧各大关键领域上的合作空间与合作路径，为中欧在“共同但有区别的责任”原则下开展绿色经济深度合作提供了有价值的行动指南，更为我们勾勒了中欧绿色经济的广阔合作前景。

在未来，相信中欧在环境气候务实合作、绿色能源、绿色金融等方面的深度交流，将为新时期中欧全面战略伙伴关系深化注入新活力，为更多国家的经济转型提供新方案，为推动全球可持续发展贡献新力量，中欧绿色经济合作值得全球期待！

专家评论

Experts' Comments

张景安

国际欧亚科学院中国科学中心常务副主席，国际欧亚科学院院士

自英国经济学家戴维·皮尔斯在1989年首次提出“绿色经济”的概念，欧洲国家一直是绿色经济发展的先行者，从制度、政策和法律层面探索欧洲可再生能源发展，推动在社会层面形成践行低碳、绿色生活的民意基础。

中国在2020年提出了“碳达峰”“碳中和”的宏伟目标之后，相继出台多项绿色经济的政策措施，可以说，中国和欧洲在绿色转型方向志同道合。《中欧绿色经济合作展望报告》梳理了中国和欧洲的能源消费现状和绿色经济政策，全面呈现了中国和欧洲在绿色基建、能源、交通、金融等方面密切合作的面貌，不仅有助于专业人士评估双方绿色经济的发展，也希望能帮助中国和欧洲的企业家发掘双方在绿色经济领域的优势与合作机会。

当今世界正经历百年未有之大变局，互利合作是应对挑战的发展之道。在新冠疫情和“脱钩断链”等国际环境挑战下，绿色经济领域的合作符合中国和欧洲的双边政治经济利益，加强绿色合作势必成为双边合作的重点领域，成为中国和欧洲全面战略伙伴关系的新亮点和新引擎。中国有庞大的国内市场和相对完善的制造业体系，特别是在新能源汽车等领域，中国将所积累的技术和经验分享给不同国家，提供解决方案，创造就业机会，惠及广大国家和地区的民众。欧洲在绿色技术上有先发优势，通过政策引领、金融、碳市场等多种方式，全面推动绿色转型。在全球绿色发展进程中，中国和欧洲都扮演着至关重要的角色，双方均应坚持开放合作、共同发展，充分发挥双边市场优势和技术创新互补能力，为世界更美好的发展而奋斗！

曾勇

国际欧亚科学院院士
电子科技大学校长

2022年，新冠疫情叠加地缘政治新变化，全球经济发展受到前所未有的冲击。在后疫情时代，绿色低碳的发展道路已成为全球共识，“双碳”战略既是中国向世界做出的庄严承诺，也是加快向绿色发展方式与生活方式的转变的选择。

中国的绿色经济发展起步虽晚于欧洲，但在发展速度上已逐渐赶上欧洲先行国家的步伐，合作发展低碳技术、共同提高发展质量，已成为中欧双方的共同愿景。过去十来年，中国和欧洲在绿色基建、绿色能源、绿色交通、绿色金融等方面进行了广泛的交流与合作。《中欧绿色经济合作展望报告》真实呈现了中欧绿色经济发展和合作的全貌，评估了中欧合作的前景和面临的挑战，为促进中欧在绿色能源、绿色金融、绿色基建等领域的发展和合作提供了建设性意见。

展望未来，随着数字经济的发展，中欧在绿色低碳发展方面有着更广阔的合作空间。中国的新能源产品在欧洲有巨大的市场潜力，但也面临诸多出口和投资的困难。不论欧洲是推进能源转型的主动措施，还是应对乌克兰冲突带来的能源危机加剧，加强与中国的合作都是“双赢”的选择。在世界经济复杂多变的环境中，我们相信中欧合作是中欧经济发展的“压舱石”。求同存异、合作发展的中欧经贸关系，定将为增强中欧绿色经济活力与全球经济发展助力。

龚俊中

天府大数据国际战略与技术研究院副院长，布鲁金斯学会智库成员，卡内基智库成员

中国与欧洲是全球绿色经济发展的引领者。欧洲很早就提出了绿色发展的理念，在全球带动了绿色经济的发展；中国近年来努力推进绿色发展实践，业已提出2030年“碳达峰”、2060年“碳中和”发展目标，并付诸严格的执行。在当前，中欧双方共同探讨绿色经济的发展方向以及具体技术，能对全球绿色经济的推动产生巨大的示范作用。

绿色经济不仅会给社会各方面带来新的发展机遇，也会因为与数字经济等新技术不断融合而实现效率的提高：政府、企业可以利用大数据对碳排放指标进行监控与管理，物联网与人工智能因绿色技术的融入打开了更广阔的市场空间，金融科技也与绿色经济实现有机结合，进而对绿色经济的长期发展产生良好的引导。

发展绿色经济是循序渐进的过程，需要基建、能源、交通、金融等众多行业的共同参与，也需要中国与欧洲携起手来，共同推广新技术、共同实现绿色发展新目标。中国的企业需要更加重视欧洲市场，学习欧洲企业的技术和管理经验。而拥有广阔市场的中国，更需要欧洲企业家、同行们的关注，与中国一起，持续推动能源改革，共同助推全球绿色发展。

近四十年以来，虽然中欧双方举办了不少交流活动，也确实增进了彼此理解，但面对一个崭新的话题，中欧彼此还存在很多信息的空白点。疫情的阻隔，也减少了双方获得信息的渠道。为此只有了解双方发展绿色经济的最新动态，总结双方好的做法，才能推动双方切实合作。

希望本报告能成为中欧致力于绿色经济发展的同仁们一座沟通的桥梁，双方也能因本报告找到合作的机遇，从而为双方绿色经济合作贡献一份力量！

王洪涛

中国电子节能技术协会全生命周期绿色管理专委会主任，欧盟《国际LCA数据系统ILCD指南》国际评委及公开咨询会议联合主席，联合国环境署生命周期倡议UNEP/SETAC Life Cycle Initiative理事会委员，UNEP《全球LCA数据库指导原则》技术指导委员会委员以及数据收集工作组主席

欧盟在可持续发展政策法规方面一直发挥着引领作用，而中国作为制造业大国切实推动了全产业门类的低碳绿色转型，双方优势互补，有巨大的合作潜力和共同发展机遇。

当前中欧双方都已提出碳中和目标，这不仅是应对全球气候变化的长期行动，同时也是推动各个行业低碳绿色转型、重塑全球产业链协作、推动经济高质量发展的重大机遇。尤其是针对产品生命周期全过程碳减排的一系列欧盟政策法规，涵盖了各个产业门类，远远超出传统碳交易制度的控排行业范围。全生命周期碳减排意味着国际供应链更密切的合作，将带来国际贸易和全球市场的巨大转变。“全生命周期碳中和”正在成为全球碳中和领域的主战场。

中欧双方在全生命周期碳中和领域有长期的积极探索，有扎实的技术支持，是全球制造业普及生命周期方法最广泛、最迅速的国家和地区。通过双方实质性的共识和协同，可以成为强大的全球性碳中和推动力量，推动全球负责任生产与消费，落实联合国可持续发展目标。

中欧的碳中和与绿色发展正处在一个关键阶段，政策法规和行业发展模式正在成型，本报告正当其时，非常重要。希望本报告可以推动中欧双方更密切的交流，尤其是围绕重点政策法规，推动双方政府、上下游行业和企业、研究机构之间的专题交流，让巨大的合作潜力变为真正的共同发展机遇。

一、引言

绿色可持续发展一直是全球经济发展的重要主题。中国一直对发展绿色经济持开放合作的态度，需要与在这方面走在前列的欧洲共谋发展。而欧洲企业在中国发展，也能与中国共同推动全球绿色发展，开拓广阔市场。本报告从中欧经济发展和能源消费现状，中欧绿色经济的主要政策梳理与比较、合作案例分析，中欧绿色经济合作展望等方面，通过数据、政策、案例等角度进行分析，力图得到一份有启发、有价值、直观的研究报告。

中国把碳达峰、碳中和纳入生态文明建设整体布局，加快发展风电、光伏等新能源，努力推动绿色低碳生产生活方式成为全社会的自觉追求。图为贵州省威宁县平箐光伏电站和大海子风电场。

二、中欧概况及能源消费浅析

2.1 中欧经济发展及主导产业简介

近十年来，中国经济快速发展，国际影响力持续增强。经济总量从2000年的1.21万亿美元增长到2021年的17.7万亿美元，增长了约14倍，排名世界第二，与欧盟国家总体水平相近。欧洲一直是全球经济的领跑者。2021年欧洲国家经济总量为24.71万亿美元，其中欧盟国家约为17.09万亿美元。中国GDP与欧盟水平差距越来越小，到2021年中国GDP反超欧盟6391.8亿美元。①

① 国际货币基金组织（IMF）数据，2022年4月发布

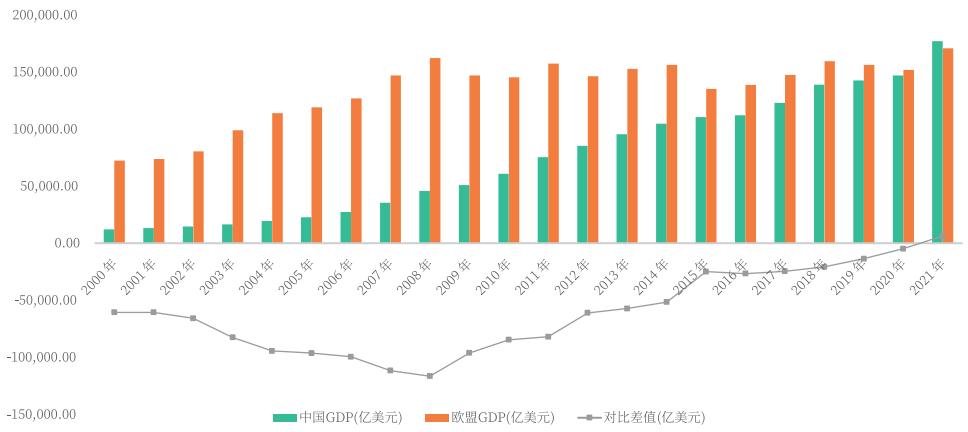


图1
2000年-2021年欧盟与中国GDP对比

数据来源：国际货币基金组织（IMF）

中国作为新兴发展中国家，近四十年经济产业快速发展，已在电子产品、纺织服装、机械产品、小型商品等产业产品上获得了优势，相关的钢铁、纺织、机械、电子产业也逐渐成为了主导产业。这些产业一般具有技术含量不是很高，生产附加值相对较低，尚未形成规模效益的特征，所生产的产品单位能耗相对较高，急需新的技术手段和资金提升绿色生产效率。

欧洲拥有悠久的工业历史传统和强大的工业基础。经过几百年的发展，欧盟国家已在农产品、钢铁、交通设备、药物等产业形成传统优势。欧洲国家众多，但通过经济一体化，各国已在许多特定产业形成优势，高科技产业、传统轻工业、环保产业是不少国家的主导产业，欧洲已逐渐进入低碳发展时代。

2.2 中国能源消费基本情况

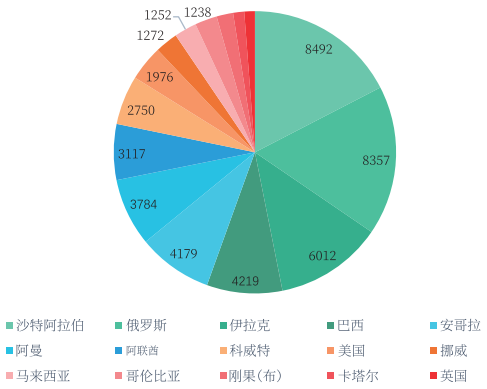


图2
2020年中国原油消费进口情况(单位:万吨)

数据来源:中华人民共和国海关总署

随着工业化和城镇化进程的不断加快，2016至2020年，中国能源消费量呈现持续增长态势。其中，石油、煤炭和水电的增长率明显提升。从2001年起，中国的原油进口量连续增长，并在2017年以全年原油进口量4.2亿吨，首次超过美国成为全球最大的原油进口国。中国主要原油进口来源国为沙特阿拉伯、俄罗斯、伊拉克、巴西、安哥拉、阿曼等，其中沙特阿拉伯及俄罗斯的进口占比最大。

2.3 欧洲能源消费基本情况

近年来，欧洲国家在清洁能源方面的投入力度加大，但中短期来看对传统能源的依赖程度仍较高。2020年，欧洲能源消耗量排名前三的国家分别为德国、法国和英国。

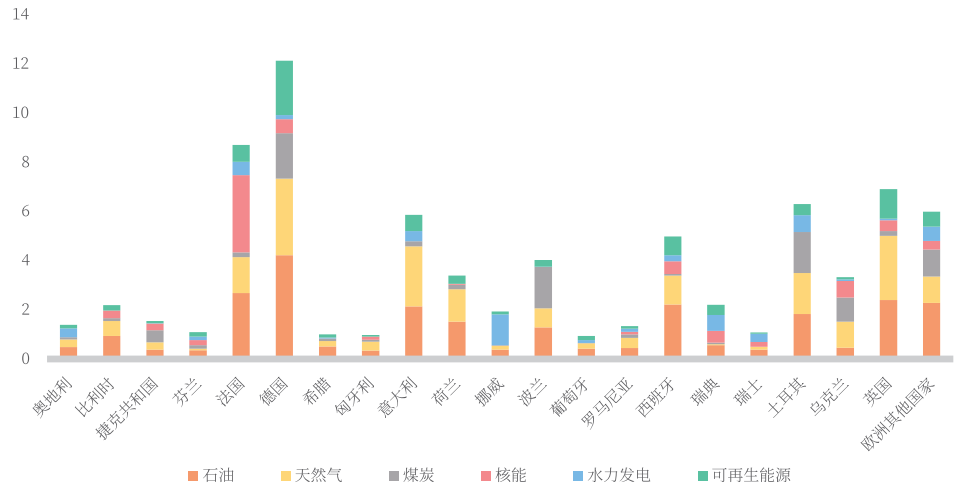


图3
2020年欧洲各国一次能源消耗量(单位:艾焦耳;按燃料计算的消耗量)

数据来源:BP Statistical Review of World Energy

能源消费量与对外依存的“双高”现象长期困扰欧洲。根据欧盟统计局发布的数据，2020年欧

盟能源消费的58%来自进口，俄罗斯为欧洲主要的石油、天然气和煤炭供应国。如何进一步克服能源对外依存高的不利影响成为欧洲未来绿色转型必须解决的关键问题。

通过将欧洲主要能源进口数据以标准煤的形式进行量纲统一化处理并比较②，来自俄罗斯的天然气位居欧洲对各国各类能源进口量首位。同时，欧洲对美国、西非的天然气和石油进口依存度也较高。

② 能源品种丰富多样，所含热值各不相同，为将欧洲煤炭、天然气和原油三种不同品种能源的进口数据进行统一视角下的观察并加总比较，需要将其换算为具有统一规定的标准热值的标准煤计量单位，本文基于三类能源的折标准煤系数进行逐一计算和统一汇总分析，能源标准进口量=能源进口量*折标准煤系数γ_i得出此分析结果。

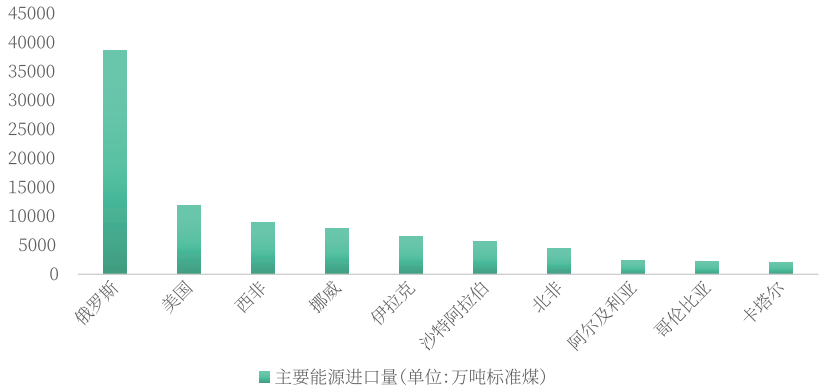


图4 2020年欧洲主要能源对外依存国家及进口量（单位：万吨标准煤）

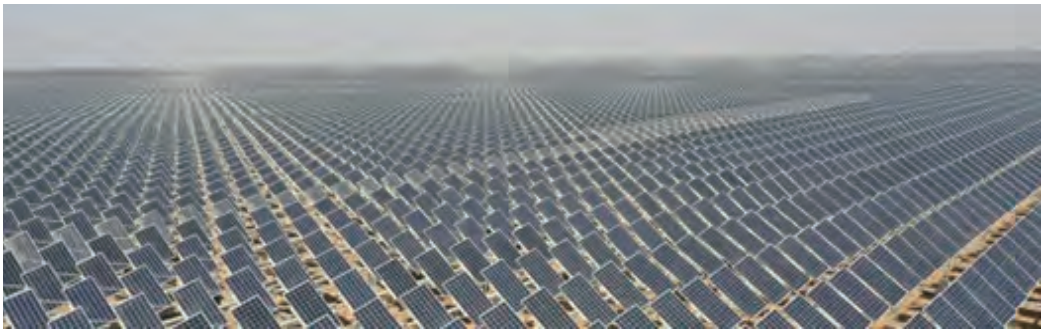
数据来源：IEA前瞻产业研究院、BP Statistical Review of World Energy

三、中欧绿色经济主要政策梳理与比较

3.1 中国主要绿色经济政策

与欧洲国家相比，中国绿色经济政策起步较晚，但发展迅速。2020年9月22日习近平主席在第七十五届联合国大会一般性辩论上对碳达峰碳中和目标做出庄严承诺后，配套政策的出台更为迅速、精准。

2021年，《关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见》和《2030年前碳达峰行动方案》相继发布，这是中国碳达峰碳中和“1+N”政策体系中最为核心的内容。在此基础上，各部委及地方政府相继出台多项指导意见，对能源、基建、交通和金融等领域的绿色转型提供根本遵循。能源方面，清洁能源获得井喷式发展；基建方面，新基建成为重要抓手；交通方面，绿色交通物流全面启动；金融方面，绿色金融服务经济大局。



全球最大单体农光互补电站——中国宁夏宝丰农光一体光伏电站。

3.2 中国双碳目标的提出与经济转型

近年来，中国全面贯彻新发展理念，坚定走绿色低碳高质量发展道路。碳达峰碳中和目标的提出，是中国政府应对全球气候变化、协调可持续发展的重大战略决策。最近十年中国碳排放走势也具有明显的阶段性特征。如图5所示，碳排放量经历先增长后持平再放缓的态势。

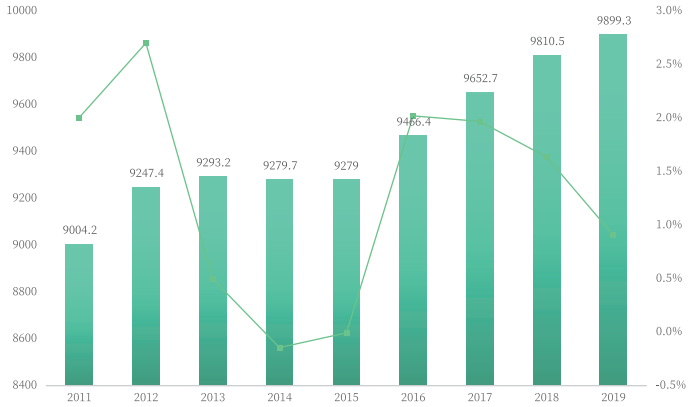


图5：2011年-2020年中国碳排放情况（单位：百万吨二氧化碳当量；增长率：%）

数据来源：BP Statistical Review of World Energy

制造业不同细分行业的碳排放量区别较大。如图6所示，电力行业、钢铁、水泥、石油化工等排名靠前，需重点调控。其他行业和民用碳排放量占比较少。

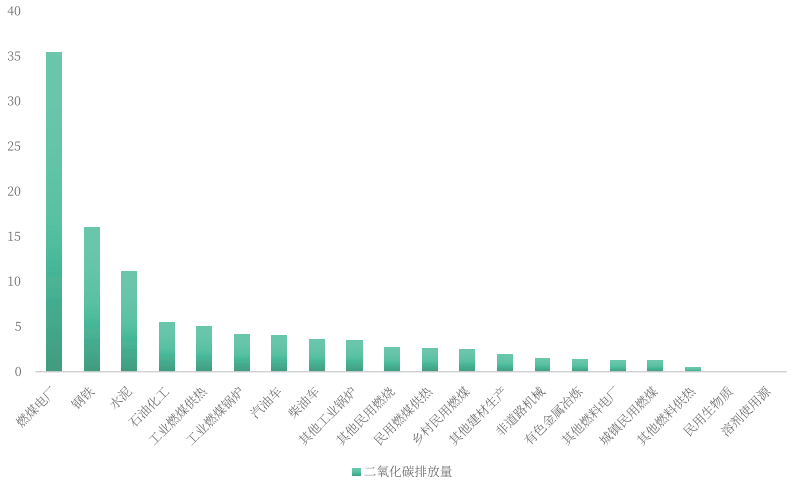


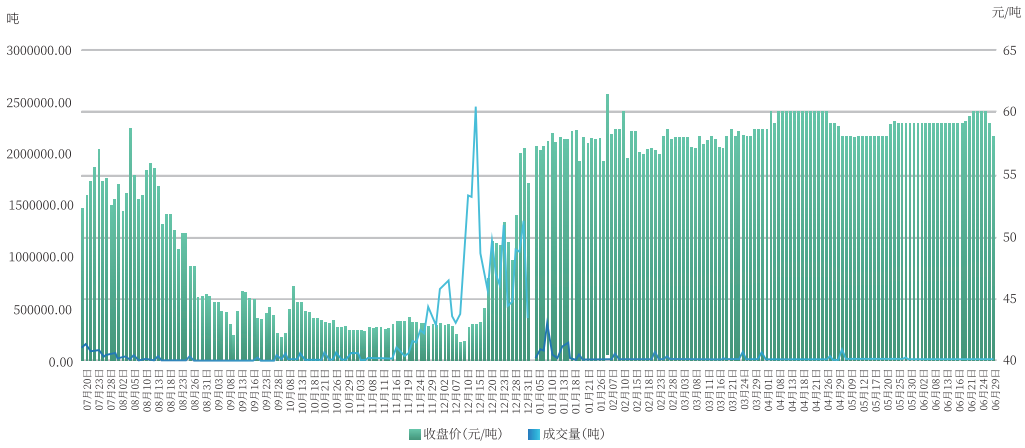
图6：2020年中国各细分行业碳排放情况（单位：亿吨）

数据来源：网易研究局碳中和报告

2021年7月16日，全国碳排放权交易市场上线交易正式启动。图为启动仪式现场。

构建全国统一碳交易市场，是中国双碳目标实现的重要驱动与市场路径。2010年-2021年6月，深圳、上海、北京、广东、天津、湖北、重庆和福建开展了碳排放权交易的地方试点；2021年7月，中国正式启动了全国统一碳排放权交易市场（简称“全国碳市场”），标志着中国进入碳排放交易全国运行新时期。

欧盟早在2005年就已实施欧盟碳排放权交易体系(EUETS),目前已成为全球最大的碳交易市场,其碳交易价格已于2020年末攀升至约40美元/吨[③]。而纳入首批碳市场覆盖的中国企业碳排放量超过40亿吨二氧化碳,意味着中国碳市场将成为全球覆盖温室气体排放量规模最大的市场,中国也成为碳排放配额交易定价权的有力发声者。



数据来源:上海环境能源交易所

图7
中国碳交易市场行情图 ④

③
数据来自路孚特公司,"Pricing and Market Data"数据库。

④
使用上海环境交易所2020年7月20日至2021年6月21日碳交易数据,求得期望收盘价 $E(X)=\sum_{i=1}^{n} x_i/n$,期望成交量 $E(Y)=\sum_{i=1}^{n} y_i/n$,以此考察碳排放量配额的日成交量及收盘价格的波动情况。分析可得,碳配额交易的期望收盘价为52.58元/吨,期望成交量为123116.38吨。2021年8月至12月的收盘价处于全年最低水平,2021年12月成交量从50万吨飙升超过250万吨,碳交易活跃,其他交易区间的收盘价与成交量都较为稳定。可视化分析结果如图7所示。

全国碳市场正成为中国利用市场机制优化合理配置碳资产的重要机制。由图7可知,全国碳市场在成交量与交易价格方面均具有较大的弹性,中国碳交易的市场化机制已经初具规模,在实现碳资产价格发现功能的同时也将激励中国低碳产业的高速发展。

3.3 欧洲主要绿色经济政策

欧盟在绿色经济政策方面起步较早,目前已形成涵盖温室气体排放、清洁能源、工业转型等方面的全面政策体系。各主要经济体也有相应的政策,为欧洲绿色经济发展提供政策引领。尤其在能源方面,欧盟于2019年颁布《欧洲绿色协议》;于2021年提出了"减碳55"一揽子计划;于2022年3月就欧盟碳边境税达成一致。

2021年10月31日,《联合国气候变化框架公约》在英国苏格兰格拉斯哥正式开幕,国际社会期待各方尤其是发达国家能真正落实减排承诺,共同行动以有效应对气候变化带来的危机和挑战。图为《联合国气候变化框架公约》第26次缔约方大会开幕式现场。

3.4 欧洲减碳目标的提出与经济转型

2021年10月在德国法兰克福拍摄的一处热力发电站。

二十余年前，部分欧洲国家宣称已实现GDP增长与CO_2排放的脱钩；德国等九个欧盟成员国已于1990年碳达峰，其余十八个成员国分别在1991-2008年实现碳达峰。

2018年，欧盟批准了碳排放贸易体系的改革方案，通过市场稳定储备机制（MSR）回收更多的富余配额。2020年，欧洲议会将2030年温室气体排放量（相比1990年）从目前40%的减排目标提高到60%[⑤]，坚持欧盟2030年的目标应该只依赖欧盟国内减排，体现出减碳转型的雄心。

⑤ 中华人民共和国商务部，《欧洲议会支持欧盟2030年减排60%的目标》，2020年10月17日

如图8所示，2019年至2020年期间，欧洲各国碳排放量均有下降，其中比利时、希腊、冰岛的碳排放量降幅显著，匈牙利的碳排放量降幅最小，其余各国的碳排放降幅普遍位于10%-20%之间，减排效果较为显著，但距目标仍有差距。

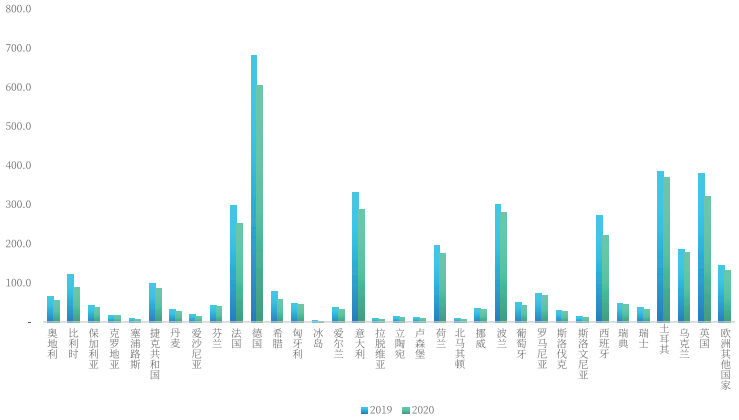


图8 2019年-2020欧洲各国碳排放情况（单位：百万吨二氧化碳当量）

数据来源：BP Statistical Review of World Energy

3.5 中欧绿色经济政策比较与合作机遇剖析

海上风电是可再生能源发展的重点领域。这是2021年7月19日拍摄的华能（庄河）风力发电有限责任公司建设的海上风电场址。

中欧双方在政策层面对发展绿色经济有着广泛的共识。中欧分别制定了短期和中长期的政策目标。在长期目标上，双方均规划了到2050年的愿景；欧洲按碳预算期，提出了第三个碳预算期（2024-2028）的政策目标。

由于经济发展水平和社会环境的差异，中欧的绿色经济政策存在明显的差异。在绿色建筑方面，中方重视对农村建筑设施的改造，这在欧洲各国政策中鲜有提及。在绿色交通方面，欧洲更加关注新能源汽车的发展，而中国政策同时也关注交通运输的基础设施，如换电站、充电桩的建设。

另外，中国在绿色供应链上具备领先优势，矿产资源丰富，工业发展较为成熟，零部件生产和组装居于全球领先；而欧洲在氢能网络、碳捕集、碳封存等技术研究领域领先世界，但在商业化推广方面相对较弱。中欧开展绿色合作将有效带动欧洲数字经济和绿色发展，助力欧盟实现传统产业转型升级。同时，欧洲的跨国企业具备较强的所有权优势和内部化优势，而中国具备较强的区位优势且对资本输入具备足够的韧性，中欧合作切实符合双边产业绿色高质量发展的需要。

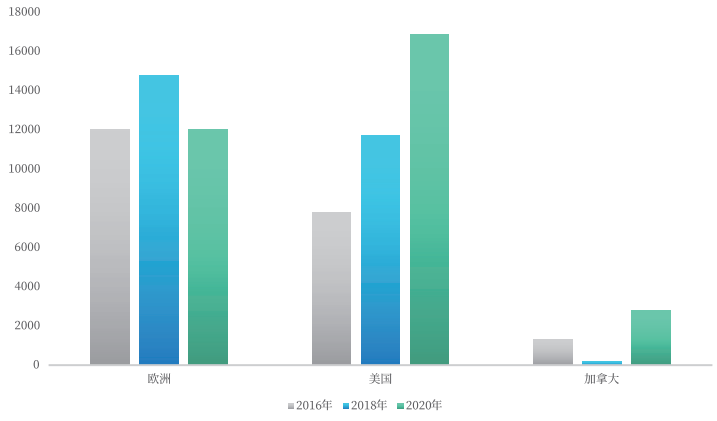
表9
中欧绿色经济的政策对比

	绿色能源	绿色基建	绿色交通	绿色金融
相同点	·中欧都分阶段制定了短中长期目标，例如到2030年、2050年等 ·在绿色能源方面，中欧都重点聚焦氢能、核能、碳捕集等 ·在绿色基建方面，中欧都重点围绕房屋供暖 ·在绿色交通方面，中欧都重点关注了新能源汽车的发展 ·在绿色金融方面，中欧都聚焦到了绿色债券、绿色投融资			
不同点	·欧洲在目标和措施制定上，量化措施更为具体 ·在绿色基建方面，中方重视对农村的建筑改造 ·在绿色交通方面，欧方更加关注新能源汽车，中方同时关注交通运输的基建			

3.6 中欧经贸合作的绿色转型

作为全球两大力量，面对碳中和目标中国和欧洲有着共同的价值取向和坚实的合作基础。欧洲是ESG理念的积极响应者和引领者，如图10所示，根据全球可持续投资联盟（GSIA）统计，2018年欧洲的ESG资管规模以14.1万亿美金位列世界首位。为促进碳中和并提升ESG投资规模，欧盟委员会先后提出了欧洲绿色协议和欧洲绿色交易投资计划。《欧洲分类法（EUT）》和《可持续金融披露条例（SFDR）》的发布则进一步对资管机构的ESG投资做出了规范化的要求，规范资管机构ESG投资信息披露的同时减少资管机构的“漂绿”行为，监管趋严使得欧洲ESG资产增速趋缓，需要转型提振。

图10
全球可持续投资的资产规模（单位：十亿美金）



数据来源：全球可持续投资联盟（GSIA）

中国近年来积极融入国际绿色金融市场，图11显示了Wind ESG数据统计结果，截至2022年4月30日，本年中国已有1410家A股上市公司披露独立ESG报告，占全部A股公司数29%，较2021年增长22.5%，显示出中国企业对国际绿色金融合作的决心。

中欧在加强金融与投资绿色合作方面前景广阔，可加快绿色低碳标准的衔接，通过构建满足准确性、一致性、可比性、透明性等要求的低碳标准计量体系，加速中欧绿色金融市场合作，推动投资转型。

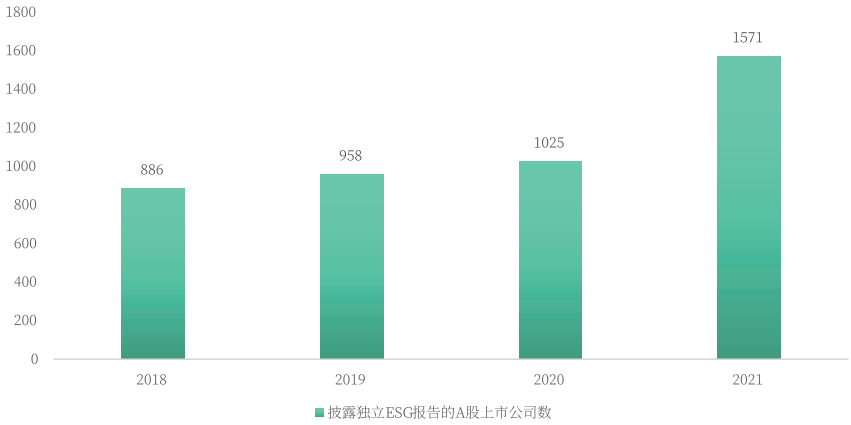


图11
2018-2021年中国披露独立ESG报告的A股上市公司数目(单位:家)

数据来源:Wind ESG

综上所述,欧洲已经在绿色经济发展方面拥有了长期的技术积累,低碳环保产业的发展历史悠久。不过中国近年来绿色经济发展迅速,且已在绿色产业、绿色基础设施、绿色金融等方面取得了一定的创新发展。中国拥有广阔的市场,良好的工业设计和生产能力,以及优秀的商业推广能力。尽管当前国际背景下,中欧双边贸易与投资都受到一定影响,但中欧应更加出台更多优惠政策,推进绿色技术合作,鼓励绿色供应链共享,发掘互补优势,实现中欧绿色经济合作共赢。

四、中欧绿色经济合作主要领域概况与案例分析

近十年来,中国和欧洲在绿色发展领域开展了广泛且长期的合作,取得了丰硕成果。本部分聚焦绿色基建、绿色能源、绿色交通、绿色金融、绿色制造领域,分析中欧合作概况及典型案例。

4.1 大力发展绿色基建,积极参与行业改革

中国近年来致力于打造绿色建筑,“十三五”期间,中国严寒寒冷地区城镇新建居住建筑节能达75%,累计建成绿色建筑面积超过66亿平方米,节能建筑占城镇民用建筑面积比例超过63%。[⑥] 在绿色基础设施建设方面,中欧开展了许多合作项目,位于青岛的中德生态园在核心技术、产业企业合作以及人才建设等各方面都有较成熟的发展,是中欧绿色基建合作的典范。

⑥ 住房和城乡建设部,《“十四五”建筑节能与绿色建筑发展规划》,2022年3月11日

图为位于中国青岛的海尔中德生态园,已经打造成为全球首个碳中和“灯塔基地”。

中德生态园从2013年7月全面启动建设,到如今发展成为中德合作的新平台,被中国商务部、德国经济部誉为“中德两国政府间生态领域的灯塔项目,是双边合作园区的典范”。中德生态园作为中德可持续发展的合作平台,结合自身特色和优势对被动式建筑进行了一系列积极探索。如:建设完成了符合德国PHI认证标准的亚洲体量最大的单体被动式建筑——被动房技术体验中心,与现行国家节能设计标准相比,节能达92%以上;与全国建筑节能标准化委员会合作,编制完成一系列国家和地方相关标准等。

以中德生态园为典范的中欧合作项目践行了绿色发展战略，参与了中国绿色基建行业的改革，解决了当前基础设施建设可持续发展难题，更有效地促进出台中国绿色建筑行业标准。与此同时，作为中国与欧洲单一国家的合作模式，中德生态园能更加聚焦德国的产业发展特征提供定制服务，促进德国绿色产业来华投资合作，快速形成产业聚集。其一市对一国的建设思路值得推广。

4.2 推进绿色能源转型，拓宽国际多元合作

近十年来，中国在能源绿色转型方面成效显著，煤炭消费占能源消费的比重下降到56%左右，清洁能源比重上升至25.3%，光伏、风能装机容量和发电量均居世界首位[⑦]，绿色发展成效逐步显现。

⑦ 央广网，《中国绿色发展成效显现 清洁能源占能源消费比重上升至25.3%》，2022年2月19日

2022年欧盟委员会公布了“REPowerEU”能源计划，欧盟将进一步加大对风电、光伏等领域投资，显著提升清洁能源行业在欧盟经济中的重要性。中欧在能源领域目标一致、技术互补，具有广袤的合作前景。根据“REPowerEU”计划，将有270亿欧元直接投资于电解槽和绿氢储运，而中国作为最大的氢气生产国，在制氢、储氢、运氢、加氢的产业链上拥有众多企业，目前已有挪威、比利时的企业和中国企业开展氢能制造领域的合作，未来中欧合作的商业空间值得期待。

2021年7月1日，远景动力（Envision AESC）与日产汽车（Nissan）共同宣布，远景动力将为日产汽车下一代电动汽车平台提供动力电池，并共同在英国桑德兰市建设“EV36Zero”—— 全球首个集电动汽车生产、动力电池制造和可再生能源系统于一体的电动汽车零碳生态基地，为全球汽车行业电动、绿色转型树立标杆。远景动力在英国桑德兰市的动力电池超级工厂，将为每年10万辆的日产电动汽车提供高品质的绿色动力电池，助力英国绿色工业革命。

远景、日产和英国政府这次的合作项目，是企业与企业间、企业与政府间以及国际间多元合作的典型案例。由于新能源电池在电动汽车等终端消费品上有广泛应用，因此电池产品也具有相当的品牌效应。远景、日产和英国政府的合作经验，对未来的国际间多方能源合作有重要的示范效应。

远景鄂尔多斯零碳产业园内，重型卡车在进行换电操作。

4.3 健全绿色交通体系，深度融合产业升级

为加快建设交通强国，构建现代综合交通运输体系，中国国务院印发了《“十四五”现代综合交通运输体系发展规划》。到2035年，便捷顺畅、经济高效、绿色集约、智能先进、安全可靠的现代化高质量国家综合立体交通网将基本形成。图为一列动车组列车行驶在江苏连云港市境内（无人机照片）。

中国自“十三五”以来，积极推进交通绿色发展。2021年新能源城市公交达到100余万辆，与2015年相比，营运货车二氧化碳排放强度下降8.4%。[8]中国绿色交通体系的蓬勃发展，离不开中国新能源汽车产业的快速发展。新能源汽车产业列入了《中国制造2025》十大战略重点发展领域。自2017年以来，中国的新能源汽车产销量连续多年居世界首位，发展势头超过了不少欧洲汽车企业。

在欧洲绿色政策推动下，新能源汽车在欧洲终端市场的渗透率逐年稳步上升。而中国对欧盟（含英国）出口的新能源汽车，自2019年以来实现了每年倍增。从图12可以看出，在2017年至2021年期间，中国对欧洲的新能源乘用车出口额呈指数式增加，尤其是纯电动乘用车的出口，短短几年时间从1100万美元增长到65亿美元。截止2021年，欧盟已经成为中国最大的新能源汽车出口市场，在中国新能源汽车出口中的占比高达72%。[9]

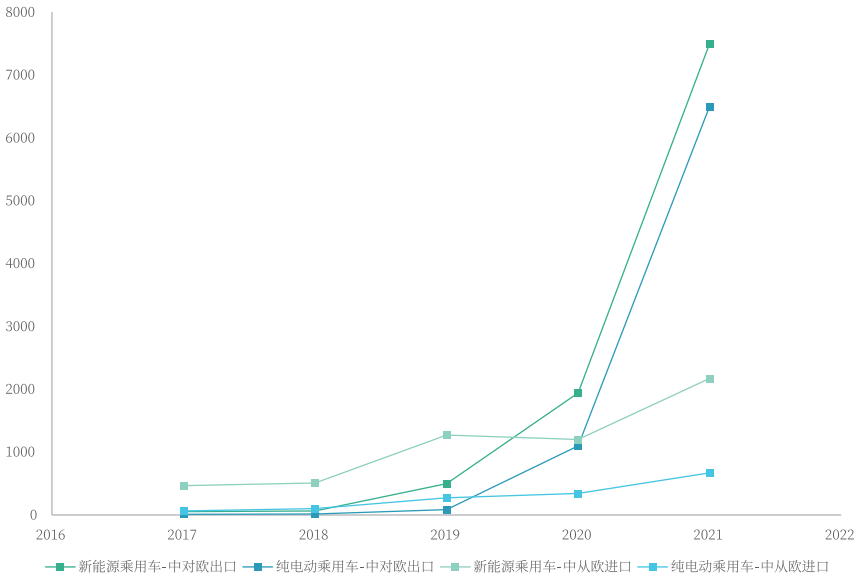


图12
中国与欧洲的新能源乘用车贸易（单位：百万美元）

数据来源：联合国商品贸易统计数据库（UN Comtrade），笔者整理

除了整车贸易，新能源汽车产业链上的两类关键产品，电机和锂电池，中欧贸易也蓬勃发展。中国对欧洲的锂电池出口额，从2017年的8.7亿美元快速上升到2021年的83亿美元（增长约10倍），电机的出口额从9100万美元增长到2.9亿美元（增长约3倍）。在中国从欧洲的进口上，两种核

⑧ 交通运输部，《绿色交通“十四五”发展规划》，2021年10月29日

⑨ 数据来源于UN Comtrade数据库，经笔者整理计算所得。

心产品的进口额都有所增长，锂电池较电机增长更快，从2019年开始锂电池进口额开始超过电机。相较于整车贸易，中欧在关键产品上的经贸往来，对中欧新能源汽车产业链的深度融合或更有意义。

2022年9月16日，蔚来汽车官方宣布，由位于匈牙利的蔚来能源欧洲工厂生产下线的首座换电站正式发运德国，该站发运标志着蔚来将加速欧洲市场能源布局，为欧洲用户提供更加便捷的加电服务。图为9月16日，在匈牙利比奥托尔巴吉，一辆蔚来汽车停放在换电站中。

德国是欧洲新能源汽车的制造大国，我们以德国为例，运用RCA指数[10]来分析中欧在新能源汽车市场的国际竞争力。表13统计了中国和德国在三种细分新能源乘用车产品上的显示比较优势。在混动乘用车市场上，德国产品具有压倒性的比较优势，RCA指数常年在3以上；中国的RCA指数虽有稳步上升，但仍然远低于1。在插电式柴油混动乘用车上，德国的压倒性优势在2019年RCA指数达到5.8，而中国在柴油混动乘用车市场几乎处于空白。

[10] 国际竞争力的衡量指标为显示比较优势指数（Revealed Comparative Advantage，RCA），是广泛用于分析各个国家的比较优势的指标，其计算方法为：$RCA_{ij}=\frac{X_{ij}/X_i}{W_j/W}$，其中$X_{ij}$代表i国j产品的出口，$X_i$代表i国所有产品的出口，$W_j$代表全球的产品j出口，W代表全球的所有产品的出口总额。RCA_{ij}代表i国j产品在全球的国际竞争力，通常来说RCA指数越大，代表越具有比较优势。

表13
中国与德国的新能源乘用车国际市场竞争力对比

产品	插电式汽油混动乘用车（HS-870360）		插电式柴油混动乘用车（HS-870370）		纯电动乘用车（HS-870380）	
年份	RCA中国	RCA德国	RCA中国	RCA德国	RCA中国	RCA德国
2017	0.0712	3.5984	0.0012	2.9267	0.0915	2.0060
2018	0.1001	3.3887	0.0000	4.7146	0.0839	1.8791
2019	0.2462	3.5090	0.0001	5.7981	0.1369	2.0511
2020	0.2369	3.5952	0.0000	3.9731	0.2798	2.7565
2021	0.1933	3.0946	0.0000	4.9083	0.7896	2.9700
平均	0.1696	3.4372	0.0003	4.4641	0.2763	2.3325

数据来源：原始数据来自UN Comtrade，RCA指数经笔者计算所得

然而，纯电动乘用车的市场环境有所不同。德国的纯电动乘用车RCA指数维持在2左右的高位。中国的纯电动汽车起步较晚，其RCA指数仍然低于1，但在2017到2021年间，中国的纯电动车RCA指数飞速提升，出现了追赶趋势。

总体上来说，基于欧洲深厚的汽车工业基础，欧洲新能源汽车的国际竞争力整体上高于中国，中国在混动乘用车领域有待拓展发展空间，但在纯电动乘用车产品上的发展速度和赶超能力有目共睹。中国对欧洲的新能源汽车出口增长迅猛，尤其以纯电动乘用车为主，尽管中国在纯电动乘用车产品上不具备比较优势，但仍然凭借相对低廉的成本和完整的制造业产业链，实现了纯电动乘用车出口的快速增长。此外，在关键产品上，德国在电机产品上国际竞争力较强，而中国在锂电池上具有压倒性的比较优势。

结合中国在纯电动乘用车产品出口欧洲的强劲表现以及在锂电池产品上的国际竞争力，就不得不提中国的比亚迪汽车。作为中国民营企业代表，比亚迪从1999年在荷兰鹿特丹成立欧洲总部开始，在欧洲市场已经耕耘多年。在英国，比亚迪向伦敦交通署和运营商Go-Ahead前后交付了五百台纯电动大巴，并设计制造了世界首台零排放双层纯电动大巴。截止2021年底，比亚迪在欧洲纯电动客车市场的占有率超过两成。[11]比亚迪电动大巴能进入法规和标准严苛的欧洲市场，关键在于其核心技术——磷酸铁锂电池，其特点在于稳定性高，与公共大巴所需的高安全性正好匹配。其次比亚迪以技术换市场，在欧洲多地投资建立了新能源汽车生产厂，除了为当地创造更多就业机会，也向当地输送全球顶尖的新能源技术。比亚迪的发展诚然也会带动其他中国新能源汽车企业的出海，推动中欧电动车产业优化升级。

当地时间2022年8月1日，比亚迪宣布与欧洲经销商集团Hedin Mobility合作，为瑞典和德国市场提供优质的新能源汽车产品。图为比亚迪欧洲分公司与Hedin Mobility线上签约现场。

综上所述，在绿色交通领域，中国和欧洲在不同产品上具有各自的比较优势，加强交流、深化合作必然是长远的政策导向。在中欧合作的路径上，大可以选择各自更具有优势的产品进行合作，充分利用各自的产业比较优势和市场优势，推动产业升级。

4.4 激发绿色金融活力，加快全球资源配置

中国自2005年开始绿色金融体系的建设，相较于欧洲起步较晚，但发展迅速，发展规模目前已处于全球领先。绿色信贷方面，截至2021年末，中国本外币绿色贷款的存量规模居全球第一位；绿色债券方面，截至2021年11月，在中国境内市场贴标发行的绿色债券累计达1.67万亿元，存量余额也在1万亿元以上；[12]绿色保险方面，截至2021年6月，保险机构将超过9000亿元的资金投向以“碳达峰”“碳中和”为目标的绿色发展相关产业。[13]

在绿色金融规模日益增大的背景下，建立规范化的绿色金融标准，对中国绿色金融的发展至关重要。2018年11月，在人民银行指导下，中国金融学会绿色金融专业委员会与伦敦金融城共同发布了《“一带一路”绿色投资原则》(Green Investment Principles,简称“GIP”)。GIP原则将低碳和可持续发展议题纳入“一带一路”倡议，致力于提升投资环境和社会风险管理水平，进而推动“一带一路”投资的绿色化。GIP原则的提出，展现了中国和欧洲在绿色金融标准领域的引领作用。自发布以来，GIP得到中国、英国、欧洲以及“一带一路”沿线主要金融机构的大力支持。

值得关注的是，中国企业和金融机构在绿色金融产品创新的道路上，不断探索、步履不停。

⑪ 经济参考报，《比亚迪：海外市场快速“出圈”》，2022年1月21日

⑫ 人民银行研究局，《绿色金融助力碳达峰碳中和》，2022年3月4日

⑬ 央视网，《保险资金支持绿色发展投资规模超9000亿元》，2021年9月19日

2022年5月，蜀道（四川）保险经纪有限公司与中国太平洋财产保险股份有限公司合作，一方面，积极推动传统业务向绿色金融领域延伸，加快传统产品转型升级；另一方面，在全国统一碳市场正式运行的背景下，充分调研四川当地需求，实现碳金融创新型产品落地。蜀道与太平洋的合作构建了以ESG理念为核心的绿色保险产品体系，主要包含四大类产品。一是碳金融保险，将碳配置持有企业与贷款银行间的碳配质押贷款合同作为底层合同，将借款人贷款到期后不能偿还贷款作为保险责任，对贷款银行进行风险保障，提高碳配额质押效力，有效盘活碳资产流动效率。第二类是低碳项目机器损坏碳交易损失保险，对非主观故意造成的减排设备故障停机，进而使企业生产经营中产生额外碳排放导致的碳排放配额或资源减排量损失，保险人提供赔偿，帮助企业合理锁定碳排放成本或资源减排收益。第三类是聚焦碳市场配额的降碳减排损失保险，对于自然灾害或意外事故导致被保险人温室气体排放量超过正常生产经营所需的碳排放配额，由此产生的碳排放配额交易费用，保险人提供赔偿。第四类是生态环境保护保险，包括环境污染责任保险、农产品食品安全责任险、生鲜食品安全责任险以及高标准农田IDI等。

绿色发展助力产业改革，绿色金融领域不断延伸，包括高标准农田IDI等，图为内蒙古五原县塔尔湖镇现代农业产业园（2022年9月17日摄，无人机照片）

与蜀道保险经纪类似，越来越多的中国企业和金融机构积极投入到绿色发展的产业支持中，不断扩大绿色金融规模和创新绿色金融产品，激发绿色金融活力。在对外合作方面，对接中欧绿色经济合作需求，既有引入诸如法国开放署在中国开展绿色信贷，也有GIP原则在“一带一路”国家的走出去，这种双向互动势必会促进中欧企业深化在绿色金融领域的合作，优化全球资源配置。

4.5 全生命周期碳中和，助推中欧绿色制造

工业和信息化部公开数据显示，“十三五”期间，工业和信息化部共组织实施了300余项绿色制造重大工程项目，发布了184家绿色制造系统解决方案供应商，制定绿色制造相关标准500多项，对工业绿色低碳转型发挥了重要引领作用。

在中国绿色制造推进过程中，大规模纳入了生命周期评价（Life Cycle Assessment，LCA）方法，并且在绿色工厂评价中也加入了企业碳排放和产品碳足迹要求。尤其是2020年9月中国提

出国家碳中和目标之后，覆盖生命周期全过程的产品碳足迹和企业碳排放核算蔚然成风，全生命周期绿色制造与全生命周期碳中和已逐渐融合，与欧盟全生命周期相关政策和国际市场的发展方向不谋而合，逐渐形成国内外政策与国内外市场双重驱动的良好态势。中国的LCA和碳足迹相关研究与欧盟机构有着长期的交流合作，其中中国生命周期核心数据库CLCD采用了欧盟ILCD数据库规范，是欧洲之外全球首个此类数据库。

欧盟是全球率先大力推动全生命周期绿色制造的策源地。在21世纪之初，欧盟就在限制产品有害物质含量方面先后制定了电子电器的RoHS法规、汽车的ELV指令、以及适用于大批行业和产品的REACH指令。这些欧盟法规不仅直接影响欧洲市场上的产品准入，更通过产品的全球供应链延伸到各个国家，推升了产品全生命周期的环保要求。这些欧盟法规也客观上带动了中国制造业的升级，促使中国相关部门和多个国家制定了同类政策法规，事实上形成了全球共识，为全球可持续发展合作树立了成功的典范。

2022年9月，由吉利控股集团与梅赛德斯-奔驰公司合资打造的全新smart精灵#1纯电SUV开始上市。smart电动车计划将在欧洲上市销售，因此委托中国技术服务企业亿科环境，按照欧盟电池PEF（Product Environmental Footprint）标准的严格要求，开展了smart精灵#1动力电池的产品碳足迹调查，采用中国CLCD数据库和欧洲数据库，建立了电池的全生命周期碳足迹模型，电池碳足迹报告由欧洲认证机构德国莱茵TÜV完成了第三方审核认证。这是国内第一个按照欧盟PEF完成的产品碳足迹认证，是中欧研究机构、企业、服务机构合作的典型案例，代表着中欧在全生命周期碳中和与绿色制造领域的重要发展方向。

产品碳足迹国际互认将是全球碳中和最关键的考验之一。如果成功，意味着达成实质性的国际共识，并形成强大的碳中和市场动力，将推动全球制造业向绿色制造深度转型，是中欧深化合作的重要方向。

五、中欧绿色经济合作发展面临的挑战与前景展望

当前，低碳绿色发展已经成为全球的共识，中国与欧洲已经走到了这一大趋势的前列。合作发展节能低碳技术、共同提升经济发展的质量，也应该成为中欧双方的发展方向。

5.1 “共同但有区别的责任”——中欧绿色经济合作原则

中国与欧洲的经济发展历程不同，工业化所处的阶段还有较大的差异，国民收入差距也比较明显。因此双方在国际气候碳排放、合作发展绿色经济的时候应遵循“共同但有区别的责任”的原则。发达国家已经做到了立法规定碳减排，但对于肩负消除贫困经济发展为主要目标的发展中国家，发达国家更应该以开放包容的心态，肯定和鼓励发展中国家应对气候变化所作贡献，照顾其特殊困难和关切。

中国与欧洲在新阶段的绿色经济合作中，各方应秉持“共同但有区别的责任”这一原则，最大程度展示诚意，聚同化异，相向而行。各国应该履行好各自的职责，量力而行，各司其职，形成良性的互动框架，避免将气候问题政治化，以开放包容协作的绿色经济合作来共同应对气候变化。

5.2 中欧绿色经济合作面临的挑战

虽然中欧双方都意识到了发展绿色经济的重要性，但并不意味着合作发展绿色经济不会进一步优化。以碳壁垒为例，2005年起欧盟开始通过碳交易内化高排放产品的外部性，2020年“碳边境调整机制”的颁布，虽然一定程度上促进域外市场降低了碳排放，但也违反了WTO贸易规则，为发展中国家与欧洲开展绿色经济合作增加了不小的负担；所以，中国与欧洲若想实现持久、深入的绿色经济合作与协作转型，碳壁垒的有效磋商与妥善调整将成为中欧双方共同面临的必答题。综合来看，中欧绿色经济合作主要面临国际碳市场发展不定、碳关税壁垒和全球能源不确定性三大挑战。

国际碳市场仍发展不定。在碳中和目标下，国际碳市场正在成为应对气候变化的焦点议题。欧盟希望利用自身的承诺以及在减排、碳交易、绿色金融等领域的先进经验，加强在全球气候变化和能源转型过程中的规则话语权。

碳关税壁垒增加合作难度。2022年6月22日，欧洲议会通过了“碳边界调整机制”（CBAM欧盟碳关税）草案的修正案，对其他没有碳价或者碳价水平较低的国家生产并出口到欧盟的产品或征收二氧化碳排放特别关税。中国作为欧盟最大的贸易伙伴，或将面临新的“绿色壁垒”，中国的钢铁、化工等高碳行业产品将面临较大影响。

以“服务合作促发展 绿色创新迎未来”为主题的2022年中国国际服务贸易交易会8月31日在北京举行。尽管当前全球面临多重困难，经济发展、贸易流动、供应链等受到冲击，国际贸易合作，减少壁垒影响仍是大趋势。

全球能源不确定性大幅增加。近年来新冠疫情、俄乌冲突等一系列不确定性事件，打乱了全球推进绿色经济的进程，带来了能源价格大幅不确定性，节能减排的进度也被大大推后，绿色经济投资受到负面影响。

5.3 中欧绿色经济合作前景展望

尽管中欧绿色经济的合作面临诸多挑战，但中欧共同发展绿色经济仍有众多机遇。中国幅员广阔、人口众多，近几十年经济高速增长，大多数产业都在最近几年获得了发展，在节能减排等方面有相当庞大的需求，经济增长的趋势也仍十分强劲，欧洲企业赴中国发展前景向好。

低碳清洁是中国能源战略发展的方向，中欧在氢能重要性上有高度共识。图为广东国鸿氢能云浮生产基地，氢能源产业在此落地生根，技术研发日新月异。

（1）中国和欧盟存在广泛的合作空间，在中欧环境与气候高层对话机制基础上，中欧应当继续深化在能源转型与气候行动的合作关系，彼此关怀对方关切，就双方在多边气候谈判中的立场、国内政策措施、合作项目运营等问题进一步交流协商。

（2）由于经济发展水平和社会环境的差异，中国和欧洲的绿色经济在发展路径和政策上也存在着差异。中国拥有统一的中央政府，能够制定强有力的绿色经济发展路线图，为来华发展的欧洲企业提供稳定发展预期。换电站、充电桩等绿色交通基础设施在中国的快速发展也能为欧洲新能源产业在中国的高速发展提供保证，欧洲氢能网络、碳捕集等技术也能成为绿色经济合作下一步共同发展的方向。国际碳市场的建立则为双方更优化地利用碳资源提供了更好平台，通过中欧双方成熟的商业化运作，能为绿色技术的市场化、普及化发展提供便捷的途径。

（3）中欧绿色经济合作恰好能与全球数字经济建设的大潮流相契合。数字经济能够降低全球经济活动的成本，推动全球资源要素高效利用。中国与欧洲应该紧抓数字经济的发展契机，建设能源管理的数字化管理系统，提升双方企业的绿色化水平；利用大数据技术，为企业与社会的节能提供准确的建议；通过区块链等技术，实现碳标签的全球流通，从而为全球层面的碳减排碳交易提供必要的基础平台等。

（4）中欧绿色经济的合作还能带动更多发展中国家的参与。中欧绿色金融可以作为发展中国家更多绿色行动的资金，成为刺激缔约方强化国家自主贡献目标的工具。

六、结语

本报告对中国与欧洲的绿色经济发展的基本情况进行了分析，梳理了中欧绿色经济合作的机遇与未来进一步合作的方向。虽然与欧洲相比，中国发展绿色经济相对较晚，但随着近几年中国政府对绿色发展的高度重视，中国的绿色经济正在快速发展，在绿色能源、绿色基建、绿色交通、绿色金融、绿色制造等领域均有共同导向。

作为全球两大经济体，面对碳中和目标时中国和欧洲有着共同的价值取向和坚实的合作基础。双方企业的先进技术一定能与双方广阔市场相结合，推动全球经济的绿色可持续发展。虽然中欧绿色经济合作面临关税壁垒增加等一系列不确定因素，合作进程受到了一定影响，但双方应秉持“共同但有区别的责任”原则，最大程度展示诚意、聚同化异、相向而行。双方企业也应该把握彼此经济未来发展的机遇差异，以期在确保利润收益的同时，实现绿色技术可持续推广。

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Abstract

Developing a green economy, promoting energy efficiency and emissions cut, and attaining the goal of carbon neutrality stand as the major trends of global economic development. Both China and Europe have set overall goals for green development, and the application of new technologies and market demands will certainly drive the economies of both sides for better quality improvements. In order to develop a green economy and attain the goal of carbon neutrality, all countries need to be open-minded and cooperative and learn and introduce advanced technologies and development experience of others.

Vigorously promoting ecological civilization and green development, China has made great progress in building Beautiful China, presenting a bright new scene of blue skies, green land, and clear water. The photo shows the view of the Erhai Lake and surrounding villages in Dali, Yunnan Province. (Photographed by a UAV on May 26, 2022)

As the largest developing country, China is vigorously promoting ecological civilization and has clearly proposed "promoting green, circular, and low-carbon development" and "building Beautiful China". This is not only an upgrade of the theoretical understanding of the importance of ecological civilization but also shows that taking the path of green development has become China's unwavering strategic choice.

On October 12, 2021, at the much-anticipated leaders' summit of the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15), Chinese President Xi Jinping raised "China's Voice" on building a clean and beautiful world. President Xi also called on the international community to strengthen cooperation and build a shared future for all life on Earth. The photo shows the opening ceremony site of COP15.

Europe has long been a pacesetter in global economic development, and its green economy is leading the world. The EU achieved a carbon peak in the 1990s and remained a global leader in terms of green, low-carbon, and energy-saving levels in the energy sector, with strong competitiveness in the utilization of renewable energy and technology research and development. The EU also boasts a strong industrial base for the green transition.

As the world's carbon neutrality processes make advances, the international industrial and financial landscape is being reshaped at an accelerated pace, bringing new opportunities for cooperation and investment. China and Europe share a consensus on policy measures, technological innovation, green and low-carbon transportation, green finance, and the circular economy. There is significant space for China and Europe to cooperate in the green economy.

Driven by continuous green investment, in the past decade, China has repeatedly broken records in technological innovation in such areas as renewable energy and electric vehicles. Through international cooperation, China is also sharing its technology and experience with different countries, benefiting people in more regions around the world and playing an important role in green development globally. The photo shows the photovoltaic (PV) power station in Gonghe County, Hainan Tibetan Autonomous Prefecture, Qinghai Province.

The Report summarizes the similarities and differences between China and Europe in terms development of the green economy by surveying the economic development and energy consumption of both sides and analyzing and comparing their main policies in this area. In addition, the Report further explores the opportunities and outlook for cooperation between China and Europe in the green economy from an overall perspective as well as through examining case studies of green infrastructure, green energy transition, green transportation, green finance, and carbon neutrality.

Foreword

Philippe Mariani

CEO Sophia Antipolis Foundation, Sophia Antipolis Science & Technology Park France.

The Report on the Outlook of Sino-European Cooperation in the Green Economy gives a clear picture of the challenges ahead and the interesting opportunities to engage with green economic development and cooperation between China and Europe.

Many companies in Europe have already begun their transformation for a more virtuous activity. The EU has fixed into law its target to cut net emissions 55% by 2030, from 1990 levels and has committed in 2019 to being the first carbon neutral continent. China is following suit with net-zero emissions commitments. Yet this will require trillions of dollars to be invested in green and low-carbon industries and an understanding of transition strategies.

Investing in innovation into clean technologies has become vital in the global transition to net-zero objectives. Without eco innovation it will be very challenging and costly to address major environmental issues. Fostering, facilitating, and accelerating innovation is decisive for an effective medium to long term mutual response to climate change and can lead to new initiatives for climate and sustainability opportunities.

In Sophia Antipolis the leading science and technology Park in Europe, located in south of France, we have been at the forefront of the green economy since the seventies and are pursuing our goals through international initiatives such as with China since 2016 and recently with Qingdao High Tech Zone through projects developing innovative and transformational clean technologies. We are currently aiming to play a key role in the Green Innovation practices. How? By creating favorable conditions for environmental startups, by facilitating a marketplace that uses AI to connect companies to green entrepreneurship projects, by investing in sustainable mobility and smart vehicles; by enhancing scientific research, upgrading technological capabilities, and expanding international cooperation.

The need for green solutions to everyday problems has become a priority for many communities. Experts say that creating a virtuous relationship between economic growth and environmental wellbeing can reduce the impact of production and consumption on the environment. Therefore, we have a greater responsibility than ever before to engage in multi-lateral initiatives by promoting cooperation today for future generations. I strongly believe that innovative partnerships between Europe and China will create new models for sustainable growth.

Shi Yong

Counselor of the State Council, Member of the International Eurasian Academy of Sciences, Member of the World Academy of Sciences for the Advancement of Science in Developing Countries, Director of the Research Center for Virtual Economy and Data Science of the Chinese Academy of Sciences, Director of the Key Laboratory of Big Data Mining and Knowledge Management of the Chinese Academy of Sciences, and President of Tianfu Institute of International Big Data Strategy and Technology

"Carbon peak" and "carbon neutrality" are inevitable paths for green development in China. Digitalization and smart technology are important aspects of developing the green economy and achieving carbon peak and carbon neutrality goals. In many areas such as infrastructure, energy, transportation, finance, and manufacturing, China and Europe are creating a new atmosphere of digital technology, empowering development and green ideas leading innovation. In the process of tackling global climate change and transitioning to a green economy, China and Europe have complemented each other to a high level in technology, capital, and industry and possess key advantages for cooperating together in these areas.

In the *Report on the Outlook of Sino-European Cooperation in the Green Economy*, the key elements, links, and areas required for cooperation between China and Europe in transitioning to the green economy are objectively analyzed and evaluated. Starting with an analysis of leading industries and energy consumption, a comparison of green economy policies, major cooperation areas, typical case studies, and the outlook for Sino-European cooperation, the Report highlights the scope and path of Sino-European cooperation in key areas. The Report also provides a valuable guide for in-depth cooperation in the green economy according to the principle of "Common But Differentiated Responsibilities". It outlines the broad scope of Sino-European cooperation in the green economy.

It is believed that future in-depth exchanges and practical cooperation on the environment and climate, green energy, and green finance will further invigorate the comprehensive strategic partnership between China and Europe in the coming period. It will provide new solutions for the economic transitions of other countries and contribute to the promotion of sustainable development globally. Sino-European cooperation in the green economy is worthy of global anticipation!

Experts' Comments

Zhang Jing'an

Executive Vice Chairman of the China Science Center of the International Eurasian Academy of Sciences and Member of the International Eurasian Academy of Sciences

Ever since the British economist David Pearce first proposed the concept of "green economy" in 1989, European countries have been pioneers in the development of this concept, exploring the development of renewable energy in Europe at institutional, policy, and legal levels. This approach can stimulate public opinion and promote the practice of low-carbon and green lifestyles in the community.

After the ambitious goals of "carbon peak" and "carbon neutrality" were proposed in 2020, China has introduced a number of policy measures for developing the green economy. It can be said that China and Europe are like-minded in their approaches to transitioning to a green economy. The *Report on the Outlook of Sino-European Cooperation in the Green Economy* examines the status quo of energy consumption and green economic policies in China and Europe and presents a comprehensive picture of their close cooperation in such areas as green infrastructure, energy, transportation, and finance. The Report helps stakeholders on both sides to assess the development of the green economy. It is hoped that the Report will help Chinese and European entrepreneurs to explore the benefits of the green economy and bilateral cooperation opportunities.

The world today is experiencing a level of change unseen in a century. Mutually beneficial cooperation is the way to tackle developmental challenges. Under such international challenges as the COVID-19 pandemic and the decoupling of industrial and supply chains, cooperation in the green economy is in line with the bilateral political and economic interests of China and Europe. Strengthening green cooperation is bound to become a key area of bilateral cooperation, as well as a new focus and driving force of the comprehensive strategic partnership between China and Europe. China has a huge domestic market and a robust manufacturing sector, especially in areas such as new energy vehicles, where China shares its technology and experience with different countries, offers solutions, creates jobs, and benefits people in a wide range of countries and regions. Benefitting from having the first-mover advantage in green technology, Europe is comprehensively promoting the green transition through policy guidance, finance, carbon trading exchange, and other means. In green development globally, both China and Europe play crucial roles. Both China and Europe should support opening-up, cooperation, and common development, give full play to their bilateral market advantages and complementary capabilities in technological innovation, and strive for a better world!

Zeng Yong

Member of the International Eurasian Academy of Sciences and President of the University of Electronic Science and Technology of China

In 2022, global economic development is facing an unprecedented assault due to the COVID-19 pandemic and new geopolitical changes. In the post-pandemic era, a green and low-carbon development path has become a global consensus. The "carbon peak and carbon neutrality" strategy is not only a solemn commitment made by China to the world, but also a policy choice to accelerate the transition to green development modes and lifestyles.

Although starting later than Europe in terms of green economic development, China has gradually caught up with pioneering European countries in terms of development speed. China and Europe have a shared vision of cooperation in developing low-carbon technologies and improving the quality of development. Over the past decade, China and Europe have engaged in extensive exchanges and cooperation in such areas as green infrastructure, energy, transportation, and finance. The *Report on the Outlook of Sino-European Cooperation in the Green Economy* presents an accurate picture of green economic development and cooperation between China and Europe, assesses the outlook and challenges for Sino-European cooperation, and puts forward constructive advice to promote Sino-European development and cooperation in such areas as green energy, finance, and infrastructure.

In the future, China and Europe will broaden the scope of cooperation in green and low-carbon development as well as in the digital economy. China's new energy products have huge market potential in Europe, but they also face many export and investment-related difficulties. Strengthening cooperation with China is a win-win choice for Europe, regardless of whether this cooperation is a proactive measure to promote energy transition or a way to offset the energy crisis brought about by the conflict in Ukraine. In the complex and volatile environment of the world economy, we believe that Sino-European cooperation provides stability for China and Europe's economic development. Economic and trade relations between China and Europe, in which both sides seek to achieve common goals while respecting each other's differences, will certainly help enhance the vitality of the green economy in China and Europe, as well as promote global economic growth.

Gong Junzhong

Vice President of the Tianfu Institute of International Big Data Strategy and Technology, Member of the Brookings Institution Think Tank, and Member of the Carnegie Think Tank

Both China and Europe play leading roles in the development of the green economy globally. Europe pioneered the concept of green development and has driven the development of a green economy globally. In recent years, China has made efforts to promote green development practices, and has proposed and strictly implemented measures to achieve the development targets of "carbon peak" by 2030 and "carbon neutrality" by 2060. Currently, China and Europe are discussing the direction of the development of the green economy as well as specific technologies. This cooperative approach can demonstrate the positive effects of the green economy globally.

The green economy will not only bring new development opportunities to all areas of society, but will also achieve efficiency gains due to the continuous integration of new technologies. In the digital economy, governments and enterprises can utilize big data to monitor and manage carbon emission indices; the Internet of Things and artificial intelligence can develop markets due to the integration of green technology; financial technology can also be flexibly integrated into the green economy. These approaches will, in turn, guide the long-term development of the green economy.

The development of the green economy is a step-by-step process, which requires the joint participation of many industries, including infrastructure, energy, transportation, and finance. It requires China and Europe to join hands to promote new technologies and achieve new goals in green development. Chinese enterprises must pay more attention to the European market and learn from the technology and management experience of European enterprises. With its vast market, China needs the attention of European entrepreneurs and peers to continuously promote energy reform and jointly contribute to global green development.

Over the past four decades, China and Europe have held many exchanges and indeed increased mutual understanding. But when faced with a brand new topic, there may still exist information gaps between the two sides. Obstructions resulting from the COVID-19 pandemic have also reduced access to information for both sides. Therefore, practical cooperation can only be promoted through both sides learning about the latest developments in green economic development and reviewing beneficial methods.

It is hoped that this Report will serve as a bridge between Chinese and European colleagues involved in the development of the green economy and that both sides will discover cooperation opportunities through it, thus contributing to green economic cooperation between China and Europe.

Wang Hongtao

Director of the Life Cycle Assessment & Management Committee of China Electronics Energy Saving Technology Association, International Jury, Co-chairman of the Public Consultation Conference of EU's ILCD Guide for International LCA Data System, Council Member of the UNEP/SETAC Life Cycle Initiative, Member of the Technical Steering Committee of Global Guidance Principles for LCA Database and Chairman of the Data Collection Working Group of UNEP

The EU has played a leading role in sustainable development policies and regulations, while China, as a major manufacturer, has effectively promoted the low-carbon green transition of all industrial sectors. By complementing each other's strengths, both sides have great potential for cooperation and shared development opportunities.

Both China and Europe have proposed goals for carbon neutrality, which is not only a long-term action to tackle global climate change, but also a major opportunity to promote the low-carbon and green transition of various industries, reshape global industrial chain collaboration, and promote high-quality economic development. In particular, a series of EU policies and regulations cutting carbon emissions throughout the product life cycle covers various industrial sectors, far exceeding the scope of traditional carbon trading systems.Carbon emission reductions in the life cycle can be translated into closer cooperation in international supply chains, which will bring about a huge shift in international trade and global markets. "Life cycle carbon neutrality" is becoming the main focus in the field of global carbon neutrality.

Both China and Europe enjoy a long history of active exploration in the field of life cycle carbon neutrality as well as robust support for technologies, resulting in the widest and most rapid diffusion of the life cycle approach in the global manufacturing industry. Through strong consensus and substantial collaboration, both sides can become powerful driving forces for carbon neutrality globally, promote responsible production and consumption around the world, and implement the UN's Sustainable Development Goals.

Carbon neutrality and green development in China and Europe are at a critical stage. Policies, regulations and industry development models are taking shape, and this important Report comes at an opportune time. It is hoped that this Report can promote closer exchanges between China and Europe, especially in relation to key policies and regulations. By promoting exchanges on special topics between governments, upstream and downstream industries and enterprises, and research institutions, the huge potential for cooperation can be turned into real opportunities for shared development.

I. Introduction

Green, sustainable development has always been an important theme of global economic development. China has always been open to cooperation in developing its green economy and needs to work together with Europe, which stands at the forefront in this field. European companies developing in China can also work with China to promote green development globally and develop broad markets. This Report aims to be an inspiring, valuable and intuitive research report. It outlines and compares the current status of the economic development of China and Europe and the main policies of the green economy of both sides. This Report also analyzes instances of collaboration, and presents expectations concerning Sino-European cooperation in the green economy from such perspectives as big data, policy approaches and case studies.

China has incorporated carbon peak and carbon neutrality into the overall framework for developing ecological civilization, accelerated the development of new energy sources such as wind and solar power, and strived to promote green, low-carbon production and lifestyles as a conscious aim of the whole society. The photo shows the Pingqing photovoltaic (PV) Power Station and Dahaizi Wind Farm in Weining County, Guizhou Province.

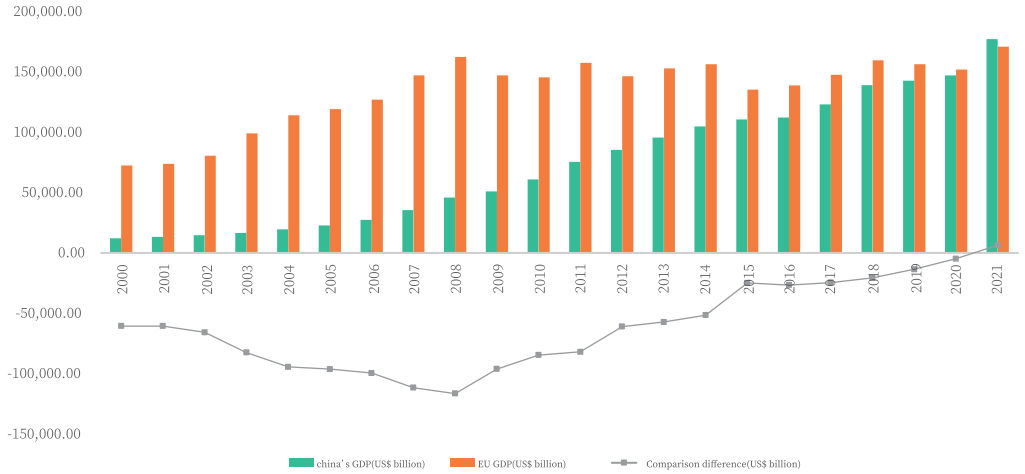
II. Overview of China and Europe and Analysis of Energy Consumption

2.1 Introduction to economic development and leading industriesin China and Europe

Over the past decade, China has experienced rapid economic growth, and its international influence continues to grow. Its economy grew from USD 1.21 trillion in 2000 to USD 17.7 trillion in 2021, an approximately 14-fold increase. China's economy ranks second in the world and is comparable in size to the combined economies of EU countries. Europe has taken a leading role in the global green economy. The total economic volume of European countries in 2021 was USD 24.71 trillion, of which EU countries accounted for around USD 17.09 trillion. The gap between China's GDP and the EU's has been getting smaller and smaller. China's GDP exceeded the EU's by USD 639.18 billion in 2021. ①

① IMF Data, Issued April 2022.

Figure 1
EU's GDP vs China's GDP from 2000 to 2021



Source: International Monetary Fund (IMF)

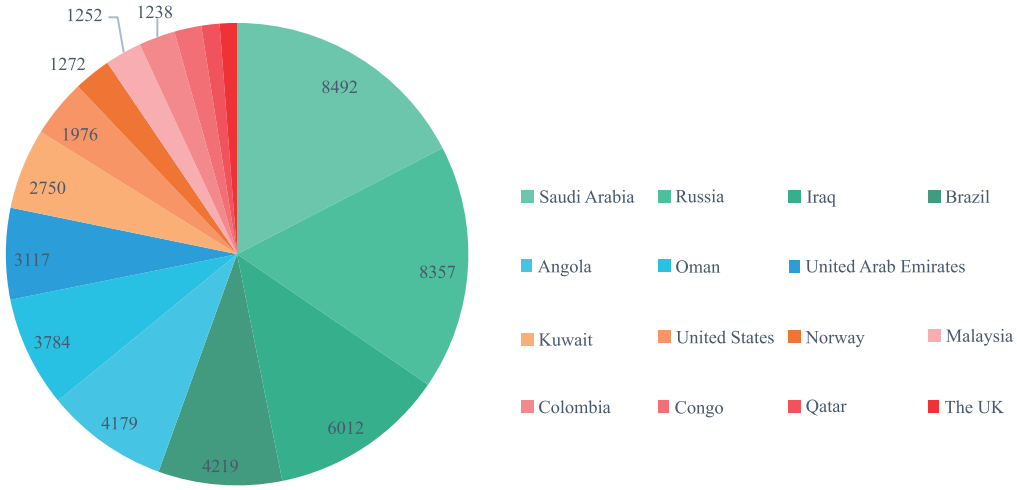
China, as an emerging developing country, has seen rapid economic and industrial development in the past four decades. China has obtained a competitive edge in manufacturing products such as electronics, textiles and garments, mechanical products, and small commodities, and the related steel, textile, machinery, and electronics industries have gradually become leading industries. Generally, these industries are characterized by a low level of technology and relatively low levels of added value in the production chain, and have not yet developed the features of scale efficiency. The per unit energy consumption that is produced is relatively high, and there is an urgent need for new technologies and funding to enhance green production.

Europe has a long industrial history and a strong industrial base. Through hundreds of years of development, EU countries have gained traditional advantages in agricultural production, steel, transportation equipment, pharmaceuticals, as well as other industries. There are many countries in Europe, but through economic integration, each country has become competitive in many specific industries. High-tech industries, traditional light industry, and the environmental protection industry are leading sectors in many countries, and Europe has steadily entered the era of low-carbon development.

2.2 Basic conditions of energy consumption in China

With the continuous acceleration of industrialization and urbanization, China's energy consumption showed continuous growth from 2016 to 2020. Among them, the growth rates of oil, coal, and hydropower were significant. Since 2001, China's crude oil imports have grown continuously. In 2017, with annual crude oil imports of 420 million tons, China surpassed the United States for the first time to become the world's largest crude oil importer. The main countries supplying China's crude oil were Saudi Arabia, Russia, Iraq, Brazil, Angola, and Oman. Crude oil imports from Saudi Arabia and Russia accounted for the largest proportion.

Figure 2
China's Crude Oil Consumption and Imports in 2020 (Unit: 10,000t)

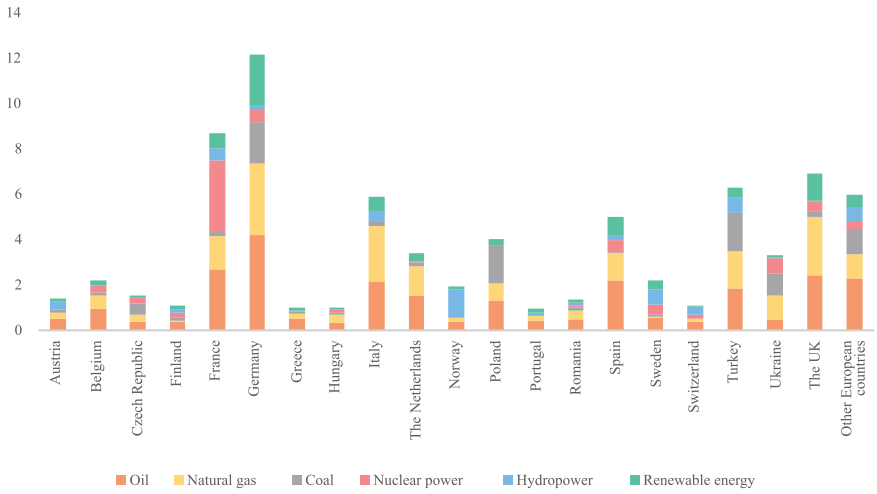


Source: General Administration of Customs of the People's Republic of China

2.3 Basic conditions of energy consumption in Europe

In recent years, European countries have increased their investment in clean energy, but their dependence on traditional energy sources is still high in the short and medium terms. In 2020, the top three European countries in terms of energy consumption were Germany, France, and the UK.

Figure 3
Primary Energy Consumption of European Countries in 2020(Unit: EJ; calculated by fuel consumption)

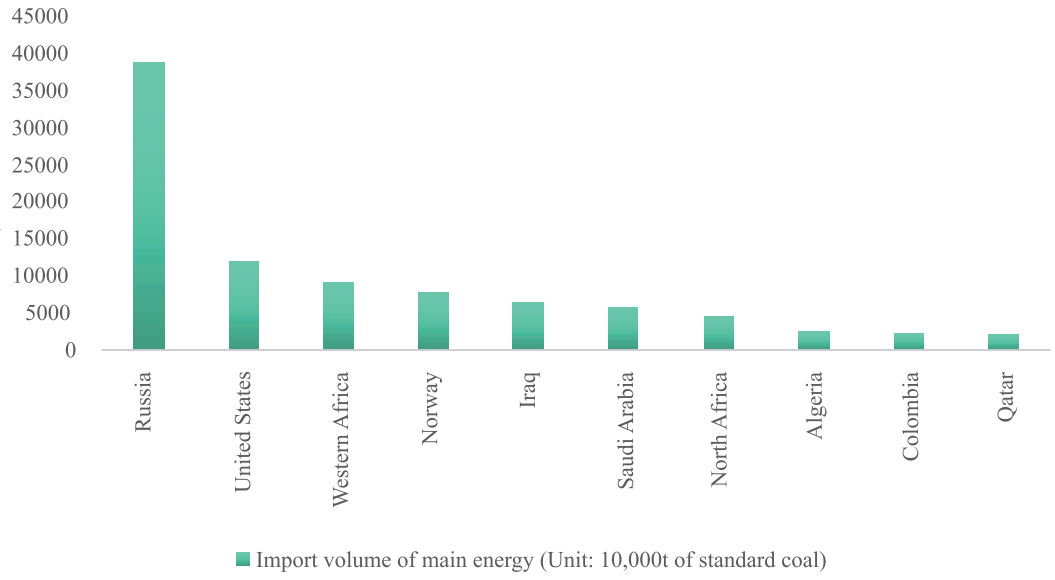


Source: BP Statistical Review of World Energy

High energy consumption and high external dependence have long afflicted Europe. According to the data released by Eurostat, 58% of the EU's energy consumption in 2020 came from imports. Russia was Europe's main supplier of oil, natural gas, and coal.How to further overcome the negative impact of high energy dependency on foreign countries has become a key problem that must be solved in Europe's future transition to a green economy.

By processing and comparing the data on Europe's main energy imports (in the form of standard coal equivalency), natural gas from Russia ranked first in Europe's imports of all kinds of energy from other countries.[②] In addition, Europe's dependence on the United States and West Africa's natural gas and oil imports was also significant.

Figure 4 Europe's Major Energy-Dependent Countries and Imports in 2020 (Unit: 10,000t of standard coal)



Source: IEA Qianzhan Industry Research Institute and BP Statistical Review of World Energy

②

There are various types of energy with different calorific values. In order to observe and calculate the import data of three types of energy in Europe (namely, coal, natural gas, and crude oil), they need to first be converted into standard coal units of measurement with a uniformly defined standard calorific value. In the Report, the analysis results are obtained through calculation, summarization, and analysis of the standard coal conversion factor based on the three types of energy with the formula of standard energy imports = energy imports * standard coal conversion factor.γ_i

III. Outline and Comparison of Main Policies of the Green Economy in China and Europe

3.1 China's main green economic policies

Compared with European countries, China started its green economy policies relatively late, but their development has been rapid. Optimized supportive policies were introduced soon after President Xi Jinping made a solemn commitment to the carbon peak and carbon neutrality goals at the general debate of the 75th session of the United Nations General Assembly on September 22, 2020.

In 2021, the *Opinions on Completely, Accurately and Comprehensively Implementing the New Development Concept and Doing a Good Job in Carbon Peaking and Carbon Neutrality* and the *Action Plan to Reach Carbon Peaks by 2030* were issued. They are the core contents of China's "1+N" policy framework for achieving carbon peak and carbon neutrality. On this basis, various ministries, commissions, and local governments have issued a number of guidelines to provide fundamental compliance with the transition to green energy, green infrastructure, green transportation, and green finance. Clean energy has achieved rapid development; new infrastructure has become an important focus; green transportation logistics have been comprehensively launched; green finance serves the overall economy.

The largest single complementary Agriculture & photovoltaic (PV) power station in the world - Baofeng Integrated Agriculture & PV Power Station in Ningxia, China.

3.2 China's proposal for carbon peak, carbon neutrality and economic transition

In recent years, China has fully adopted a new development concept and firmly pursued the path of green, low-carbon, and high-quality development. Carbon peak and carbon neutrality goals are major strategic decisions of the Chinese government to tackle global climate change and coordinate sustainable development. The trend of China's carbon emissions in the past decade also showed noticeable characteristics in different phases. As shown in Figure 5, carbon emissions first increased, then held steady, and then slowed down.

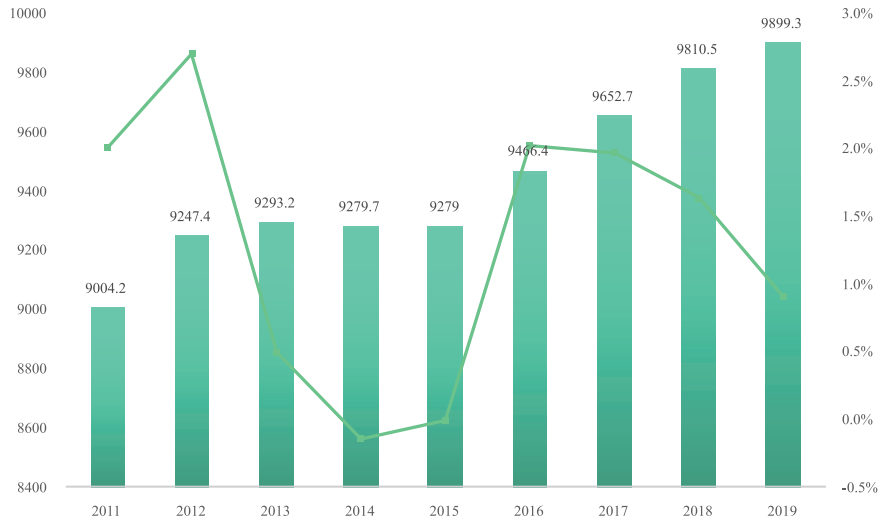
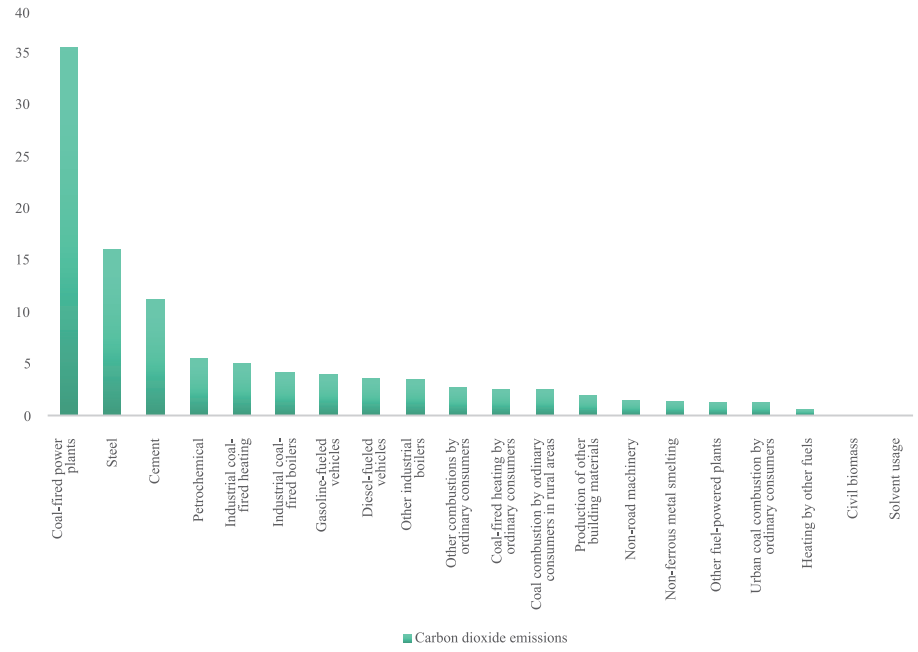


Figure 5 China's Carbon Emissions from 2011 to 2020 (Unit: one million tons of carbon dioxide equivalent; growth rate: %)

Source: BP Statistical Review of World Energy

The carbon emissions of different sub-sectors of manufacturing varied greatly. As shown in Figure 6, the power, steel, cement, and petrochemical industries ranked top, requiring focused regulation. Other industries and carbon emissions from ordinary consumers accounted for a relatively small proportion.

Figure 6 Carbon Emissions of China's Sub-sectors in 2020 (Unit: 100 million tons)



Source: Carbon Neutrality Report of NetEase Economic Research Bureau

Building a national unified carbon exchange is an important driving force and market path for China to achieve its carbon peak and carbon neutrality goals. From 2010 to June 2021, Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei, Chongqing, and Fujian carried out local pilot projects of carbon emissions trading. In July 2021, China officially launched the China Carbon Emission Trade Exchange (CCETE), marking China's entry into a new period of national carbon emission trading.

On July 16, 2021, China's national carbon trading market was officially launched. The photo shows the ceremony site of the launch.

As early as 2005, the EU implemented the European Union Greenhouse Gas Emission Trading Scheme (EUETS). EUETS has become the world's largest carbon exchange, and its carbon trading price has risen to about USD 40/t by the end of 2020. ③ The carbon emissions of Chinese enterprises included in the first batch covered by the carbon exchange exceeded 4 billion tons of carbon dioxide, which means that China's carbon exchange will become the largest exchange covering greenhouse gas emissions in the world. China will also become a powerful voice in setting prices in the trading of carbon emission quotas.

③ Data from Refinitiv's "Pricing and Market Data".

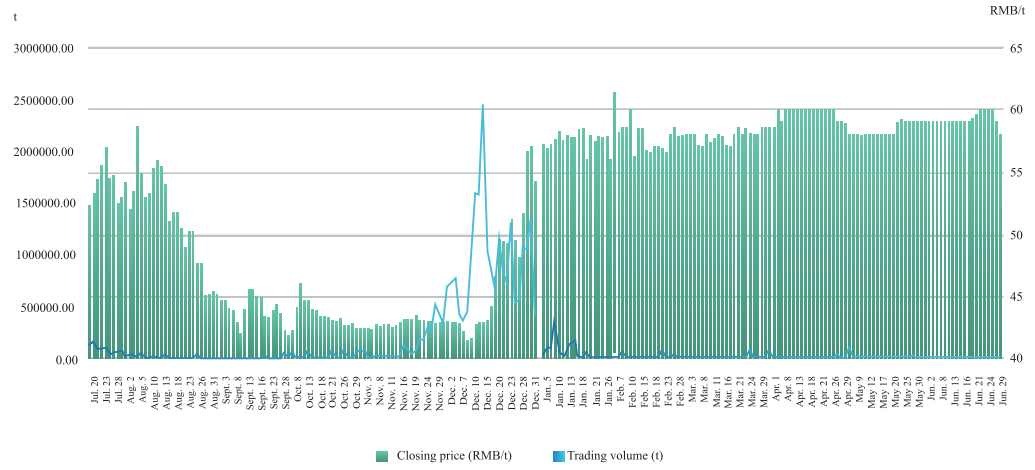


Figure 7 CCETE Information ④

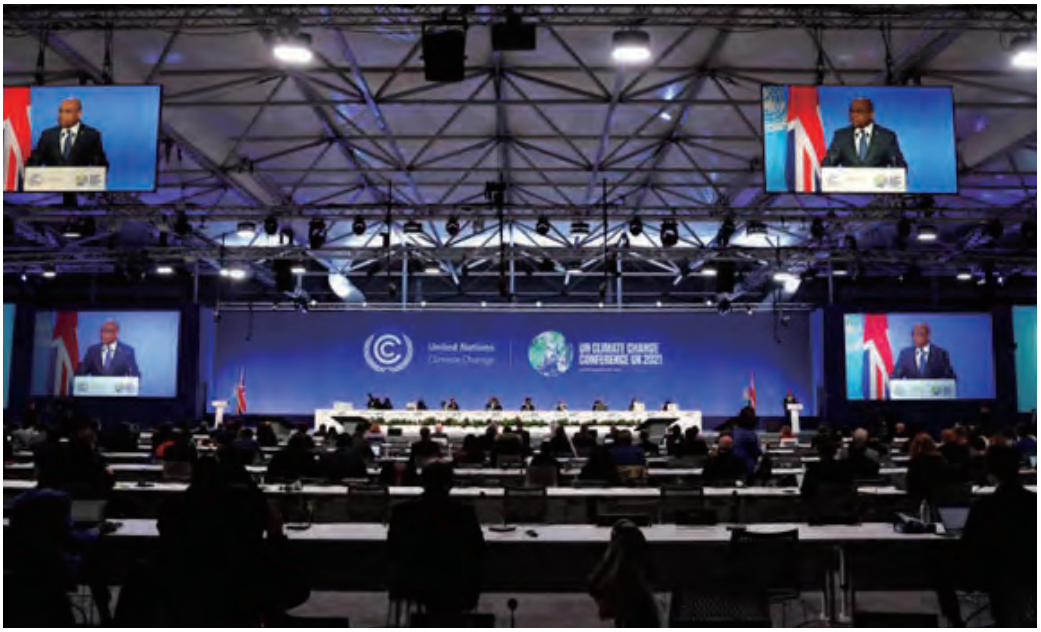
Source: Shanghai Environment and Energy Exchange

④ According to carbon exchange data from the Shanghai Environment and Energy Exchange from July 20, 2020, to June 21, 2021, the expected closing price and the expected exchange volume were used to examine the daily exchange volumes of carbon emission quotas and the volatility of closing prices. $E(X)=\sum_{i=1}^{n} x_i/n$ $E(Y)=\sum_{i=1}^{n} y_i/n$ The analysis showed that the expected closing price of carbon quota exchange was RMB 52.58/t, and the expected exchange volume was 123,116.38t. The closing price from August to December 2021 was at the lowest level in the year, and the exchange volume in December 2021 soared from 500,000t to more than 2.5 million tons, Carbon exchange was dynamic, and the closing price and trading volume of other trading ranges were relatively stable. The results of the visual analysis are shown in Figure 7.

CCETE is becoming an important means for China to utilize the market to optimize and rationally allocate carbon assets. As can be seen in Figure 7, CCETE is very elastic in terms of volume and trading price. The market-based mechanism of carbon trading in China has taken shape and will stimulate the rapid development of low-carbon industries in China while realizing the function of carbon asset price discovery.

3.3 Europe's main green economic policies

The EU pioneered green economic policies and has established a comprehensive regulatory system covering greenhouse gas emissions, clean energy, industrial transition, and so forth. All major economies also have corresponding policies, providing regulatory guidance for the development of the green economy in Europe. In particular, in the area of energy, the EU issued the *European Green Deal* in 2019, proposed A "Fit for 55" Package Based on Environmental Integrity and Solidarity in 2021, and agreed on the EU carbon border tax in March 2022.



On October 31, 2021, the Conference of the Parties to the United Nations Framework Convention on Climate Change was officially convened in Glasgow, Scotland. The international community expects all parties, especially developed countries, to fully implement their emissions reduction commitments and work together to effectively address the crises and challenges brought about by climate change. The photo shows the opening ceremony site of the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change.

3.4 Proposal of Europe's carbon emission reductions and economic transition

More than 20 years ago, various European countries announced that they had realized the decoupling of GDP growth from CO2 emissions. Nine EU member states, including Germany, achieved a carbon peak in 1990, with the remaining 18 member states also realizing this goal between 1991 to 2008.

A thermal power station photographed in Frankfurt, Germany in October 2021.

In 2018, the EU approved a reform plan for the carbon emissions trading system and recycled even more surplus quotas through the Market Stability Reserve (MSR). In 2020, the European Parliament raised its greenhouse gas emission reduction targets 2030 from the current 40% goal to 60% [5] (compared with 1990). The Parliament also affirmed that the EU's 2030 goal should rely only on emissions reductions inside the EU, reflecting its clear carbon reduction and transition ambitions.

As shown in Figure 8, the carbon emissions of European countries decreased from 2019 to 2020. Belgium, Greece, and Iceland implemented the most significant carbon emission reductions, while Hungary's reductions were the lowest. In general, carbon emissions of other countries are reduced by around 10%-20%. Although there was a significant reduction, it still fell short of the goal.

[5] Ministry of Commerce of the People's Republic of China. *European Parliament Backs 60% EU Emission Cuts for 2030*, October 17, 2020

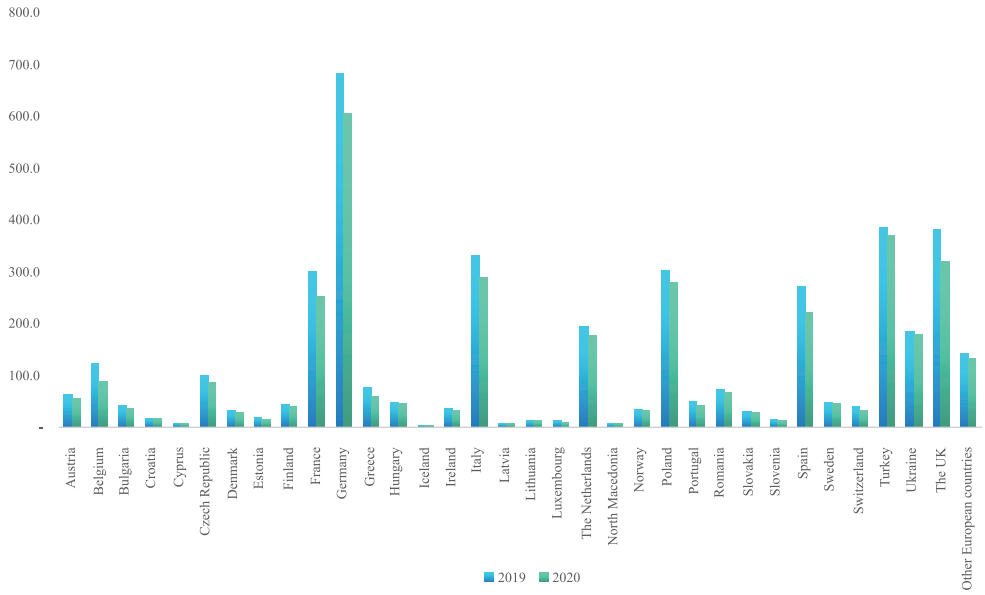


Figure 8 Carbon Emissions of European Countries from 2019 to 2020 (Unit: one million tons of carbon dioxide equivalent)

Source: BP Statistical Review of World Energy

3.5 Comparison of China and Europe's green economic policies and analysis of cooperation opportunities

China and Europe share a broad consensus on policies for the development of the green economy. China and Europe have both formulated short-term and medium to long-term policy goals. In terms of long-term goals, both sides have outlined their visions for 2050. Europe has proposed policy goals for the third carbon budget period (2024-2028).

The green economy policies of China and Europe show obvious differences due to differences in levels of economic development and social environment. In terms of green construction, China pays attention to the renovation of buildings and facilities in rural areas, which is seldom mentioned in the policies of European countries. In terms of green transportation, Europe pays extra attention to the development of new energy vehicles, while China's policies also focus on transportation infrastructure, including the construction of stations for battery swapping and charging.

Offshore wind power exists as a key area of renewable energy development. The photo shows the offshore wind power farm site built by Huaneng (Zhuanghe) Wind Power Co., Ltd., photographed on July 19, 2021.

In addition, China is at the cutting edge of green supply chains, with abundant mineral resources, relatively mature industrial development, and global leadership in parts production and assembly. Europe, on the other hand, leads the world in research on technologies such as hydrogen energy networks, carbon capture, and carbon sequestration. However, it is relatively weak when it comes to popularizing these technologies commercially. Green cooperation between China and Europe will effectively drive the digital economy and green development in Europe and help the EU to achieve the upgrading of traditional industries. In addition, European multinational enterprises have a competitive edge in ownership and internalization, while China possesses strong advantages in terms of location and ample resilience to capital imports. Sino-European cooperation effectively meets the needs of green and high-quality development for industries on both sides.

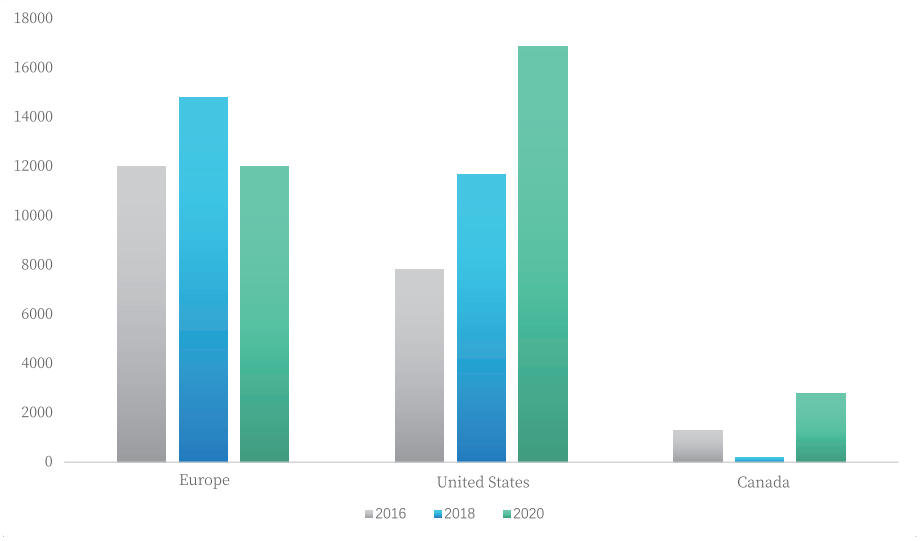
Table 9 Comparison of Green Economic Policies in China and Europe

	Green energy	Green infrastructure	Green transportation	Green finance
Similarities	·Both China and Europe have set short-, medium- and long-term goals in stages, such as the 2030 and 2050 goals. ·In terms of green energy, both China and Europe focus on hydrogen, nuclear energy, carbon capture, etc. ·In terms of green infrastructure, both China and Europe focus on household heating. ·In terms of green transportation, both China and Europe focus on the development of new energy vehicles. ·In terms of green finance, both China and Europe focus on green bonds, green investment and green financing .			
Differences	·In terms of developmental targets and evaluation, Europe's quantitative measures are more specific. ·In terms of green infrastructure, China pays significant attention to the renovation of buildings in rural areas. ·In terms of green transportation, Europe pays extra attention to the development of new energy vehicles, while China's policies also focus on transportation infrastructure.			

3.6 The green transition of economic and trade cooperation between China and Europe

As two major global powers faced with carbon neutrality goals, China and Europe share common values and a solid foundation for cooperation. As shown in Figure 10, Europe is an active responder and plays a leading role in environmental, social and governance (ESG) investment. According to the Global Sustainable Investment Alliance (GSIA), Europe ranked first in the world with USD 14.1 trillion in ESG capital management in 2018. To promote carbon neutrality and increase the scale of ESG investments, the European Commission has proposed the European Green Deal and the European Green Deal Investment Plan. The promulgation of the *European Taxonomy (EUT)* and the *Sustainable Finance Disclosure Regulation (SFDR)* has further standardized ESG investment requirements for asset management organizations. They regulate the disclosure of ESG investment information by asset management organizations while reducing the "greenwashing" behaviors of asset management organizations. This stricter regulation has slowed down the growth of ESG assets in Europe, a situation which needs to be transformed and improved.

Figure 10 Global Asset Size of Sustainable Investment (Unit: USD 1 billion)

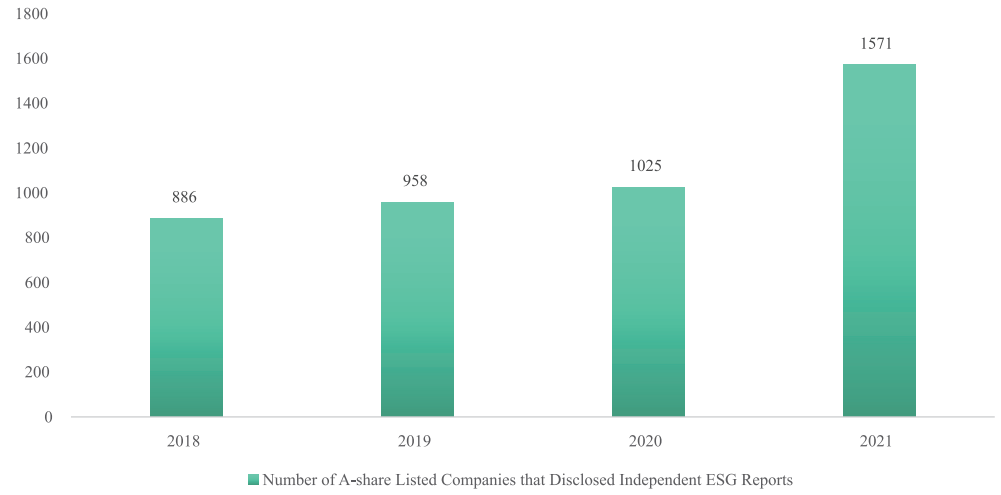


Source: Global Sustainable Investment Alliance (GSIA)

China has actively integrated into the international green finance market in recent years. Figure 11 shows the statistical results of Wind ESG data. As of April 30, 2022, 1,410 A-share listed companies in China had disclosed independent ESG reports this year, accounting for 29% of all A-share companies, an increase of 22.5% over 2021. This demonstrates the commitment of Chinese companies to international green finance cooperation.

China and Europe share a promising outlook for strengthening green cooperation in finance and investment and can accelerate the convergence of green and low-carbon standards. China and Europe can also accelerate market cooperation in green finance and promote transitional investment by building a low-carbon standard measurement system that meets the requirements of accuracy, consistency, comparability, and transparency.

Figure 11 Number of A-share Listed Companies that Disclosed Independent ESG Reports in China from 2018 to 2021 (Unit: No.)



Source: Wind ESG

In summary, Europe has long accumulated technology to develop its green economy, and its low-carbon environmental protection industry has a long history. However, China has rapidly developed its green economy in recent years and has made some innovative developments in green industries, infrastructure, and finance. With a large market, China possesses good industrial design and production capacities, as well as excellent commercialization capabilities. Bilateral trade and investment between China and Europe has been affected to a certain extent by the recent international situation. Nonetheless, China and Europe should introduce more preferential policies, promote cooperation in green technologies, encourage the sharing of green supply chains, explore complementary advantages, and achieve win-win bilateral cooperation in the green economy.

IV. General Conditions of Main Areas of Sino-European Cooperation in the Green Economy and Case Study Analysis

Over the past decade, China and Europe cooperated extensively in the area of green development, with fruitful results. This section focuses on green infrastructure, energy, transportation, finance and manufacturing. It analyzes the general conditions and representative cases of Sino-European cooperation.

4.1 Green infrastructure development and reform of industries

In recent years, China has been committed to constructing environmentally friendly buildings. During the 13th Five-Year Plan period, the energy efficiency of new residential buildings in urban areas in severely cold regions in China reached 75%, with a total green building area of more than 6.6 billion square meters. The proportion of energy-efficient buildings in urban residential areas exceeded 63%. In terms of green infrastructure construction, China and Europe have carried out many cooperation projects, and the Sino-German Ecopark in Qingdao is a model of Sino-European green infrastructure cooperation. This project demonstrates advanced development in all aspects, including core technology, industrial enterprise cooperation, and talent building.⑥

⑥ Ministry of Housing and Urban-Rural Development of the People's Republic of China, *"14th Five-Year Plan" for Building Energy Efficiency and Green Building Development,* March 11, 2022

The Sino-German Ecopark, which was comprehensively initiated in July 2013, has developed into a new platform for Sino-German cooperation. This Ecopark has been hailed by the Ministry of Commerce of the People's Republic of China and the German Ministry for Economic Affairs and Climate Action as "a lighthouse project between the Chinese and German governments in the field of ecology and a model for bilateral cooperation in eco-parks". As a collaborative platform for Sino-German sustainable development, a series of explorations on passive architecture have been made in the Sino-German Ecopark, combining its own characteristics and advantages.For example, the Passive House Technology Experience Center, the largest single passive building in Asia, has been built. This Center complies with the German Passive House Institute's (PHI) certification standards and achieves energy savings of over 92% compared to current national standards in energy-saving design. The Ecopark party and the National Technical Committee 452 on Building Energy Efficiency of Standardization Administration of China prepared a series of national and local standards.

The Sino-German Ecopark is a model project of Sino-European cooperation that follows the green development strategy, participates in the reform of China's green infrastructure industry, solves the sustainable development challenges of current infrastructure construction, and effectively promotes the introduction of China's industry standards for green buildings. Meanwhile, as a model of cooperation between China and a single European country, the Sino-German Ecopark focuses on the industrial development characteristics of Germany to provide customized services, promotes German green industries to invest and cooperate in China, and rapidly forms industrial clusters. The idea of "one city connecting one country" is worth popularizing.

The photo shows Haier Sino-German Ecopark in Qingdao, China, which has become the world's first "lighthouse base" for carbon neutrality.

4.2 Promoting the transition to green energy and broadening diverse international cooperation

In the past decade, China has achieved remarkable results in the transition to green energy. The proportion of coal in energy consumption has dropped to about 56%, clean energy has risen to 25.3%, and the installed capacity and power generation of photovoltaic (PV) and wind energy ranks first in the world. Green development has steadily achieved results. ⑦

⑦ www.cnr.cn, *China's green development has achieved remarkable results and the proportion of clean energy in energy consumption has risen to 25.3%*, February 19, 2022

In 2022, the European Commission announced the "REPowerEU" energy plan, in which the EU will further increase investment in wind power and PV to significantly increase the importance of the clean energy sector in the EU's economy. China and Europe share the same goals, possess complementary energy-related technologies and have a broad cooperative outlook. According to the "REPowerEU" plan, EUR 27 billion will be directly invested in electrolytic cells and green hydrogen storage and transportation. As the largest hydrogen producer, China has many enterprises in the industrial chain of hydrogen production, storage, transportation, and refueling. At present, Norwegian and Belgian enterprises and Chinese enterprises have cooperated in hydrogen energy manufacturing. Future commercial opportunities for Sino-European cooperation are promising.

On July 1, 2021, Envision AESC and Nissan announced that Envision AESC would provide power batteries for Nissan's next-generation electric vehicle platform and jointly build in Sunderland, UK, the "EV36Zero"— the world's first zero-carbon eco-base for electric vehicles. This eco-base will integrate electric vehicle production, power battery manufacturing, and renewable energy systems, setting a benchmark for the global auto industry's transformation to electric and green energy. Envision AESC's super-factory of power batteries in Sunderland, England, will provide high-quality green batteries for 100,000 Nissan electric vehicles every year, boosting the UK's green industrial revolution.

The cooperation project between Envision AESC, Nissan, and the British government is a representative case of diversified cooperation between enterprises, governments, and international actors. Batteries also have considerable effects on branding since new energy batteries are widely utilized in electric vehicles and other consumer products. The cooperation experience of Envision AESC, Nissan, and the British government carries an important demonstration effect for future international multi-party energy cooperation.

At the Envision AESC Ordos Zero-Carbon Industrial Park, the battery of a heavy truck is being swapped.

4.3 Improving the green transportation system and deeply integrating industrial upgrades

Since the 13th Five-Year Plan, China has actively promoted the development of green transportation. In 2021, the number of new energy buses in urban areas reached more than one million, and the carbon dioxide emission intensity from trucks decreased by 8.4% compared with 2015. The vigorous development of China's green transportation system cannot be separated from the rapid development of China's new energy vehicle industry.[8] The new energy vehicle industry is included in the ten strategic key development areas of China's *Made in China 2025* policy. In many consecutive years since 2017, China has led the world in new energy vehicle production and sales, outpacing many European vehicle companies.

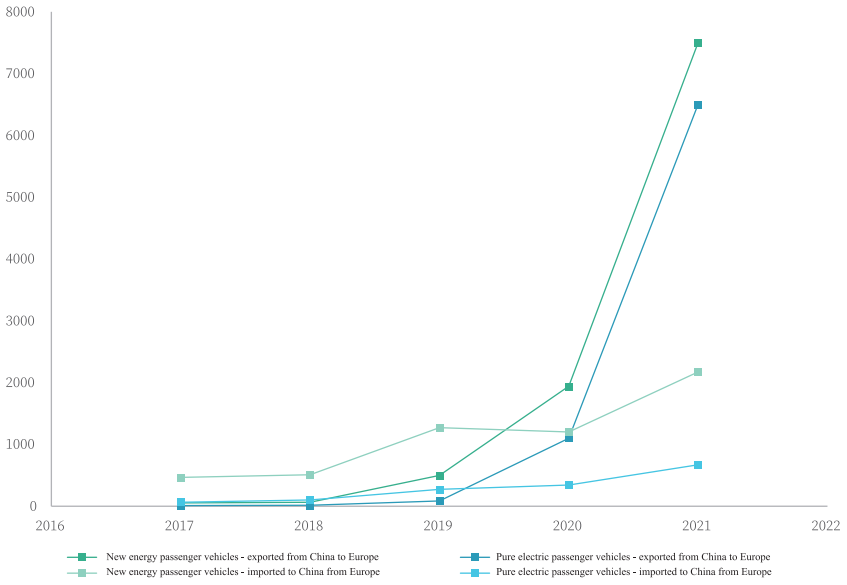
[8] Ministry of Transport of the People's Republic of China, *"14th Five-Year" Plan of Development for Green Transportation,* October 29, 2021

In order to accelerate the strengthening of China's national transportation system, the State Council of the People's Republic of China issued the *"14th Five-Year Plan" for the Development of a Modern Integrated Transportation System.* By 2035, a modern, high-quality national, comprehensive, three-dimensional transportation network that is convenient, smooth, cost-effective, green, advanced, safe, and reliable will basically be formed. The photo shows a multiple-unit train running in Lianyungang City, Jiangsu Province (photographed by a UAV).

Driven by Europe's green policies, the penetration rate of new energy vehicles in the European end market has been steadily increasing year by year. China's exports of new energy vehicles to the EU countries (and the UK) have doubled annually since 2019. As seen in Figure 12, China's exports of new energy passenger vehicles to Europe increased exponentially between 2017 and 2021. In particular, the exports of pure electric passenger vehicles increased from USD 11 million to USD 6.5 billion over just a few years. As of 2021, the EU had become China's largest export market for new energy vehicles, accounting for 72% of China's exports of new energy vehicles. [9]

[9] Calculated from data from UN Comtrade.

Figure 12 New Energy Passenger Vehicle Trade between China and Europe(Unit: USD one million)



Source: UN Comtrade

In addition to the trade of completed vehicles, trade between China and Europe is also booming for two key products in the new energy vehicle industry chain, namely, motors and lithium batteries. China's exports of lithium batteries to Europe increased rapidly from USD 870 million in 2017 to USD 8.3 billion in 2021 (an increase of approximately tenfold). In the same period, exports of motors increased from USD 91 million to USD 290 million (an increase of around three times). Imports from Europe of both key products increased, with lithium battery imports increasing faster than those of motors. Since 2019, lithium battery import has begun to exceed those of motors. Compared with the trade of completed vehicles, economic and trade exchanges between China and Europe on key products may be more significant for deepening the integration of the new energy vehicle industry chain.

On September 16, 2022, NIO officially announced that the first battery-swapping station produced by the NIO Power Europe Plant in Hungary was officially shipped to Germany. The station's shipment signifies that NIO will accelerate its distribution in the European energy market and provide more convenient charging services for European customers. The photo shows an NIO car parked in a battery swapping station in Biatorbagy, Hungary on September 16, 2022.

Germany is a major manufacturer of new energy vehicles in Europe. We take Germany as an example and use the RCA index to analyze the international competitiveness of China and Europe in the new energy vehicle market.[10] Table 13 provides statistics on the RCAs of China and Germany in three subdivisions of new energy passenger vehicle products. German products have an overwhelming comparative advantage in the hybrid passenger car market, with an RCA index above 3 over many years. China's RCA index has risen steadily but is still well below 1. In terms of plug-in hybrid diesel-engine passenger vehicles, Germany's RCA index reached an impressive 5.8 in 2019, while China was almost missing from the hybrid diesel passenger vehicle market.

[10] The measure of international competitiveness is the Revealed Comparative Advantage (RCA) index. This index is widely used to analyze the comparative advantages of countries, which is calculated as follows: where, represents exports of product j from country i, represents the exports of all products from country i, represents the exports of product i worldwide, and represents the total exports of all products worldwide. $RCA_{ij}=\frac{X_{ij}/X_i}{W_j/W}$ $X_{ij}X_iW_jWIt$ represents the international competitiveness of product j from country i in the world, and generally, the higher the RCA index, the greater the comparative advantage.RCA_{ij}

Table 13 Comparison of Competitiveness of China and Germany in the International Market of New Energy Passenger Vehicles

Product	Plug-in hybrid gasoline-engine passenger vehicles (HS-870360)		Plug-in hybrid diesel-engine passenger vehicles (HS-870370)		Pure electric passenger vehicles (HS-870380)	
Year	RCA of China	RCA of Germany	RCA of China	RCA of Germany	RCA of China	RCA of Germany
2017	0.0712	3.5984	0.0012	2.9267	0.0915	2.0060
2018	0.1001	3.3887	0.0000	4.7146	0.0839	1.8791
2019	0.2462	3.5090	0.0001	5.7981	0.1369	2.0511
2020	0.2369	3.5952	0.0000	3.9731	0.2798	2.7565
2021	0.1933	3.0946	0.0000	4.9083	0.7896	2.9700
Average	0.1696	3.4372	0.0003	4.4641	0.2763	2.3325

Source: Calculations based on UN Comtrade and RCA indexes.

However, the market environment for pure electric passenger vehicles is different. The RCA index for pure electric passenger vehicles in Germany remains high at around 2. China started producing pure electric vehicles fairly late, and its RCA index is still below 1. However, between 2017 and 2021, China's RCA index for pure electric vehicles soared, demonstrating a catch-up trend.

To sum up, based on the solid foundation of the European automobile industry, the international competitiveness of European new energy vehicles as a whole is higher than China's. China has yet to expand its development of hybrid passenger vehicles, but its ability to catch up in terms of pure electric passenger vehicle production is clearly apparent. China's exports of new energy vehicles to Europe are growing rapidly, especially pure electric passenger vehicles. Although China does not hold a comparative advantage in pure electric passenger vehicle products, it still achieves rapid growth in exports of these products by virtue of relatively low costs and a complete industrial chain. In addition, in terms of key products, Germany is more competitive internationally with regard to motor products, while China has an overwhelming comparative advantage in lithium batteries.

In terms of China's excellent performance in exporting pure electric passenger vehicle products to Europe

and its international competitiveness in lithium battery products, China's BYT must be mentioned. Ever since it established its European headquarters in Rotterdam, the Netherlands, in 1999, BYD has been working in the European market for many years and is representative of Chinese private enterprisesIn the UK, BYD has delivered five hundred pure electric buses to Transport for London and operator Go-Ahead and designed and built the world's first pure electric zero emissions double-decker bus. By the end of 2021, BYD's share of the pure electric bus market in Europe exceeded 20%. The key to BYD's electric buses being able to enter the European market (with its stringent regulations and standards) lies in its core technology - lithium iron phosphate batteries. These are highly stable and match exactly the high safety standards required for public buses.[11] Secondly, BYD has exchanged technology for the market and invested in and built many new energy vehicle production plants in Europe. In addition to creating more jobs for local people, it has also delivered the world's top new energy technologies to local consumers. BYD's development will admittedly also drive other Chinese new energy vehicle companies to venture forth and promote the optimization and upgrading of electric vehicle industries in China and Europe.

[11] Economic Information, *BYD: Rapidly "Emerging" in the Overseas Market,* January 21, 2022

On August 1, 2022, BYD announced cooperation with Hedin Mobility, a European dealer group, to provide premium new energy vehicle products for the Swedish and German markets. The photo shows the online signing agreement between BYD Europe and Hedin Mobility.

To sum up, in the area of green transportation, China and Europe have their own comparative advantages in different products, and there is bound to be a long-term policy orientation for the strengthening of exchanges and the furthering of cooperation. On the path of Sino-European cooperation, both sides can select more competitive products to collaborate on, make full use of their comparative industrial advantages and market advantages, and promote industrial upgrading.

4.4 Stimulating green financial vitality and accelerating global resource allocation

China has been building a green finance system since 2005. Although this was relatively late compared to Europe, China is developing rapidly and is now leading the world in terms of the scale of development. By the end of 2021, China ranked first in the world in terms of the size of green loans issued in both domestic and foreign currencies. In terms of green bonds, the cumulative amount of green bonds issued in China's domestic market reached RMB 1.67 trillion, and the stock balance was also above RMB 1 trillion as of November 2021. As of June 2021,[12] insurance institutions invested more than RMB 900 billion in green development-related industries that have carbon peak and carbon neutrality goals.[13]

As the scale of green finance increases, it is crucial for China to establish standards for the development of green finance. In November 2018, under the guidance of the People's Bank of China, the Green Finance Committee of China Society for Finance and Banking (GFC) and the City of London jointly released the Belt & Road Green Investment Principles (GIP). The GIP incorporates low-carbon and sustainable development themes into the Belt and Road Initiative, which is aimed at improving the environmental and

[12] People's Bank of China Research Bureau, *Green Finance Helps Realizing Carbon Peaking and Carbon Neutrality,* March 4, 2022,

[13] cctv.com, *Insurance Funds Support Green Development with an Investment Scale of More Than 900 Billion Yuan,* September 19, 2021

social risk management of investments, thereby promoting the greenification of Belt and Road projects. The proposal of the GIP demonstrates the leading role of China and Europe in the field of green finance standards. Since its release, GIP has been strongly supported by China, the UK, Europe, and major financial institutions.

It is noteworthy that Chinese enterprises and financial institutions are constantly exploring and making advances in green finance product innovation. In May 2022, Shudao (Sichuan) Insurance Brokers Co., Ltd. cooperated with China Pacific Property Insurance Co., Ltd. to promote the extension of the conventional business to areas of green finance, as well as accelerate the transition and upgrading of conventional products. In addition, against the backdrop of the formal operations of CCETE, they comprehensively researched the local needs of Sichuan and pioneered innovative carbon finance products. Shudao and Pacific jointly established a green insurance product system with the ESG investment concept at its core. The system mainly contains four major products. The first is carbon finance insurance. The carbon quota pledge loan contract between the carbon quota holding enterprise and the lending bank is used as the underlying contract. At the same time, the borrower's failure to repay the loan upon maturity is taken as the insurance liability to provide risk protection for the lending bank, which improves the effectiveness of the carbon quota pledge, and stimulates the efficiency of carbon asset transfers. The second is machine damage and carbon trading loss insurance for low-carbon projects. The insurer provides compensation to help the enterprise reasonably cover the carbon emission costs or resource emission reduction benefits for the loss of the carbon emission quota or resource emission reductions caused by the non-intentional shutdown of emission reductions equipment, which may lead to additional carbon emissions in the production and operations of the enterprise. The third is the carbon emission reduction loss insurance focusing on carbon exchange quotas. The insurer provides compensation for the carbon emission quota trading costs resulting from natural disasters or accidents that cause the insured party's greenhouse gas emissions to exceed the carbon emission quota covering normal production and operations. The fourth is ecological protection insurance, which includes environmental pollution liability insurance, agricultural food safety liability insurance, fresh food safety liability insurance, high-standard farmland IDI, and so on.

"Green development helps industrial reform". The scope of green finance continues to expand, including high-standard farmland IDI, etc. The photo shows the modern agricultural industrial park in Ta'erhu Town, Wuyuan County, Inner Mongolia (photographed by a UAV on September 17, 2022).

Similar to Shudao, more and more Chinese enterprises and financial institutions are engaged in industrial support for green development, expanding the scale of green finance and stimulating the innovation of green finance products. In terms of external cooperation, to meet the needs of Sino-European cooperation in the green economy, not only has AFD carried out green credit lending in China, but the GIP principle has also been put forward in Belt and Road countries. This two-way interaction promotes Sino-European cooperation in green finance and optimizes the allocation of global resources.

4.5 Achieving life cycle carbon neutrality to promote green manufacturing in China and Europe

According to data disclosed by the Ministry of Industry and Information Technology of the People's Republic of China, during the 13th Five-Year Plan period, the Ministry of Industry and Information Technology organized and implemented more than 300 major green manufacturing projects. The Ministry published information for 184 green manufacturing system solution providers and developed more than 500 green manufacturing-related standards. The Ministry has played a leading role in the green and low-carbon transition of industries.

The Life Cycle Assessment (LCA) method has been incorporated on a large scale to promote green manufacturing in China, and carbon emission and product carbon footprint requirements have been added to the evaluation criteria of green factories. Especially after China proposed the national carbon neutrality goal in September 2020, the product carbon footprint and carbon emission accounting of enterprises covering the life cycle process have become widespread. Life cycle green manufacturing and life cycle carbon neutrality have gradually been integrated, coinciding with the EU's life cycle-related policies and the development direction of international markets. Driven by both domestic and foreign policies and markets, a favorable situation in this aspect has been steadily created.China's LCA and carbon footprint-related research has long been exchanged with EU institutions. The Chinese Life Cycle Database (CLCD) adopts the EU's ILCD specification and is the first such database in the world outside Europe.

The EU is the first place in the world to have vigorously promoted life cycle green manufacturing. At the beginning of the 21st century, in order to restrict the content of hazardous substances in products, the EU established the Restriction of Hazardous Substances (RoHS) for electronic appliances, the End of Life Vehicles (ELV) Directive for autos, and the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Directive for a large number of industries and products. These EU regulations not only directly impact product access in the European market, but also extend to all countries (by affecting the global supply chains), pushing up the environmental requirements throughout the life cycle of products. These EU regulations have also driven the upgrading of China's manufacturing industry, prompting relevant Chinese authorities and several countries to formulate similar policies and regulations. This has, in fact, resulted in a global consensus and the setting up of a successful model for global cooperation in sustainable development.

In September 2022, the brand new Smart 1 Electric SUV jointly developed by Geely Holding Group and Mercedes-Benz went on sale. The Smart EV is planned to be marketed and sold in Europe, so IKE, a Chinese technical service provider, was commissioned to conduct a product carbon footprint survey of the Smart 1 power battery in accordance with the strict requirements of the EU'S Product Environmental Footprint (PEF) standard on batteries. A life cycle carbon footprint model of batteries was established by using CLCD and ILCD. The battery carbon footprint report was audited and certified by a third party, TÜV Rheinland, a European certification body. This is the first carbon footprint certification for a product

completed in accordance with the EU's PEF in China, which is a typical case of cooperation between Chinese and European research institutions, enterprises, and service organizations. It represents an important development direction in the area of life cycle carbon neutrality and green manufacturing between China and Europe.

The international mutual recognition of carbon footprints for products will be one of the most critical tests for global carbon neutrality. If the test is passed, it means a substantial international consensus has been reached, and a strong market momentum for carbon neutrality has been formed. This will promote the deep transition from global manufacturing to green manufacturing and is an important area for furthering Sino-European cooperation.

V. Challenges and Outlook for Sino-European Cooperation in the Green Economy

At present, low-carbon green development has become a global consensus, and China and Europe have taken the lead in this trend. Cooperation in developing energy-efficient and low-carbon technologies and jointly improving the quality of economic development should also become the development direction for both China and Europe.

5.1 "Common but Differentiated Responsibilities": A principle for Sino-European cooperation in the green economy

China and Europe have different economic development histories, and there are still major differences in their stages of industrialization. In addition, the income gap between the nations is noticeable. Therefore, both sides should follow the "Common But Differentiated Responsibilities" principle in relation to international climate, carbon emissions, and cooperation in green economic development. Developed countries have produced legislation on carbon emission cuts, but for developing countries, whose main goal is to eradicate poverty and develop their economies, it is more important for developed countries to recognize and encourage the contribution of developing countries to tackle climate change with an open and inclusive frame of mind and take care of the special difficulties and concerns of developing countries.

In the new stage of Sino-European cooperation in the green economy, the parties should adhere to the "Common But Differentiated Responsibilities" principle, show sincerity to the greatest extent, converge on similarities, resolve differences, and move forward in the same direction. In Sino-European cooperation in the green economy, all countries should fulfill their respective responsibilities, act according to their own abilities, develop a favorable framework for interaction, avoid politicizing climate issues, and tackle climate change together with an open, inclusive, and collaborative spirit of cooperation in the green economy.

5.2 Challenges for Sino-European cooperation in the green economy

Although both China and the EU are aware of the importance of developing a green economy, it does not mean that there will be no adjustments in green economic cooperation. Take carbon barriers as an example. The EU has started to internalize non-domestic high-emission products through carbon trading since 2005, and although the "Carbon Border Adjustment Mechanism" issued in 2020 has played a role in promoting carbon emission reductions in foreign markets, it has also violated WTO trade rules and added to the burden for developing countries to cooperate with Europe in the green economy. Therefore, if China and Europe want to achieve lasting and in-depth green economic cooperation and collaboration in the transition to the green economy, effective negotiation and a proper adjustment of carbon barriers will become critical issues for both sides. From a comprehensive perspective, Sino-European cooperation in the green economy mainly faces three big challenges; namely, an uncertain future development of international carbon exchanges, carbon tariff barriers, and global energy uncertainty.

The development of international carbon exchanges remains uncertain. With the goal of carbon neutrality, international carbon exchanges are becoming a focal point in tackling climate change. The EU hopes to utilize its commitment and advanced experience in emission reductions, carbon exchange, green finance, and other areas to strengthen its voice in relation to the issues of global climate change and energy transition.

Carbon tariff barriers make cooperation more difficult. On June 22, 2022, the European Parliament adopted draft amendments to the Carbon Border Adjustment Mechanism (CBAM or EU Carbon Tariff), which would have imposed a special tariff on carbon dioxide emissions for products produced in and exported to the EU from other countries that do not have a carbon price or have a low carbon price.China, as the EU's largest trading partner, may face new "green barriers", and Chinese products in high-carbon industries, such as steel and chemicals, will be greatly impacted.

With the theme of "Cooperation for Better Development, Innovation for a Greener Future", the 2022 China International Fair for Trade in Services (CIFTIS) was held in Beijing on August 31. The world is facing many difficulties, and economic development, trade flows, supply chains, etc. have been impacted. Reducing barriers is still the major trend in international trade cooperation.

Global energy uncertainty has increased significantly. A number of events in recent years, such as the COVID-19 pandemic and the Russia-Ukraine conflict, have disrupted the global push for a green economy, brought about significant uncertainty about energy prices and greatly delayed progress in energy efficiency and emission reductions. This has negatively impacted investments in the green economy.

5.3 Outlook for Sino-European cooperation in the green economy

Although Sino-European cooperation faces many challenges, there are still many opportunities for joint development in the green economy. China is a vast country with a large population and has experienced rapid economic growth in recent decades. Most industries have developed in recent years, and there is a considerable demand for energy efficiency and emission reductions. Economic growth is still a very strong trend, and there are good prospects for European companies to develop in China.

（1）China and the EU can cooperate widely. On the basis of the High-level Environment and Climate Dialogue between China and the European Union, China and Europe should continue to advance their cooperative relationship on energy transition and climate action. They should also continue to pay attention to each other's concerns, and further exchange and engage in discussions on their positions in multilateral climate negotiations, domestic policy measures, and the operations of collaboration projects.

Low-carbon clean energy is the direction of China's energy strategy development. There is a high degree of consensus between China and Europe on the importance of hydrogen energy.The photo shows the Guangdong Sino Synergy Yunfu Production Base, where the hydrogen energy industry has taken root, and technological research and development is changing with each passing day.

（2）The development paths and policies of the green economy in China and Europe are also different due to differences in the levels of social and economic development. With a unified central government, China is able to put forward an effective roadmap for the development of the green economy. European companies in China can expect stable development opportunities. The rapid development of green transportation infrastructures, such as battery swapping and charging stations in China, can also guarantee the rapid development of Europe's new energy industry in China. European technologies such as hydrogen energy networks and carbon capture can also be the next common development direction for green economic cooperation. The establishment of international carbon exchanges provides a better platform for both sides to optimize the use of carbon resources, and through the mature commercial operations of both China and Europe, it can provide a convenient way for the marketization and popularization of green technologies.

（3）Sino-European cooperation in the green economy complements the big trend of building a global digital economy. The digital economy can reduce the cost of global economic activities and promote the efficient utilization of global resources. China and Europe should seize the opportunity presented by the development of the digital economy to build digital systems for energy management and improve the greenification of their enterprises. Both sides should utilize big data technology to provide accurate recommendations for energy efficiency in enterprises and the wider society. In addition, they should achieve the global circulation of carbon labels through such technologies as blockchain, thus providing the necessary foundational platforms for carbon emission reductions and carbon exchange at the global level.

（4）Sino-European cooperation in the green economy can also lead to the participation of more developing countries. Sino-European green finance can serve as capital for more green actions in developing countries and as a tool to stimulate parties to strengthen their independent national contribution targets.

VI. Conclusion

In this Report, the basic conditions of Sino-European green economic development are analyzed, and the opportunities and the direction for such future cooperation are presented. Compared with Europe, China started developing its green economy relatively late. But with the Chinese government's strong focus on green development in recent years, China's green economy has grown rapidly. China's green economy is developing quickly, with a common orientation in green energy, infrastructure, transportation, finance, and manufacturing.

As two major global economies, China and Europe share common values and a solid foundation for cooperation to achieve carbon neutrality goals. The advanced technologies of enterprises from both sides can surely be linked up with these vast markets to promote the green and sustainable development of the global economy. Sino-European cooperation has been affected to some extent since the green economy is facing a series of uncertainties, such as increased tariff barriers. However, both sides adhere to the "Common But Differentiated Responsibilities" principle, show sincerity to the greatest extent, converge on similarities, resolve differences, and move forward in the same direction. Enterprises from both sides should also seize opportunities in each other's economic development, with a view to achieving the sustainable promotion of green technologies while ensuring the acquisition of profits.

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