中国循环再生 100 计划进展报告（2023-2025）：

中国加速循环主流化

The Circularity Agenda:

China Accelerates Circularity Mainstreaming

CC100 2025 旗舰报告

全球气候学院

青合循环经济与碳中和研究院

2025 年 10 月, 无锡

A Flagship report of China Circularity 100 Initiative

Global Climate Academy

Institute of Carbon Neutrality and Circular Economy

October 2025, Wuxi, China

摘要

2023 年，在迪拜举行的 COP28 上，青合循环经济研究院和全球气候研究院联合发起“中国循环再生 100 倡议”（CC100）。作为一个源自中国的全球旗舰项目，该“倡议”立志与中国和全球的公共及私营部门的领导者一道携手同行，共同倡导和推动中国加速循环和脱碳进程。

两年即将过去，中国的循环再生和“双碳”目标的推进正在如火如荼地前行中。中国果断地将循环经济原则纳入制造业、消费和投资体系的主流， 将循环再生从合规驱动的议程转变为高质量生产力的战略推动力之一。

欧盟通过可持续产品生态设计法规（ESPR）、数字产品护照（DPP）和碳边境调整机制（CBAM）来推进“绿色新政”和“竞争力战略”的同时，中国正在通过与欧盟立法覆盖的主要行业协同的节奏推进转型，为纺织、电池、电子和化工等行业提供更加明确的市场激励措施和赋能，加速建设系统性基础设施的循环再生助能和赋能属性，例如：数字溯源、物料回收生态系统、低碳产业园区、绿色融资机制等。

中国采取的方法将以下三个维度有机相结合：

- 国家目标和监管设计（生产者责任延伸制（EPR）、“十四五”循环经济发展行动方案、生态/环境法典草案；
- 大规模资金投入回收和工业再利用基础设施（电池回收、分类、再制造）；
- 以主要制造商和园区为切入点推动的工业生态设计和标准。

这些转变既减轻了欧盟气候贸易措施带来的近期贸易风险，又为低碳、可追溯的中国产品创造了出口机会。

正值 2025“无锡循环纺织与时尚论坛”召开之际，《中国循环再生 100 计划进展报告》综合了中国在错综复杂的全球转型背景下不断探索和创新的循环框架、政策和产业应对措施，重点介绍了中国在循环、脱碳和新质生产力等方面发挥领导作用的一些旗舰企业案例，特别是 CC100 的旗舰项目 -“废弃纺织再生助力 1.5 度零碳社区”，作为青合研究院与上海纤循新材等合作伙伴引领推进的优秀实践案例。

Part I 从创造性破坏到创造性重构和重建

用熊彼特理论来阐述，中国当前阶段不仅代表着创造性的破坏 - 用新产业取代旧产业， 而且更是一个以循环再生和脱碳为转型和创新引擎的创造性重构和重建的过程。

- **创造性破坏**：资源密集型增长模式在碳和资源约束下变得不可持续。
- **创意重构**：数字工具（人工智能、物联网、区块链）重新定义了材料、产品和数据的流通方式。
- **创造性重建**：基于可追溯性、再利用和再生的新型循环生产生态系统，同时创造价值和弹性。

因此，循环再生主流化支持中国向高效、低碳、数字化生产体系的战略和系统性转变，这是新质生产力的基础。在中国，行业和投资者正在经历加速转型的多重驱动力：

- 外部监管压力 - 欧盟的可持续产品生态设计法规 （ESPR） / 产品数字护照（DPP） 进程和碳边境调整机制 （CBAM） 加速了激励可追溯性和低隐含排放的需求方规则。DPP 进程在所覆盖的部门强制要求产品级数据披露; CBAM 对高排放进口产品施加与欧洲碳价格挂钩的成本，促使出口商实现流程脱碳并记录排放。这两项工具是中国循环政策的主要外部驱动力。
- 国内气候和资源战略 - 中国“十四五”循环经济发展规划旨在构建循环利用体系和提高再生材料使用率;各部委已发出到 2025 年推出 EPR 以及回收和使用二次原材料的目标。同时，国内主要起草（环境法典和 EPR 标准化）推动了循环商业模式的法律确定性。
- 市场动态和资产规模 - 快速的电气化和纺织品制造规模意味着退役产品流量很大：预计到 2025 年，仅退役电动汽车电池的产量就达到约 100 万吨，并且增长迅速 - 这是金属和矿产回收原料的机会。大型工业买家和龙头企业（宁德时代，主要资源循环集团和大型企业）正在投资循环价值链，为二次材料市场创造产业锚点。

Part II 中国的政策和监管进展

2.1 有目共睹的进展：

- **电池回收能力迅速扩大 - 中国在全球产能中占据主导地位**。最近的行业分析显示，中国占全球锂离子电池预处理和黑粉精炼产能的绝大部分（据估计，到 2025 年，中国产能将占全球产能的 70-89%，并计划到 2025 年处理数百万吨废旧电池）。这是循环原材料安全的一项材料结构成就。
- **“十四五”目标和政策架构到位 - 到 2025 年国家路线图落实**。中国“十四五”循环经济规划和工信部/发改委相关政策工作设定了资源生产率、循环系统建设和生态设计等量化目标;国际能源署政策跟踪器记录了到 2025 年构建资源循环利用型产业体系的目标。
- **大型公共项目和基础设施交付取得进展**。发改委和相关中央报告表明，“十四五”重大项目和包括绿色和循环项目在内的万亿元债券基础设施项目加快交付（报告 2024-25 年项目动员和竣工进度）。
- **标准、试点和融资工具得以扩大**。中国已经发布了数十项新标准，扩大了 EPR/试验区（循环示范区、国家试点），并调整了绿色金融指南，将循环指标纳入了循环指标 - 为循环基础设施（包装、WEEE、电池）提供支持管道。这反映在部门政策跟踪器和到 2025 年的国家塑料/包装行动计划中。
- **宏观韧性：经济和规模使循环投资成为可能，尽管面临不利因素**。中央统计和规划师报告称，“十四五”期间实现了强劲的 GDP 绝对增长和持续的工业规模，使实体经济即使在投资模式发生变化的情况下也能投资于循环基础设施。

维度	关键发展	影响
国家战略	《循环经济促进法修订（2024 年）》整合了产品生命周期资源能耗水耗管理和评价指标提醒，强化生产者责任延伸制，采用先进技术，突出数据基础，采用 EPR 与 DPP 的核心高度一致。	实现与欧盟和东盟贸易伙伴保持一致的统一数字标准。
产业政策	工信部绿色制造体系,累计培育**国家级绿色工厂 6430 家**、绿色工业园区 **491 个**和发改委循环经济示范区,**27 个园区循环化改造示范试点**和 **4 个“城市矿产”示范基地。**	推动工业共生和物料再循环中心。
标准化	80 多项关于资源效率、产品可回收性和数字可追溯性的新 GB/T 标准。	促进 DPP 互作性和 CBAM 数据就绪。
数字基础设施	多个行业和区域在电池、纺织、钢铁等产品试行 DPP 兼容二维码。	为跨境数据验证和碳追溯奠定基础。
金融工具	中国人民银行更新**《绿色金融支持项目目录（2025 年版）》** 首次将绿色债券和绿色信贷的认定标准合一，新增	将资本获取与材料效率和再利用结果联系起来。

	“**资源循环利用**”；人民银行浙江省分行联合多个部门，在全国率先出台《关于转型金融支持纺织业绿色低碳高质量发展的指导意见》	
贸易与 CBAM 响应	国家税务总局在 2024 年 4 月推出**“反向开票”** 措施，解决资源回收企业向自然人采购报废产品无法取得合规的 “第一张发票”，导致增值税无法抵扣、企业所得税成本难以列支。 销售以再生资源（即回收材料）为主要原料生产的产品，可选择享受**增值税即征即退**或**免征增值税**政策.	

- **EPR 和政策目标。**中国的路线图承诺到 2025 年完成关键领域的 EPR 法律法规，目标是到 2025 年将重点废物的回收率提高 50%，在试点部门中重点产品中回收原材料的使用率达到 20%。省市 EPR 试点（电子、电池、包装、纺织）正在扩大。
- **国家法律整合**。生态和环境法典草案明确要求循环经济标准、绿色设计以及扩大电子和电池的 EPR，这标志着立法主流化和对企业更强的合规期望。
- **中欧循环合作**。正式对话和中欧循环经济路线图（2024 年启动）将塑料、电池和再制造确定为共同优先事项，为技术交流和标准调整开辟了制度渠道。

2.2 投资和产业规模扩大

- **电池回收 - 规模和企业举措。**中国主要电池企业正在迅速扩大回收能力。公开报道和行业消息来源表明，投资金额达数十亿元人民币（例如，宁德时代宣布扩大产能扩张和大规模设施投资，并大力扩大闭环回收）。预测显示，退役动力电池吨位将急剧上升（2025 年为 104 万吨，到 2030 年将达到数百万吨），这需要快速建立拆解、湿法冶金和精炼能力。这些投资使中国能够从报废电池中获取价值，并减少关键电池金属对初级进口的依赖。
- **纺织品和纤维回收**。全球和国内对“纤维到纤维”（T2T）回收的投资越来越受欢迎（私人资本投入到可扩展的化学品/熔融回收技术和试点工厂中）。中国正在启动废旧纺织品收集试点和产业链测试;市场估计显示，国内纺织品回收市场将产生数亿美元的收入，预计到 2030 年复合年增长率将达到中个位数。
- **电子/电子垃圾基础设施**。据报道，与 EPR 草案和生态设计标准保持一致，加速了当地 EPR 试点和正式 WEEE（废弃电气和电子设备）收集和处理的设施升级。025 年 6 月财政部下发《关于下达 2025 年废弃电器电子产品处理专项资金预算的通知》（财资环〔2025〕59 号），涉及省份（地区）大部分已公示或发布 2025 年废弃电器电子产品处理专项资金（以下简称专项资金）分配方案。

Part III 行业概览 - 循环性发展最快的地方

3.1 电池（电动汽车和工业）

- 为什么优先考虑：源于关键材料（锂、镍、钴、锰）的高价值、巨大回收潜力及欧盟进口依赖风险。
- 正在发生的事情：正由领军企业与物流伙伴共建闭环体系，推进集中式电池回收网络试点，强化可追溯性与再利用，并已启动大规模扩建投资。

3.2 纺织品和时尚

- 为什么优先考虑：欧盟监管重点（DPP)、全球品牌压力及废物处理需求。
- 正在发生的事情：推进试点纺织到纺织，和化学回收试点，及投资扩容，强化家庭废旧废弃纺织品回收，并加快品牌回收成分目标落地。欧盟即将实施的的纺织品数字产品护照（DPP）提升了对欧盟出口企业的合规紧迫性。

3.3 电子和电气

- 为什么优先考虑：物料流的复杂性、EPR 可行性及高价值组件回收。
- 正在发生的事情：正在推进电子产品 EPR 试点，倡导生态设计和可修复性标准；并加正规 WEEE 处理与再制造投入。

3.4 化学品和化肥

- 为什么优先考虑：某些化学产品和化肥原料的 CBAM 风险与产业共生潜力。
- 正在发生的事情：推进行业脱碳试点、工业废物流的协同处理及出口产品隐含排放记录等举措。

PartIV 欧盟规则（DPP 和 CBAM）：对中国工业的具体影响

- 数字产品护照 （DPP）。DPP 要求受监管类别的结构化产品级数据（材料、可修复性、回收成分、供应链排放）。向欧盟出口的公司将需要 IT 系统、供应商可追溯性和经过验证的 LCA/隐含排放报告来维持市场准入。这对于纺织品、电池、电子产品和建筑材料来说尤其紧迫。
- CBAM 的演变和实际意义。CBAM 的分阶段实施和最近的欧盟调整（对交易量非常小的进口商的豁免;时间表的改变）减轻了最小贸易商的行政负担，但为最大的出口商和碳密集度最高的产品组（钢铁、水泥、铝、化肥）保留了实质性的碳定价风险。这些商品的中国出口商要么面临额外成本，要么需要证明较低的内含排放（这鼓励了低碳投入和循环原料）。最近的报告表明，欧盟立法有所完善，但核心要求依然存在。

尽管取得了进展，但贸易紧张局势和成本压力带来了挑战：

- CBAM 关税和潜在的美国/欧盟技术限制使碳密集型制造商的出口成本提高了 7-15%。
- 铝、锂和化肥行业面临价格波动和供应链碎片化。
- 2025 年上半年制造业投资下降 2.4%，但循环基础设施投资增长了 9.1%。
- 采用与 DPP 兼容的循环模式的公司在出口韧性和融资准入方面优于同行。

贸易紧张局势、关税、投资波动和中断风险：

- 贸易与地缘政治摩擦加剧不确定性，关税及技术出口管制促使投资转向并推动供应链多元化。同时，欧盟法规（如 DPP、CBAM）带来非关税合规成本，对无法满足要求的企业构成实质性壁垒。
- 投资放缓与目标资本集中。虽然一些制造业领域的广泛外国投资流动放缓（全球周期性因素+地缘政治不确定性），但战略资本正集中在循环基础设施上，例如电池回收、分类和扩大规模、纺织品回收——因为政策明确性（EPR，法典草案）降低了项目风险。这种模式表明重新分配而不是大规模资本撤出。
- 尽管受全球周期性因素及地缘政治不确定性影响，部分制造业外资流入趋缓，但战略投资正向循环基础设施集聚，如电池与纺织品回收、分类及规模化项目。政策明确性（如 EPR、法典草案）降低了风险，体现资本再配置而非大规模撤离。

Part V 中国和中国公司的机遇

- 依托庞大的国内电池与电子废弃物资源，湿法冶金及关键矿物精炼已形成规模效应，显著降低对进口初级原材料的依赖。
- 通过构建合规与低碳品牌实现出口差异化，具备 DPP 级可追溯性并降低碳足迹的企业将持续拓展欧盟市场份额。
- 国内循环市场逐步兴起，纤维到纤维回收、产业间工业共生及再制造模式将提升资源利用价值，创造高附加值就业，减少原材料对外支出。

循环与中国新质生产力：新质生产力注重创新、数字化、绿色化、高效化。DPP 和循环性是这一国家战略不可或缺的一部分。

工具	生产力机制
数字产品护照	将生命周期数据嵌入生产和贸易中，提高效率和透明度。
资源流通平台	实现产业共生和供应链优化。
绿色制造标准	激发创新和高价值产品差异化。
循环金融	将资本引导至低碳创新生态系统。

因此，循环主流化将资源限制转化为创新驱动力，促进中国工业在全球范围内重建竞争力。

PartVI 风险、差距和限制

- 数据与验证存在短板。DPP 与 CBAM 依赖于贯穿多级供应链的高质量排放及材料数据，而多数中小企业尚不具备相应能力，薄弱的核查机制易引发罚款、市场准入受限或声誉风险。
- 价格波动与投资不确定性亦构成挑战，出口下滑或关税上升可能导致长周期循环经济项目被私有资本降级，亟需公共资金或混合融资支持。
- 标准不统一加剧市场碎片化，欧盟与中国在 DPP 元数据及生命周期核算方面技术规范各异，易致双重合规成本。尽管中欧循环路线图等制度合作可部分缓解，但仍难根本化解。

实现“十四五”目标的一些主要差距和制约因素：

- 产品层面的碳和 DPP 数据仍然不完善。尽管诸多领先企业已披露设施或企业级碳数据，但产品级 LCA 排放及标准化 DPP 元数据仍参差不齐。多数中小企业尚未具备符合欧盟 DPP/CBAM 要求的经验证产品碳足迹，暴露出普遍的实施短板。政策追踪与企业报告分析表明，设施级覆盖远高于 SKU 级披露水平。
- 数字互操作性不足与验证体系不完善。当前存在多个试点 DPP 系统及国家平台，但与欧盟标准（如 GS1/EPCIS 或 ESPR DPP 格式）在互操作性方面仍待提升，第三方验证市场尚处发展阶段。缺乏统一接口将导致出口商面临重复性合规负担与贸易摩擦。
- 行业进展不均衡：纺织品和化学品滞后于电池领域。电池及电子废弃物因资源价值高且具备明确商业激励，产业化进程较快；而纺织品、建筑材料及多数化学品在高质量回收体系、规模化机械与化学再生能力以及产品全生命周期评估覆盖方面进展缓慢。行业分析与报告数据均印证了这一差距。
- 投资波动与行业整合加剧风险：部分项目已出现取消或延期现象，尤其在电池制造及相关领域经历繁荣后的整合阶段。区域产能过剩风险上升，若需求不及预期，可能导致循环经济投资项目搁浅，进而延缓新设施投产，并影响小型回收企业获取私人融资的能力。
- 中小企业普遍缺乏生命周期评估与产品数据管理能力。接入 DPP 平台亟需大规模公私协同能力建设。尽管国家试点彰显政策认知，整体能力提升仍任重道远。

PartVII 循环再生：中国新质生产力体系的核心引擎

2025 年 10 月召开的中国共产党第二十届中央委员会第四次全体会议，为未来五年发展擘画了战略蓝图。全会以“推动中国式现代化进入加速期”为主题，全面启动第十五个五年规划（2026—2030 年）部署。这一关键阶段，既是实现 2035 年基本实现社会主义现代化目标的重要窗口期，也标志着我国经济社会迈向以创新驱动、循环协同的高质量发展新阶段。

全会明确提出，要以“新质生产力”为引领，统筹推进产业结构、能源体系、资源循环、科技创新与社会治理的系统性升级。在此战略框架下，“循环再生”由传统环保议题上升为国家发展基础支撑，深度融入新质生产力体系。再生经济的崛起，意味着中国将依托科技创新与制度变革，迈入以再生驱动增长、以循环保障安全、以创新塑造竞争力的新时代。

7.1 战略演进：循环经济的国家化与体系化

过去十年，中国循环经济历经节能减排起步、产业试点探索、区域示范推广与政策体系完善，已步入高质量发展新阶段。未来五年，其将实现从“环境治理工具”向“经济体系基石”的战略性跃升，逐步构建具有中国特色的“循环再生国家体系”。

这一体系的演进呈现出三大特征：

- **从末端治理到源头再生** - 强化产品全生命周期管理，推动再制造与再利用成为核心模式；
- **从行业分散到体系集成** - 贯通能源、制造、交通、建筑与农业等关键领域，打造全产业链闭环；
- **从政策导向到制度定型** - 建立全国统一的法律法规、标准规范、绿色金融与数字化治理体系。

四中全会提出“以制度型开放推动制度创新”，意味着循环再生将不仅是国内的产业选择，更将成为对接国际规则（如欧盟 DPP、CBAM）的战略通道。中国将以制度化循环为桥梁，进入全球绿色贸易与低碳技术治理的核心议程。

7.2 结构重塑：循环再生融入新质生产力体系

新质生产力的本质在于科技创新引领的结构性变革，循环再生与之深度融合，成为推动产业升级与能源转型的关键支撑。

- 科技驱动的再生制造。未来五年，中国将在电池、金属、塑料、稀土及电子等领域全面推进再制造工程。依托人工智能、区块链与物联网技术，构建覆盖全生命周期的数字化循环网络，实现产品可追溯、资源可回收、价值可重塑。
- 材料科学与再生资源协同发展。以再生铝、再生锂、可降解聚合物为代表的新型材料正加速崛起，成为新材料产业的重要增长点，有力支撑新能源汽车、储能系统、绿色建筑与环保包装等战略性产业发展。
- 数字治理赋能循环新基建。全国统一的数字产品护照（DPP）体系与碳足迹信息平台加快建设，将形成集资源流动监测、排放核算与市场交易于一体的智能基础设施，推动“物质循环”与“碳循环”协同治理。

战略研判表明，循环再生正逐步演进为连接科技创新、产业升级与气候治理的系统性解决方案。

7.3 区域协同：从产业链到生态圈的空间跃迁

我国循环再生战略正由产业链协作迈向区域生态圈协同。未来五年，将形成“东部引领、中西部崛起、南北互动”的三极发展格局，实现空间布局优化与系统效能提升。

战略判断：循环再生正成为连接科技创新、产业升级与气候治理的“系统解法”。

中国循环再生战略正从产业链协作向区域生态圈协同迈进。未来五年，将形成“东部引领、中西部崛起、南北互动”的三极结构:

区域	战略定位	重点方向
长三角	循环制造与绿色供应链枢纽	再制造产业集群、DPP 标准试点、废弃资源跨区流通
粤港澳大湾区	再生消费与数字化循环引擎	塑料循环、电子废弃物回收、绿色消费创新
成渝经济圈	资源型城市转型示范	再生金属基地、绿色矿业与水资源循环

黄河流域	生态再生与流域治理样板	绿色矿业、水-能源-粮食循环治理

这些区域的循环化转型不仅优化产业结构，也重塑区域发展格局，为共同富裕和可持续增长提供新的空间动力。

7.4 循环金融：资本与再生的融合机制

在四中全会“健全绿色低碳转型体制机制”的框架下，循环金融被确立为绿色金融的重要拓展方向。其核心目标是：**以资本激活再生，以金融推动闭环**。

当前，资源循环领域呈现三大趋势：

- 循环项目融资日益标签化，绿色债券、可持续挂钩贷款及 FAST-Infra 认证项目加速向再制造与资源循环倾斜；
- 再生资产逐步证券化，推动再生材料、废弃物处理及循环基础设施纳入资本市场可交易资产体系；
- 地方绿色基金聚焦闭环发展，各地纷纷设立资源再生基金与绿色产业母基金，助力项目落地与产业化进程。

国际合作层面，亚洲开发银行、亚投行、世界银行等机构正与中国政策银行探索**循环金融联合机制**，以规模化资本支持绿色产业链的系统转型。

7.5 制度创新：立法、标准与数字监管三位一体

未来五年，中国循环再生体系的制度基础将实现三项突破：

- **循环立法升级**。《循环经济促进法（修订）》预计在 2026 年出台，扩大循环产品定义、强化生产者延伸责任制（EPR），并明确 DPP 与碳数据的法律效力。
- **标准国际互认**。欧盟数字产品护照（DPP）、碳边境调节机制（CBAM）等国际体系的互认试点将启动，中国将成为全球循环标准体系的重要规则参与者。
- **数字监管体系构建**。全国统一的“循环与碳信息平台”将实现跨部门数据共享，支撑金融、监管、产业政策的精准协同。

这些制度创新将使中国在循环再生领域具备制度性竞争力，成为“绿色规则输出国”之一。

7.6 社会动员：从产业循环到全民循环

循环再生的深化离不开社会层面的共创。未来五年，中国将进入“全民循环”阶段，推动绿色生活方式和再生文化的普及。

- **循环消费制度化**：建立碳积分、绿色积分、循环积分体系；
- **企业责任深化**：强化延伸生产者责任制、回收体系透明化；
- **教育与文化嵌入**：生态文明教育进入义务教育、职业培训与企业治理体系。

这种“从上而下的制度建设”与“从下而上的文化自觉”相结合，将成为中国再生型现代化的重要社会基础。

7.7 循环再生引领中国式现代化新阶段

未来五年，中国的“循环再生战略”将成为经济、生态与社会三重结构调整的一个核心支点。它将：

- 以再生方式实现高质量增长，在中速增长中提升创新与韧性；
- 以循环体系保障国家安全，在供应链、资源链与能源链中形成内在自给力；
- 以绿色治理塑造全球竞争力，在标准、技术、资本与文化上建立可持续优势。

总结判断：“循环再生”不仅是生态文明的深化，更是中国式现代化的新形态。它标志着从“增长逻辑”向“再生逻辑”的文明性跃迁。

7.8 十五五期间循环再生十大政策信号

序号	政策信号	关键方向	监测指标
1	循环经济纳入新质生产力体系	再制造、再设计、资源循环	循环产业增加值占 GDP 比重
2	制定《循环经济促进法（修订）》	EPR、DPP、碳数据法律化	法规落地时间表

3	建立全国 DPP 信息平台	产品全生命周期追踪	覆盖产业数量
4	推进资源循环率提升	40% → 60%	全国资源循环率
5	启动循环金融体系	再生项目标签化融资	循环金融规模占绿色金融比例
6	建设循环示范区	区域协同、跨产业闭环	示范区数量
7	加强国际标准互认	CBAM、DPP 互通机制	国际合作协议数量
8	发展再生材料产业	铝、锂、塑料、电子等	再生材料占比
9	推进零废城市群建设	城市循环体系完善	“零废城市”比例
10	普及全民循环文化	绿色消费、碳积分	循环消费渗透率

PartVIII 结语：循环再生愿景

中国的循环转型已超越可持续发展的叙事层面，成为国家高质量发展的核心战略支柱。二十届四中全会明确提出，以“新质生产力”引领“科技创新驱动的绿色转型”，加快构建现代化产业体系，推动循环经济从环保议题跃升为重塑国家竞争力的关键路径。

面向“十五五”，循环再生的主方向正被系统性重构：聚焦政策协同、重工业再造（特别是电池与材料循环）、数字可追溯体系建设以及对接国际绿色规则。这一进程为中国开辟了关键战略窗口期。率先部署具备 DPP（数字产品护照）功能的可追溯系统、锁定循环原料来源、强化国内回收与再制造基础设施的企业和金融机构，有望将政策压力与贸易壁垒转化为全球竞争优势。反之，若在数据管理、认证验证及标准一致性方面滞后，则可能面临“隐性关税”与市场准入障碍，在全球价值链整合中处于不利地位。

8.1 中国循环再生计划：政策 + 行业影响

- 政策导向验证了“重建”逻辑。全会提出“推进新型工业化、加快发展循环经济、推动绿色低碳转型”，这验证了循环再生计划所倡导的系统性重建逻辑：战略性产业（尤其是电池、稀有金属、电子与汽车）正通过资产再配置与二次流处理能力的建设，形成“再生制造”新模式。工业规模正被重新定义为循环优势，而非资源负担。
- DPP 成为产业竞争力的“数字骨架”。产品级、可验证的数字数据能力是构建中国循环经济体系的关键短板。推进 DPP 标准互认、建立独立第三方核查机制并加速中小企业数字化接入，已成为落实政策、保障贸易安全及应对 CBAM 风险的紧迫任务。全会提出的“提升数字经济核心产业竞争力”，为这一系统性建设提供了有力制度支撑。
- 公共与开发性金融需聚焦关键环节。全会重申“发挥政策性、开发性金融的引导作用”。循环经济应优先支持：区域性大型回收再制造中心的资本投入，国家级 DPP 数据与验证平台建设，以及中小企业 LCA 和可追溯性能力建设的补助机制。此举延续“十四五”重大项目投融资模式，为“十五五”绿色产业基金布局提供方向指引。
- 以行业牵引带动全国性标准体系升级。全会提出要“以重点行业为突破口，推动绿色低碳标准体系建设”。电池和电子产业可作为牵引行业，率先形成贯通设计、生产、回收与再制造的标准与验证体系，并为纺织、包装、化学品等行业提供标准化模板和共享基础设施，从而实现成本可控的全国性循环体系升级。

8.2 迈向“再生、负责任与韧性”的中国模式

《中国循环再生计划》代表了中国在全球循环转型中的新一代产业叙事与行动框架。我们共同的 DNA 是:

- **再生** 将废弃物转化为资产与价值;
- **负责任** 以 DPP 和数据透明度为支撑的供应链治理;
- **韧性** 在脱碳、贸易与地缘压力中构筑适应性竞争力。

因此，中国的循环转型不只是闭环经济，而是以价值创造、系统创新和数字信任为核心的新工业文明形态。

8.3 从循环到系统性竞争力

《中国循环再生计划》报告的最终结论是：立即行动，调整标准，调动混合资本，加速数字验证体系建设 - 这是将循环性转化为中国主流经济竞争力的切实路径。正如四中全会所强调的，未来五年中国要“加快形成绿色低碳发展方式和生活方式”，而循环再生经济正是这一战略目标的核心载体。它不仅是绿色中国的基础设施，更是实现经济高质量、安全性与国际话语权的关键机制。

零废弃物时尚和再生纺织品：将废旧纺织赋能 1.5°C 的零碳社区

中国循环 100 倡议旗舰项目

1. 背景和战略意义

- 全球规模：每年产生约 9200 万吨废旧纺织（增长是由产量增加和服装寿命缩短推动的）。
- 中国规模：中国年废纺织品产生量在 2200-2300 万吨（2022-2023 年）之间，每年利用（再利用/回收）仅为几百万吨，规模化潜力巨大。
- 回收强度差距：已发表的调查和评论显示，全球纺织品回收/回收率在 1%（纺织品到纺织品的回收）和 25%（更广泛的再利用/回收）之间，具体取决于定义;据估计，中国的综合利用率约为 20-25%，而一些领先的欧洲系统报告称，再利用/回收的回收率要高得多（德国通常认为可重复使用纺织品的回收/回收率为 75%，具体取决于指标）。
- 政策势头：欧盟委员会的《欧盟可持续和循环纺织品战略》（2022 年 3 月）规定了设计要求、更严格的再利用/回收目标，并推动了数字产品护照 （DPP）。中国的“十四五”及后续一揽子政策（循环经济条款、市政试点计划）同样强调征收、工业利用和标准，为扩大试点创造了政策窗口。

纺织服装价值链作为中国规模最大的循环经济体系之一，面临严峻的能源消耗、碳排放及回收难题。2022 年，我国废旧纺织品产生量达 2200 万吨，其中约 70%源于家庭服饰淘汰，综合回收率仅为 20%-25%，显著低于德国等欧洲国家约 75%的水平。全球每年纤维产量逾 9200 万吨，涤纶与合成纤维占比近 60%，构成高能耗与高碳排的关键环节。

在“双碳”目标与“十四五”循环经济发展规划推动下，行业正由增量减排迈向系统性循环转型。“废纺织品再生赋能 1.5°C 零碳社区”案例，展现了社区创新、数字技术融合与再生设计协同作用下，将纺织品循环利用转化为城市可持续发展实效的可行路径。

2. 案例概述：废旧纺织品再生赋能 1.5°C 零碳社区

牵头机构：青合循环经济与碳中和研究院，上海纤循新材料有限公司等

试点城市：包括上海、苏州、天津。

项目时间线：2022-2030 年（三阶段模式）

项目构建以纺织废弃物为中心的社区一体化循环体系，集智能收集、材料创新、零碳空间设计、数字化溯源于一体。它为将废物流转化为低碳资产提供了可扩展的蓝图。

2.1 智能收集基础设施

- 在 4000 个社区部署 6000 个智能回收箱，服务 460 万居民;
- 每个单元都包括自动称重、AI 图像识别和异常警报;
- 「旧衣包裹」小程式利用人工智能进行照片式体重估算，为居民提供实时追踪及金钱奖励;
- 与城市固体废物系统的数据集成确保了透明度和政策反馈。

为什么这很重要：收集密度和分拣产量决定了回收的经济性（运输、每公斤的分拣成本）和高价值再利用或纤维到纤维回收的原料质量。欧盟最近的研究强调，增加纺织品到纺织品的回收利用，即使是适度的，也能带来可衡量的二氧化碳和水的节约，但其好处是针对纤维和工艺的。

2.2 材料创新：从废旧纺织品到纤维塑料复合材料

- 将再生聚酯与聚丙烯基体相结合，纤维含量达到 60-70%;
- 机械性能：抗弯强度 35MPa，耐候性 10+年;
- 应用包括长凳、花盆和地板——在社区中部署了 12 个产品类别;

- 仅在 2023 年，就有 5,000 吨废旧纺织品被转化，减少了 12,000 吨二氧化碳排放，并节省了大约 4,000 立方米的木材。

二氧化碳减排量 - 现实框架：文献显示范围很广（某些棉/羊毛机械回收示例的每吨二氧化碳当量低个位数，避免原生聚酯生产的吨二氧化碳当量为几吨），因此将结果呈现为特定于纤维和工艺的范围，并避免单点估计。使用试点数据，使用透明的生命周期评估假设计算避免的排放量。

2.3 零碳馆：一场空间革命

- 由 100% 回收材料制成，减少 85% 的隐含碳;
- 配备光伏系统（90%能源自给自足）和雨水收集（节水 40%）；
- 集回收中心、低碳教育中心、社区活动空间于一体，空间利用效率提升三倍。

2.4 数字赋能与风险管理

- 数据无缝流入城市固体废物管理平台;
- “RiskGo”模式确保 98% 的欺诈检测和运营透明度;
- 基于人工智能的分析支持碳量化、行为洞察和与信用挂钩的公民参与;
- 建立连接公民、企业、监管机构的三层治理模式。

与欧盟 DPP 实践保持一致的后续步骤：采用欧盟 DPP 试点要求的纺织品领域（按重量划分的材料细分、耐久性指标、可修复性、回收途径、每件/批次的碳足迹），以便产品和回收产出可以追溯到欧洲价值链，那里的 DPP 和合规期望正在收紧。

3. 量化结果和行业影响

- 减碳：仅苏州（2022 年），纺织品回收利用量为 862.55 吨，避免了 4,528 吨二氧化碳;
- 标准化：项目牵头起草了《再生纤维-塑料复合材料社区应用技术规范》，填补了国家关键空白;
- 产业合作：促进 23 家纺织企业和回收商的战略合作伙伴关系，打造“收集-生产-认证”的闭环价值链;
- 数字创新：“班卓 AI 权重估算”模型入选工信部国家数字化转型案例。

4. 战略规模化：三层城市渗透与碳普惠模式

项目**采用"三层城市渗透模式"**进行扩建:

- 第一阶段（2022-2024 年）：一线城市（上海、北京、广州、深圳）验证，证明业务可行性;
- 第二阶段（2025-2027 年）：向二线城市扩张，优化成本结构和政策调整;
- 第三阶段（2028-2030 年）：向县域和农村地区推广，开发差异化的采集模式。

在纵向方面，该倡议将把个人碳减排数据整合到碳包容市场中，将行为与碳信用奖励联系起来。横向来看，该模式将扩展到塑料、电子垃圾和包装，建立与即将出台的国家"双碳"政策包（2025 年）相一致的多流社区循环网络。

5.中欧对比分析：政策、基础设施、科技与市场

比较摘要：关键指标和政策工具			
维度	**中国（试点背景）**	**欧盟（代表性实践）**	**对试点规模的影响**
年度纺织废料（全国）	**22-23 公吨**（中国 2022-23 年估计）	欧盟废物总量：人均产生量 ~15 公斤/年（欧盟总量）——全球总排放量 ~92 公吨/年。	中国的绝对规模为国内大型产业环路提供了机会，但需要上游的分拣和标准。
回收/再利用率	20-25%（中国全国利用率估计;家庭捕获率 <15%）。	德国和一些北欧系统报告了很高的收集/回收率（在某些指标中通常为 >50-75%），并得到了混合市政和慈善网络的支持。	中国需要更密集的本地收款网络+激励措施来匹配欧盟的捕获。
政策工具	市级试点、配额、绿色采购、"十四五"下行业标准。	欧盟：**设计要求**、EPR 提案、DPP（2022 年战略中优先考虑的纺织品）、再利用>回收等级。	如果嵌入了 DPP+设计合规性，试点应为贸易/市场准入利益做好准备。

DPP 和可追溯性	现有二维码/人工智能包裹打样;准备好批量 DPP 字段	欧盟 DPP 研究和试点定义了材料、耐用性、可修复性和回收途径领域。	扩展试点数据模型，将 DPP 字段包括在内，以便向欧盟可持续采购渠道出口/供应。
技术重点	纤维塑料复合材料（下循环）+机械回收试点	快速投资化学品回收、工业机械分拣，以及纺织品到纺织品回收的政策激励措施。	继续将产品用于社区资产，同时试点纤维到纤维路线并测试聚酯的化学回收合作伙伴关系。
融资与市场	不断增长的再生复合材料本地市场;通过 23 项确定协议（试点论坛）构建产业融合。	品牌承诺、工厂投资和混合金融（欧盟/工业）建设大型化学回收厂。	将公共试点融资与品牌承购承诺（需求拉动）相结合，以降低回收资本支出的风险。

资料来源：中国国家回收/使用量估算;欧盟战略委员会（2022 年）;EPRS DPP 研究;行业报告和学术 LCA 评论。

叙事要点：欧盟与中国

- **政策设计与实施差距：**欧盟政策现在侧重于产品规则（耐用性和可回收性设计）、DPP 和 EPR - 推动生产商管理报废的结构。中国的政策重点是**收集系统的建设、工业利用和标准**，这创造了一条互补但不同的路径。将中国的收集优势与欧盟式产品规则相结合的试点计划可以创造可出口的高质量回收产品。
- **上游设计很重要：**欧洲强调防止生产过剩和改进设计，将减轻未来的分拣负担。尽管如此，中国的规模优势仍可以快速提供大量原料，但质量和成分控制（单纤维流、混纺分离）将决定高价值纺织品到纺织品的回收是否可行。
- **DPP 和市场准入：**随着欧盟实施 DPP 和相关合规，带有强大数字护照（成分、碳、加工历史）的回收或再制造纺织品产品将进入优质采购渠道和出口市场 - 这是试点尽早采用 DPP 领域的战略原因。
- **技术路径组合：**欧洲正在动员机械回收和化学回收（以及大型品牌投资以扩大化学回收能力）。中国试点应继续使用纤维-塑料复合材料来满足近期的循环需求，同时与行业合作伙伴试点纤维到纤维和化学路线，以在中期内捕获更高的每吨避免排放量。

6. DPP（数字产品护照）对齐与“新质生产力”契合

维度	已涵盖的 DPP 领域	剩余差距/后续步骤	与新质生产力接轨
产品识别和可追溯性	基于人工智能的包裹识别和二维码包装	为回收物料流引入批次级碳足迹跟踪	智能循环制造
生命周期数据	收集-回收-生产一体化	添加运输和再制造能源指标	全生命周期碳管理
材料成分与安全性	标准化纤维塑料配方	建立国家回收材料特性数据库	材料科学创新
环境绩效和碳标签	每吨回收量的二氧化碳减排量	为回收产品引入经过验证的碳标签	绿色市场机制发展
社会参与与信用联动	激励式征收碳积分制	将“碳普惠+社区信用”嵌入地方治理	以公民为中心的生产力模式

7. 政策、技术和市场建议

7.1 政策与治理：

- 现在采用 DPP 字段（试点 DPP 模式）：按重量组成、批次 ID、收集地点/时间、加工路线、每批验证的碳足迹、耐久性/修复指标 - 与欧盟 DPP 试点模板保持一致，以实现未来的出口。
- 欧洲议会利用绿色采购：市政当局和州机构应致力于采购由经过认证的回收成分制成的社区产品（长凳、花盆、甲板），以创造需求拉动。
- 协调 EPR 试点与在中国采购的主要服装品牌：为收集和分类提供资金并创造承购确定性。

7.2 技术与工业：

- 投资混合分选系统：AI 图像分选 + 高光谱或近红外传感，以改进成分识别（试点级 AI 已经到位;添加光谱分选试点）。工业和初创公司（欧盟/美国）表明，高光谱技术提高了纤维到纤维回收的原料质量。

- 在可能的情况下，在收集点创建单流收集通道（例如，仅涤纶，仅棉）- 提高机械/化学回收原料的价值。
- 与品牌合作伙伴和混合金融一起试点聚酯的化学回收，以降低成本并确保起飞能力。

7.3 市场与金融：

- 确保品牌或市政采购对试点产品的承购承诺，以降低资本支出风险。
- 探索碳信用/碳包容：为居民收集者试点碳积分可转换为服务或小额经济奖励（但要确保透明度并避免重复计算）- 链接到 DPP 足迹报告。

8. “从创造性破坏到创造性重建”的见解

再生纺织品模型在实践中体现了创造性重建 - 将废物、行为和社区结构转化为新生产力的推动者。它不再将废物视为报废负担，而是在数智化、产业共生和公众参与的支持下成为城市更新的原料。这种方法将时尚生态系统从快速消费重建为循环再生，同时创造社会信任、经济机会和可衡量的脱碳。

因此，它不仅为中国零废弃物社区发展提供了可复制的蓝图，而且还为 循环时尚如何成为 1.5°C 转型的支柱提供了全球相关的模型，并通过再生设计、数据驱动治理和包容性循环展示了中国在新质生产力方面的领导地位。

The China Circularity'100 Report (2023-2025)

China Accelerates Circularity Mainstreaming

Executive summary

At COP28 in Dubai, the China Circularity 100 Initiative (CC100) was launched jointly by Institute of Carbon Neutrality and Circular Economy (ICNCE) and Global Climate Academy, as a national and global flagship, together with public and private leaders, China and global, to advocate and support acceleration of circularity and decarbonization in China. Two years on, the transformation is visibly underway.

China is moving decisively to mainstream circular economy principles across manufacturing, consumption, and investment systems - turning circularity from a compliance-driven agenda into a strategic enabler of high-quality productive forces (新质生产力).

While the European Union drives forward through the Eco-design for Sustainable Products Regulation (ESPR), the Digital Product Passport (DPP), and the Carbon Border Adjustment Mechanism (CBAM) - with clear market incentives in sectors such as textiles, batteries, electronics, and chemicals - China is building the systemic infrastructure for circularity: digital traceability, material recovery ecosystems, low-carbon industrial parks, and green financing mechanisms.

China's approach combines: (1) national targets and regulatory design (EPR, circular-economy Five-Year Plan alignment, draft Ecological/environmental Code), (2) heavy capital deployment into recycling and industrial reuse infrastructure (battery recycling, sorting, remanufacturing), and (3) industrial eco-design and standards pushed by major manufacturers and clusters. These shifts both mitigate near-term trade risk from EU climate-trade measures and create export opportunities for lower-carbon, traceable Chinese products.

This Circularity Agenda report synthesizes China's emerging circularity framework, policy, and industrial responses in the global context, and highlights ten flagship corporate cases demonstrating China's leadership in aligning circularity, decarbonization, and new quality productive forces, especially the flagship project of Zero-Waste Fashion and ReTextiles: Turning Waste Fibers into 1.5℃ Zero-Carbon Communities covering the whole life cyle of textile, jointly led by ICNCE, Shanghai ReClotex New Material Co. Ltd., and Global Climate Academy.

From Creative Destruction to Creative Reconfiguration and Reconstruction

In Schumpeterian terms, China's current phase represents not merely creative destruction - the replacement of old industries with new - but a process of creative reconfiguration and reconstruction, where circularity and decarbonization serve as engines of renewal.

- Creative Destruction: resource-intensive growth models become unsustainable under carbon and resource constraints.
- Creative Reconfiguration: digital tools (AI, IoT, blockchain) redefine how materials, products, and data circulate.
- Creative Reconstruction: new circular production ecosystems - based on traceability, reuse, recycling and regeneration - create value and resilience simultaneously.

Circularity mainstreaming thus supports China's strategic shift to high-efficiency, low-carbon, digitally enabled productive systems, the foundation of the New Quality Productive Forces. In China, industries and investors are experiencing the following driving forces:

- External regulatory pressure. The EU's Eco-design for Sustainable Products Regulation (ESPR) / Digital Product Passport agenda and the Carbon Border Adjustment Mechanism (CBAM) have accelerated demand-side rules that reward traceability and low embedded emissions. The DPP agenda makes product-level data mandatory in scope sectors; CBAM imposes carbon-price-linked costs on high-emission imports, pushing exporters to decarbonize processes and document emissions. These two instruments are a major external driver for China's circular policies.
- Domestic climate and resource strategy. China's 14th Five-Year Plan on circular economy targets system building for recycling and higher recycled-material use; ministries have signaled EPR rollouts and targets for recycling and use of secondary raw materials by 2025. Simultaneously, major domestic drafting (an Ecological & Environmental Code and EPR standardization) pushes legal certainty for circular business models.
- Market dynamics and asset scale. Rapid electrification and textile manufacturing scale mean retired products are large flows: retired EV batteries alone are forecast at ~1.0 million tones in 2025 and growing fast - a feedstock opportunity for recycling and mineral recovery. Large industrial buyers and lead firms (CATL, major textile groups) are investing in circular value chains, creating industrial anchors for secondary-material markets.

Policy and regulatory progress in China

Demonstrable progress:

- Battery-recycling capacity scaled rapidly - China dominates global capacity. Recent industry analyses show China accounting for the large majority of global Li-ion battery pre-treatment and black-mass refining capacity (estimates in 2025 place China at ~70–89% of global capacity and planned processing of multiple million tons of scrap batteries by 2025). This is a material structural achievement for circular raw-material security.
- 14th FYP targets and policy architecture in place - national roadmap to 2025 delivered. China's 14th Five-Year Circular Economy Plan and related NDRC/MIIT policy work set quantified targets for resource productivity, recycling system construction and eco-design; the IEA policy tracker documents the Plan's objective to build a resource-recycling industrial system by 2025.
- Large public projects and infrastructure delivery advanced. The NDRC and related central reporting indicate accelerated delivery of major 14th-FYP projects and trillion-RMB bond-funded infrastructure programs that include green and circular projects (reporting on 2024-25 project mobilization and completion progress).
- Standards, pilots and finance instruments expanded. China has issued dozens of new standards and expanded EPR / pilot zones (circular demonstration zones, national pilots) and adjusted green-finance guidance to include circular indicators - enabling pipelines for circular infrastructure (packaging, WEEE, batteries). This is reflected in sectoral policy trackers and 14th Five Year Plan against Plastic Pollution to 2025.
- Macro resilience: economy and scale enable circular investment despite headwinds. Central statistics and planners report that the 14th FYP period delivered strong absolute GDP growth and sustained industrial scale, enabling the real economy capacity to invest in circular infrastructure even as investment patterns shifted.

Dimension	Key Development	Implications
National Strategy	*Circular Economy Promotion Law* revision (2024) integrates product lifecycle carbon management and DPP-compatible traceability.	Enables unified digital standards aligned with EU and ASEAN trade partners.
Industrial Policy	*MIIT Green Manufacturing 2.0* and *NDRC Circular Economy Demonstration Zones* expansion to 75 cities.	Drives industrial symbiosis and material recylcing hubs.

Standardization	Over 80 new GB/T standards on resource efficiency, product recyclability, and digital traceability.	Facilitates DPP interoperability and CBAM data readiness.
Digital Infrastructure	National Circularity Data Platform (jointly by NDRC, MIIT, MEE, SASAC) piloting DPP-compatible QR codes in 8 sectors, battery DPP was the first	Foundation for cross-border data verification and carbon traceability.
Financial Instruments	Green bond guidelines updated by PBoC include circularity indicators; CIB and ICBC launched "Circular Supply Chain Finance" pilots.	Links capital access to material efficiency and reuse outcomes.
Trade & CBAM Response	New export rebate mechanisms for recycled-content products; circular materials recognized under dual-carbon trade adjustment.	

- EPR and policy targets: China's roadmap commits to completing laws/regulations for EPR across key areas by 2025 with targets such as ~50% recycling rates for priority wastes and a 20% use-rate of recycled raw materials in key products by 2025 in pilot sectors. Provincial and municipal EPR pilots (electronics, batteries, packaging, textiles) are expanding.
- National legal consolidation: A draft ecological and environmental code explicitly calls out circular economy standards, green design, and expanded EPR for electronics and batteries - signaling legislative mainstreaming and stronger compliance expectations for firms.
- EU-China circular cooperation: Formal dialogues and an EU-China Roadmap on Circular Economy (launched 2024) identify plastics, batteries and remanufacturing as joint priorities - opening institutional channels for technical exchange and standards alignment.

Investment and industrial scale-up

- Battery recycling - scale and corporate moves. Major Chinese battery firms are rapidly expanding recycling capacity. Public reporting and industry sources indicate multi-billion-RMB investments (e.g., CATL announced large capacity expansion and sizeable facility investments to scale closed-loop recycling). Forecasts show retired power battery tonnages rising steeply (~1.04 Mt in 2025; multi-Mt by 2030), which requires rapid creation of disassembly, hydrometallurgical and refining capacity. These investments position China to capture value from end-of-life batteries and reduce reliance on primary imports for key battery metals.
- Textiles and fiber recycling. Global and domestic investments into textile-to-textile recycling have gained traction (private capital into scalable chemical/solute recycling technologies and pilot plants). China is initiating waste-textile collection pilots and industrial chain tests; market estimates show the domestic textile recycling market producing hundreds of millions USD of revenue and projected mid-single-digit CAGR through 2030.

- Electronics / e-waste infrastructure. Accelerated local EPR pilots and facility upgrades for formal WEEE (waste electrical and electronic equipment) collection and treatment have been reported, aligning with draft EPR and eco-design standards. (See policy trackers and provincial announcements in 2024–2025.)

Sector snapshots - where circularity is moving fastest

Batteries (EV and industrial)

- Why priority: volume, material value (Li, Ni, Co, Mn), and EU regulations of ELV, CRM, and Battery Passport.
- What's happening: lead firms and logistics partners building closed-loop collection + hydrometallurgy; pilots for battery swapping networks that centralize used-battery collection (helpful for traceability and reuse). Investment announcements indicate large scale build-outs.

Textiles and fashion

- Why priority: high EU regulatory focus (DPP), global brand pressure, large waste volumes.
- What's happening: pilot textile-to-textile chemical recycling ventures and scaling investments, strengthened domestic waste-textile collection pilots, and brands accelerating recycled content targets. The EU's upcoming DPPs for textiles heighten compliance urgency for EU market.

Electronics and electricals

- Why priority: complexity of material flows, EPR feasibility, high embedded-value components.
- What's happening: EPR pilots for electronics, push for eco-design and repairability standards; greater investment in formal WEEE processing and component remanufacturing.

Chemicals and fertilizers

- Why priority: EU REACH and green claim for certain chemical products and fertilizer feedstocks; industrial symbiosis potential.
- What's happening: industry de-carbonization pilots, co-processing of industrial waste streams, and initial moves to document embedded emissions for export batches.

Ten Good Practice Cases of Chinese Companies:

#	Company	Sector	Circular Innovation
1	BYD	EVs & Batteries	Closed-loop lithium and rare metal recovery; DPP-aligned traceability pilot.
2	CATL	Battery Materials	AI-based lifecycle tracking, modular battery reuse in energy storage.

3	Li-Ning	Textiles & Fashion	Full garment supply chain transparency .
4	Huawei	Electronics	Circular design standard + reverse logistics for reconditioning.
5	Haier	Appliances	Smart DPP for home appliances; parts remanufacturing ecosystem.
6	China Baowu Steel	Metals	Hydrogen-based DRI, scrap recovery system, and carbon tracking.
7	China National Chemical (ChemChina)	Fertilizers & Chemicals	Circular biofertilizer from waste streams; digital nutrient passports.
8	LONGi Green Energy	Solar PV	Silicon recycling and remanufacturing plant in Xi'an.
9	Lenovo	Electronics	Product DPP + blockchain carbon verification.
10	Tetra Pak China	Packaging	Fiber recovery + renewable polymer sourcing via circular ecosystem.

DPP Alignment and Gaps Table:

Company	DPP Coverage Fields	Remaining Gaps
BYD	Material composition, carbon footprint, recyclability	Product-level social data disclosure
CATL	Lifecycle tracking, carbon data, repairability	Third-party interoperability
Li-Ning	Material origin, recyclability, end-of-life tracking	Product durability metrics
Huawei	Reuse rate, repair history, recyclability	Consumer data transparency
Haier	Component traceability, maintenance logs	Secondary market reporting
Baowu	Material & carbon data	Scope 3 supplier integration
ChemChina	Resource efficiency, circular material passport	EU chemical taxonomy mapping
LONGi	Material traceability, process carbon data	Circular performance verification
Lenovo	Carbon & resource data blockchain	End-of-life feedback loop
Tetra Pak	Material composition, recyclability, sourcing	Data exchange with EU DPP schema

EU rules (DPP and CBAM): specific impacts for Chinese industry

- Digital Product Passports (DPPs). DPPs require structured, product-level data (materials, repairability, recycled content, supply-chain emissions) for regulated categories. Firms exporting to the EU will need IT systems, supplier traceability, and validated LCA/embodied-emissions reporting to maintain market access. This is especially urgent for textiles, batteries, electronics, and construction materials.
- CBAM evolution & practical implications. CBAM's phased implementation and recent EU adjustments (exemptions for very small importers; schedule shifts) reduce administrative burden for the smallest traders but keep substantive carbon pricing exposure for the largest exporters and the most carbon-intensive product groups (steel, cement, aluminum, fertilizers). Chinese exporters of these goods face either additional costs or the need to prove lower embedded emissions (which encourages low-carbon inputs and circular feedstocks). Recent reporting indicates EU legislative refinements but persistent core requirements.

Despite progress, trade tensions and cost pressures pose challenges:

- CBAM tariffs and potential U.S./EU technology restrictions have raised export costs by 7-15% for carbon-intensive manufacturers.
- Aluminum, lithium, and fertilizer sectors face price volatility and supply chain fragmentation.
- Investment in manufacturing declined 2.4% in H1 2025, though circular infrastructure investment grew 9.1%.
- Companies adopting DPP-compatible circular models outperform peers in export resilience and financing access.

Trade tensions, tariffs, investment volatility and disruption risks:

- Trade and geopolitical frictions raise uncertainty. Tariffs and export controls (select technologies / materials) have caused some investment re-direction and lead firms to diversify supply chains. At the same time, EU rules (DPP, CBAM) create non-tariff compliance costs that act like a sectoral barrier for firms unable to document compliance.
- Investment slowdowns vs targeted capital concentration. While broad foreign-investment flows slowed in some manufacturing segments (global cyclical factors + geopolitical uncertainty), strategic capital is concentrating on circular-infrastructure - e.g., battery recycling, sorting & scaling textile recycling - as policy clarity (EPR, draft code) reduces project risk. This pattern

suggests a reallocation rather than wholesale capital withdrawal. (See policy & investment trend reports.)

Opportunities for China and Chinese firms

- First-mover scale advantage in secondary raw-materials. Large domestic battery and e-waste flows enable economies of scale in hydrometallurgy and refining of critical minerals, reducing dependence on imported primary feedstocks.
- Export differentiation via compliance & low-carbon branding. Firms that implement DPP-grade traceability and lower embedded emissions stand to retain and expand EU market share.
- New domestic circular markets. Textile fiber-to-fiber recycling, industrial symbiosis between manufacturers and recyclers, and remanufacturing can create higher-value domestic jobs and reduce raw-material spending.

Circularity and China's New Quality Productive Forces:

The New Quality Productive Forces (新质生产力) emphasize innovation, digitalization, greenness, and efficiency. DPP and circularity are integral to this national strategy:

Circularity Lever	Productivity Mechanism
Digital Product Passports	Embed lifecycle data into production and trade, improving efficiency and transparency.
Resource Circulation Platforms	Enable industrial symbiosis and supply chain optimization.
Green Manufacturing Standards	Stimulate innovation and high-value product differentiation.
Circular Finance	Channel capital toward low-carbon innovation ecosystems.

Risks, Gaps and constraints

- Data and verification gap. DPPs and CBAM require high-quality emissions and materials data across tiered suppliers - a capability many SMEs lack. Weak verification systems risk fines, market loss or reputational damage.
- Price and investment volatility. If export volumes decline or tariffs rise, circular investments with long payback periods may be de-prioritized by private capital - unless supported by public finance or blended instruments.
- Standards misalignment and market fragmentation. Divergent EU and Chinese technical standards for DPP metadata or life-cycle accounting can create dual-compliance costs. Institutional cooperation (EU-China circular roadmap) is a partial mitigation but not a full solution.

Key gaps and constraints in delivering the 14th FYP:

- Product-level carbon and DPP data still incomplete. While many lead firms publish facility or corporate carbon data, product-level LCA emissions and standardized DPP metadata remain uneven. Most SMEs lack verified product-level footprints compatible with EU DPP / CBAM requirements - a pervasive implementation gap. (Policy trackers and corporate reporting reviews show facility-level coverage outstrips SKU-level disclosure).
- Digital interoperability and verification shortfall. Several pilot DPP systems and national platforms exist, but interoperability with EU schemas (GS1/EPCIS or ESPR DPP formats) and robust third-party verification markets are still maturing. Without harmonized interfaces, exporters face duplication and compliance friction.
- Uneven sectoral progress: textiles & chemicals lag behind batteries. Batteries and e-waste show the fastest industrial progress due to resource value and clear commercial incentive; textiles, construction materials and many chemicals lag in industrialized, high-quality collection, mechanical/chemical recycling scale, and product LCA coverage. Evidence from sector analyses and industry reporting confirms this divergence.
- Investment volatility and consolidation: some projects cancelled or delayed. Industry reporting documents consolidation and project cancellations in battery manufacturing and adjacent sectors (post-boom consolidation), which creates regional overcapacity risk and may strand certain circular investments if demand projections soften. This risks slowing new plant commissioning and private financing appetite for smaller recyclers.
- SME capability & supply-chain data weakness. The majority of Chinese manufacturing SMEs do not yet have in-house LCA or product-data management systems; onboarding thousands of SMEs onto DPP platforms is a heavy task requiring public-private capacity building. National pilot scope suggests government awareness but the scale of capability building needed remains large.

Strategic recommendations for industry, government and finance

For central and provincial government:

- Fast-track interoperable DPP frameworks for Chinese exporters. Publish national technical guidance and an interoperable data schema aligned with EU ESPR/DPP to reduce duplication and help firms meet EU requirements. (Use the EU-China Roadmap for negotiation leverage.)
- Scale public finance and blended capital for circular infrastructure. Target concessional finance for battery recycling, textile sorting/recycling hubs, and formal WEEE facilities to de-risk private investment and absorb stranded assets.

- SME support and capacity building. Fund supplier-level emissions accounting pilots and shared digital-tracing platforms so SMEs can feed DPP data upstream.

For industry (lead firms and clusters)

- Invest in product-level traceability now. Implement DPP-grade IT and supplier data-onboarding; pilot verifiable LCA workflows for top SKUs destined for the EU.
- Lock in circular feedstocks. Sign long-term offtake and recycling agreements to secure recycled content (batteries, plastics, fibers) at predictable prices.

For financiers and MDBs

- Design blended instruments that target circular capex. Use partial-guarantees, first-loss capital, and concessional rates for large-scale recycling plants (battery hydrometallurgy, chemical textile recycling).
- Support standards and verification capacity. Fund independent verification labs and pilot certification to reduce counterparty and data risk.

Global Implications and Cooperation Outlook

China’s progress toward DPP and circularity alignment positions it as a bridge between regional frameworks:

- EU-China: Mutual DPP data alignment can reduce CBAM trade frictions.
- ASEAN-China: Joint circular hubs in RCEP economies promote cross-border material flow.
- Africa-China: Infrastructure co-development through the Belt and Road Circularity Facility supports sustainable industrialization.

Integrating New Productive Forces into China's Circular Economy Vision

- **Harnessing Technology and Innovation for Circularity:** The CCP Plenary's focus on "new productive forces" underscores the importance of technological innovation as a driver for economic growth. In the context of circular economy, this will likely manifest through the deployment of cutting-edge technologies such as AI, big data, IoT, and blockchain, which are critical for driving resource efficiency and enabling the closed-loop systems required for circular models. **Digital Product Passports (DPPs)** and blockchain-based traceability tools will play a pivotal role in

enhancing supply chain transparency and ensuring that products and materials are continuously reused, repaired, and recycled.

- **Advancing Green Energy and Resource Efficiency:** As part of the new productive forces, China will place greater emphasis on transitioning its energy infrastructure to renewable sources, such as wind, solar, and hydrogen. This shift is essential for decarbonizing industries and creating a more sustainable and circular industrial economy. Circular practices will be embedded in the green energy transition, with energy-intensive industries being encouraged to optimize energy use and minimize waste. For instance, the circular integration of renewable energy with energy storage systems and smart grids will enhance energy efficiency and foster the creation of decentralized, resilient energy ecosystems.
- **Innovation in Manufacturing and Industrial Processes:** The manufacturing sector will be one of the primary beneficiaries of the "new productive forces" concept. In the coming years, advanced manufacturing techniques such as **3D printing**, **robotics**, and **digital twins** will revolutionize production processes, making them more adaptable, resource-efficient, and aligned with circular economy principles. These innovations will reduce waste in production, minimize energy consumption, and extend product lifecycles. Industries such as automotive, electronics, and textiles are expected to lead this transition, integrating sustainable design principles and modular production to facilitate recycling and reuse.
- **Empowering the Circular Economy through Digitalization:** China's embrace of digitalization as part of its new productive forces will significantly enhance the efficiency and scalability of circular economy systems. With the use of AI and big data, industries will be able to better forecast resource needs, optimize material flows, and reduce waste. Additionally, the rise of **smart cities** and **digital platforms** for resource sharing, waste management, and product lifecycle tracking will support the creation of circular ecosystems in urban and industrial contexts. This digital infrastructure will not only improve operational efficiencies but also unlock new economic models based on circular principles.
- **Strengthening the Role of Green Finance:** New productive forces also include the development of innovative financial instruments that enable the scaling of circular economy projects. Green finance, which has been a major focus in China's recent policy initiatives, will evolve to support circular projects through mechanisms like **green bonds**, **ESG-linked loans**, and **sustainability-linked investments**. These financial tools will be critical in driving capital towards circular projects, enabling businesses to transition to resource-efficient models while ensuring long-term profitability. The government's active role in shaping green finance policies will further integrate circular economy principles into the broader economic system.

- **Human Capital Development for Circularity:** The new productive forces will also require the development of a highly skilled workforce capable of managing and driving the circular transition. Over the next five years, there will be increased emphasis on reskilling and upskilling workers in areas related to **sustainable design**, **resource recovery**, **green manufacturing**, and **digital innovation**. This human capital investment will be crucial to ensuring that industries are equipped with the knowledge and tools necessary to fully integrate circular economy principles into their operations.
- **Synergies Between Circularity and the Digital Economy:** The intersection of circular economy with the **digital economy** represents a transformative shift in how resources are managed and used. As China continues to foster the growth of its digital economy, it will promote models that integrate both circular and digital principles. This includes the widespread adoption of **circular digital business models**, such as **platform economies**, **product-as-a-service**, and **sharing economies**, which facilitate the extended use of products and reduce the need for resource-intensive production.

These points reflect the Plenary's recognition of new productive forces as a key element in driving China's economic transformation, including its shift toward a circular economy. As part of the **China Circularity 100** initiative, these forces will be instrumental in developing an ecosystem that blends innovation, sustainability, and economic growth in ways that are aligned with both domestic policy goals and global sustainability standards.

Aligning Circular Economy with the Priorities of China's 15th Five-Year Plan (2026-2030)

The **15th Five-Year Plan** will build upon the achievements of the **14th Five-Year Plan**, while accelerating efforts to integrate the circular economy into the fabric of China's industrial and economic future. The emphasis on new productive forces, technological innovation, and green transformation will shape the priorities of the plan, setting the stage for deeper integration of circular economy principles across all sectors of the economy.

1. Priority: Accelerating the Green and Circular Transformation of Key Industries

In alignment with the CCP's broader vision, the 15th Five-Year Plan will prioritize green industrialization and resource efficiency. This will include the promotion of circular industrial parks, green manufacturing hubs, and the use of advanced technologies to drive waste reduction, recycling, and resource recovery. Key industries such as automotive, electronics, construction, and textiles will be encouraged to adopt circular production models, significantly reducing carbon footprints and ensuring sustainable use of materials.

- Circular supply chains will become a strategic focus, with policies encouraging the recycling and reuse of materials within and across industries.
- Expansion of digital tools like AI, IoT, and blockchain to optimize material flows, enhance recycling, and enable closed-loop systems will become essential.

2. Priority: Digital Economy as an Enabler of Circular Economy

The 15th Five-Year Plan underscores the importance of digital transformation as a cornerstone for future growth. As part of this, the circular economy will increasingly rely on digital innovation to optimize resource use and reduce waste. China's focus on the digital economy will empower circularity by integrating smart infrastructure, platform-based models, and AI-driven circular business models.

- Development of smart cities that leverage circular principles through digital waste management systems, resource-sharing platforms, and eco-design tools.
- Expansion of digital product passports (DPPs) and AI-based recycling systems, enabling traceability and reducing inefficiencies in material recovery and reuse.

3. Priority: Green Finance to Support Circular Economy Transition

The 15th Five-Year Plan will continue to prioritize green finance, creating a robust financial ecosystem to support circular economy initiatives. As the global demand for sustainable investment grows, China will lead efforts to scale up green bonds, sustainable finance mechanisms, and impact investing targeted at circular projects.

- Incentives for financial institutions to adopt green and circular finance models, including ESG-linked loans and sustainability-linked financing.
- Development of new financial products that directly support resource efficiency and closed-loop economies within sectors like agriculture, manufacturing, and urban development.

4. Priority: Technological Innovation to Drive Circularity

Under the 15th Five-Year Plan, technological innovation will be at the forefront of China's strategy for achieving a sustainable, circular economy. A key priority will be the integration of emerging technologies such as AI, big data, IoT, and blockchain into the circular economy ecosystem.

- Accelerating the development and implementation of advanced recycling technologies, including biodegradable materials, closed-loop water systems, and energy recovery technologies.
- Supporting the growth of green tech startups focused on developing circular solutions for manufacturing, urban systems, and industrial waste.

5. Priority: Policy Integration and Regional Coordination

The 15th Five-Year Plan will call for greater policy integration to create a coherent national framework that supports the circular economy. Regional policies will need to align with national goals, ensuring that local governments adopt circular economy strategies tailored to regional strengths and challenges.

- Implementation of national standards for **circular economy practices**, with regional adaptation for different sectors, regions, and industries.
- Strengthening of **cross-sectoral coordination**, ensuring that industries, financial sectors, and local governments are aligned in their circularity goals and policies.

6. Priority: Strengthening the Role of Education and Public Awareness

A key element of the 15th Five-Year Plan will be the expansion of education and public awareness initiatives aimed at promoting circular behavior and sustainable lifestyles. Through green

education and public campaigns, China will encourage citizens, businesses, and local governments to adopt circular principles in everyday life.

- Development of **green skills** and **circular economy literacy** at all levels of education to create a workforce capable of managing and scaling circular systems.
- Public awareness campaigns to increase participation in recycling programs, sustainable consumption, and product-as-a-service models.

Impact on the China Circularity 100 (CC100) Initiative

In light of these priorities, the **China Circularity 100 (CC100) Initiative** will play an integral role in driving forward the objectives of the **15th Five-Year Plan**. Over the next five years, the initiative will focus on:

- Expanding the **CC100 framework** to incorporate digital solutions, green finance, and new technologies that align with the priorities set in the 15th Five-Year Plan.
- Partnering with industry leaders, regulators, and financial institutions to create a **national ecosystem for circular innovation**, fostering collaboration across sectors to ensure the success of China's circular economy transition.

The focus on **new productive forces**, especially through technological innovation and green finance, will be central to scaling the CC100 initiative, ensuring that circular economy practices are embedded deeply in China's economic future.

Closing: The China Circularity'100 Vision

China's circular transition is no longer only a sustainability narrative; it is becoming an industrial strategy anchored by policy alignment, heavy industrial investment (notably in batteries), and the practical need to meet EU market rules. That creates a strategic window: firms and financiers that rapidly adopt DPP-capable traceability, lock circular feedstocks, and scale domestic recycling infrastructure will convert regulatory pressure into competitive advantage. Conversely, delays in data capability, verification, and standards alignment will generate market access friction and stranded export value.

The China Circularity'100 narrative: policy + industry implications

- Progress validates the "reconstruction" thesis. The strong scaling in strategic sectors (notably batteries) shows reconfiguration is happening: assets are being repurposed to process secondary flows. This is the kind of systemic reconstruction the Regenerative Agenda advocates: turning industrial scale into circular advantage.
- DPP is the operational linchpin - but implementation must be accelerated. The central gap is product-level, verifiable digital data. Completing DPP interoperability, building independent verification capacity, and SME onboarding are immediate priorities to convert policy into trade-safe advantage and to reduce CBAM exposure.
- Targeted public finance and de-risking instruments are still needed. Consolidation and investment volatility mean public and MDB blended finance should prioritize: (a) large recycling hubs where scale economies are critical, (b) digital DPP platform buildouts, and (c) SME LCA / traceability capacity grants. This is consistent with how China has financed major 14th FYP projects.
- Sector sequencing matters. Batteries and electronics can be leveraged as anchor sectors to develop standards, verification practices, and logistics that can be adapted for textiles, packaging, and chemicals - accelerating nationwide DPP readiness more cost-effectively.

The China Circularity'100 Initiative **represents**

China's new generation of "Recycling, Responsible, and Resilient" industries leading the circular transition. Our shared DNA:

- Recycling → turning waste into value
- Responsible → data-driven transparency through DPP
- Resilient → adaptive competitiveness under decarbonization and trade pressures

China’s circular transformation is thus not only about closing loops - but opening new pathways for value creation, system innovation, and global leadership.

The China Circularity’100 Initiative report concludes: act now at scale, align standards, and mobilize blended capital - that is the practical path to turn circularity into mainstream economic advantage for China.

Zero-Waste Fashion and ReTextiles: Turning Waste Fibers into 1.5°C Zero-Carbon Communities

A China Circularity'100 Initiative Flagship Project

1. Context and Strategic Significance

- Global scale: roughly **92 million tons** of textile waste are generated each year (growth driven by rising production and decreasing garment lifetimes).
- China scale: China's annual waste-textile generation is in the range of **22–23 million tons (2022–2023)**, with utilization (re-use/recycling) at only a few million tons annually and large potential to scale.
- Recycling intensity gap: published surveys and reviews place global textile recycling/useback rates between **1% (textile-to-textile recycling) and 25% (broader reuse/recycling)** depending on definition; China's comprehensive utilization rate has been estimated around **20–25%**, while some leading European systems report much higher recovery for reuse/recycling (Germany commonly cited 75% collection/recovery for reusable textiles depending on metric).
- Policy momentum: the European Commission's **EU Strategy for Sustainable and Circular Textiles (March 2022)** establishes design requirements, stronger reuse/recycling targets, and a push for Digital Product Passports (DPPs). China's 14th Five-Year and subsequent policy packages (circular economy provisions, municipal pilot programs) similarly emphasize collection, industrial utilization, and standards — creating a policy window for scaling pilots.

The textile and apparel value chain represents one of China's largest and most complex circular economy systems, with significant energy use, carbon intensity, and recycling challenges. In 2022, China generated approximately **22 million tons of waste textiles**, with around 70% originating from household clothing disposal. The comprehensive recycling rate remains only **20-25%**, well below that of Europe (Germany ≈

75%). Meanwhile, global fiber production exceeds **92 million tons annually**, with polyester and synthetic fibers accounting for nearly 60%, constituting a key node of energy and carbon intensity.

Under the "Dual Carbon" (carbon peaking and neutrality) framework and the **14th Five-Year Plan for Circular Economy Development**, China's textile sector is shifting from incremental emission reduction to **systemic circular reconstruction**. The case of *"Waste Textile Regeneration Empowering 1.5°C Zer-Carbon Communities"* exemplifies how community-level innovation, digital integration, and regenerative design can translate circularity into tangible urban sustainability outcomes.

2. Case Overview: Waste Textile Recycled Empowering 1.5°C Zero-Carbon Communities

Lead organizations: Institute of Carbon Neutrality and Circular Economy; Shanghai ReClotex New Materials Co., Ltd, and Global Climate Academy Pilot cities: Shanghai, Suzhou, Tianjin Project timeline: 2022-2030 (three-stage model)

The project builds an integrated community-based circular system centered on textile waste, combining intelligent collection, material innovation, zero-carbon spatial design, and digital traceability. It provides a scalable blueprint for transforming waste streams into low-carbon assets.

Smart Collection Infrastructure

- 6,000 intelligent recycling bins deployed across 4,000 communities, serving 4.6 million residents;
- Each unit includes automatic weighing, AI image recognition, and anomaly alerts;
- The "Old Clothes Parcel" mini-app enables photo-based weight estimation using AI and provides real-time tracking and monetary incentives for residents;
- Data integration with municipal solid waste systems ensures transparency and policy feedback.

Why this matters: collection density and sort yield determine the economics of recycling (transport, sorting cost per kg) and the quality of feedstock for high-value reuse or fiber-to-fiber recycling. Recent EU research highlights that increasing textile-to-textile recycling even modestly delivers measurable CO_2 and water savings — but the benefits are fiber- and process-specific.

Material Innovation: From Waste Textiles to Fiber-Plastic Composites

- Combining recycled polyester with polypropylene matrices achieves 60–70% fiber content;

- Mechanical performance: flexural strength 35 MPa, weather resistance for 10+ years;
- Applications include benches, planters, and decking—12 product categories deployed in communities;
- In 2023 alone, 5,000 tons of waste textiles were converted, reducing CO_2 emissions by 12,000 tons and saving ~4,000 m^3 of wood.

CO_2 savings - realistic framing: literature shows a wide range (low single-digit tCO_2e per ton for some cotton/wool mechanical recycling examples to several tons for avoided virgin polyester production), therefore present results as **fiber- and process-specific ranges** and avoid single point estimates. Use pilot data to calculate avoided emissions using transparent LCA assumptions.

Zero-Carbon Pavilions: A Spatial Revolution

- Constructed from 100% recycled materials, cutting embodied carbon by 85%;
- Equipped with photovoltaic systems (90% energy self-sufficiency) and rainwater harvesting (40% water savings);
- Integrates recycling hub, low-carbon education center, and community activity space—tripling space utilization efficiency.

Digital Empowerment and Risk Management

- Data seamlessly flows into the city's solid waste management platform;
- "RiskGo" model ensures 98% fraud detection and operational transparency;
- AI-based analytics support carbon quantification, behavioral insights, and credit-linked citizen participation;
- Establishes a three-tier governance model connecting citizens, enterprises, and regulators.

Next steps to align with EU DPP practice: adopt fields required by EU DPP pilots for textiles (material breakdown by weight, durability indicators, repairability, recycling pathway, carbon footprint per item/batch) so products and recycled outputs can be traceable into European value chains where DPPs and compliance expectations are tightening.

3. Quantified Outcomes and Industry Impact

- **Carbon Reduction:** In Suzhou alone (2022), 862.55 tons of textiles were recycled, avoiding 4,528 tons CO_2;

- **Standardization:** The project led the drafting of the *Community Application Technical Specification for Recycled Fiber-Plastic Composites*, filling a key national gap;
- **Industrial Collaboration:** Facilitated strategic partnerships among 23 textile enterprises and recyclers, creating a closed-loop "collection–production–certification" value chain;
- **Digital Innovation:** The "Banjou AI Weight Estimation" model was selected by the Ministry of Industry and Information Technology as a national digital transformation case.

4. Strategic Scaling: Three-Tier City Penetration and Carbon Inclusion Model

The project adopts a **"Three-Tier Urban Penetration Model"** for expansion:

- Phase I (2022-2024): Validation in Tier-1 cities (Shanghai, Beijing, Guangzhou, Shenzhen) to prove business feasibility;
- Phase II (2025-2027): Expansion to Tier-2 cities, optimizing cost structure and policy alignment;
- Phase III (2028-2030): Rollout to counties and rural regions, developing differentiated collection models.

Vertically, the initiative will integrate personal carbon reduction data into **carbon inclusion markets**, linking behavior to carbon credit rewards. Horizontally, the model will extend to **plastics, e-waste, and packaging**, establishing multi-stream community circular networks aligned with the forthcoming national "Dual Carbon" policy package (2025).

5. EU-China comparative analysis: policy, infrastructure, tech and market

Comparative summary (key metrics & policy instruments)

Dimension	China (pilot context)	EU (representative practice)	Implication for pilot scaling
Annual textile waste (national)	**~22–23 Mt** (China 2022–23 estimates)	EU aggregated waste: per-capita generation ~15 kg/yr (EU aggregate) — global total ~92 Mt/yr.	China's absolute scale presents opportunity for large domestic industrial loops, but needs upstream sorting & standards.
Recovery/ reuse rate	~20–25% (China national utilization estimate; household capture <15%).	Germany and some northern European systems report high	China needs denser local collection networks +

		collection/recovery (often >50–75% in some metrics), supported by mixed municipal and charity networks.	incentives to match EU capture.
Policy instruments	Municipal pilots, quotas, green procurement, industry standards under 14th Five.	EU: **Design requirements**, EPR proposals, DPP (textiles prioritized in 2022 Strategy), reuse>recycling hierarchy.	Pilot should prepare for trade/market access benefits if DPP+design compliance are embedded.
DPP & traceability	Existing QR/AI parcel proofing; ready for batch DPP fields	EU DPP studies & pilots define material, durability, repairability and recycling pathway fields.	Expand pilot's data model to include DPP fields to enable exports/supply to EU sustainable procurement channels.
Technology focus	Fiber-plastic composites (down-cycling) + mechanical recycling pilots	Rapid investment in chemical recycling, industrial mechanical sorting, and policy incentives for textile-to-textile recycling.	Continue product use for community assets while piloting fiber-to-fiber routes and test chemical recycling partnerships for polyester.
Financing & markets	Growing local markets for recycled composites; industrial integration building via 23 firm agreements (pilot forum).	Brand commitments, factory investments and blended finance (EU/industry) to build large scale chemical recycling plants.	Combine public pilot finance with brand offtake commitments (demand pull) to de-risk recycling CAPEX.

(Sources: China national recycling/usage estimates; EU Strategy COM(2022); EPRS DPP study; industry reports and academic LCA reviews.)

Narrative takeaways: EU vs China

- **Policy design vs implementation gap:** EU policy now focuses on product rules (design for durability & recyclability), DPPs and EPR - structures that push producers to manage end-of-life. China's policy emphasis has been on **collection system buildout, industrial utilization and**

standards, which creates a complementary but different pathway. Pilot programs that combine China's collection strengths with EU-style product rules can create exportable, high-quality recycled outputs.

- **Upstream design matters:** Europe's emphasis on preventing overproduction and improving design will reduce future sorting burden. China's scale advantage can nonetheless deliver large feedstock volumes quickly - but quality and composition control (mono-fiber streams, separation of blends) will determine whether high-value textile-to-textile recycling becomes viable.
- **DPP and market access:** As the EU operationalizes DPP and linked compliance, recycled or remanufactured textile outputs that carry robust digital passports (composition, carbon, processing history) will gain access to premium procurement channels and export markets - a strategic reason for the pilot to adopt DPP fields early.
- **Technology pathway mix:** Europe is mobilizing both mechanical and chemical recycling (and large brand investments to scale chemical recycling capacity). China pilots should continue fiber-plastic composites for near-term circular demand while piloting fiber-to-fiber and chemical routes with industry partners to capture higher avoided emissions per ton over the medium term.

6. DPP (Digital Product Passport) Alignment and "New Quality Productive Forces" Fit

Dimension	DPP Fields Already Covered	Remaining Gaps / Next Steps	Alignment with New Quality Productive Forces	Dimension
Product Identification & Traceability	AI-based parcel recognition and QR-coded packaging	Introduce batch-level carbon footprint tracking for recycled material flows	Intelligent circular manufacturing	Product Identification & Traceability
Lifecycle Data	Integrated collection–recycling–production chain	Add transport and remanufacturing energy metrics	Full life-cycle carbon management	Lifecycle Data
Material Composition & Safety	Standardized fiber-plastic formulations	Build a national database of recycled material properties	Materials science innovation	Material Composition & Safety
Environmental Performance & Carbon Labeling	Quantified CO_2 reduction per ton recycled	Introduce verified carbon labeling for recycled products	Green market mechanism development	Environmental Performance & Carbon Labeling

Social Participation & Credit Linkage	Incentive-based collection and carbon points system	Embed “carbon inclusion + community credit” in local governance	Citizen-centered productivity model	Social Participation & Credit Linkage

7. Policy, technical and market recommendations

Policy & governance:

- Adopt DPP fields now (pilot DPP schema): composition by weight, batch ID, collection location/time, processing route, verified carbon footprint per batch, durability/repair indicators - align with EU DPP pilot templates to enable future exports. European Parliament
- Leverage green procurement: municipalities and state agencies should commit to procuring community products (benches, planters, decking) made with certified recycled content to create demand-pull.
- Coordinate EPR pilots with major apparel brands sourcing in China - to finance collection & sorting and create offtake certainty.

Technical & industrial:

- Invest in hybrid sorting systems: AI image sorting + hyperspectral or near-infrared sensing to improve composition identification (pilot-level AI already in place; add spectral sorting pilots). Industry and startups (EU/US) show hyperspectral tech improves feedstock quality for fiber-to-fiber recycling. Vogue Business.
- Create mono-stream collection lanes (e.g., polyester only, cotton only) at pick-up points where possible - improves value of feedstock for mechanical/chemical recycling.
- Pilot chemical recycling for polyester with brand partners and blended finance to reduce cost & secure take-off capacity. Financial Times.

Market & finance:

- Secure offtake commitments from brands or municipal procurement for pilot products to de-risk CAPEX.
- Explore carbon crediting / carbon-inclusion: pilot carbon points for resident collectors convertible into services or small financial rewards (but ensure transparency and avoid double counting) - link to DPP footprint reporting.

8. Insights for “From Creative Destruction to Creative Reconstruction”

The regenerative textile model exemplifies **creative reconstruction** in practice - transforming waste, behavior, and community structures into enablers of new productivity. Rather than framing waste as an end-of-life burden, it becomes the **feedstock of urban regeneration**, supported by digital intelligence, industrial symbiosis, and public participation. This approach rebuilds the fashion ecosystem from **fast consumption to circular regeneration**, while simultaneously creating social trust, economic opportunity, and measurable decarbonization.

As such, it provides not only a replicable blueprint for **China’s zero-waste community development**, but also a **globally relevant model** of how circular fashion can serve as a pillar of the 1.5°C transition and a demonstration of China’s leadership in **New Quality Productive Forces** through regenerative design, data-driven governance, and inclusive circularity.

关于报告机构

青合循环经济与碳中和研究院（ICNCE）致力于成为循环经济领域的智库机构。

研究院主要业务聚焦在与产品回收和再生应用相关产业和产品，运用循环经济模式开展商业模式的创新，对标欧盟、美国法规政策，推动再生行业的产业化和规模化，特别是与塑料材料相关的应用行业，包括循环纺织、物流包装、电子电器、汽车和新能源，以及无废社区等。

研究院设立科学与战略委员会，由知名学者专家组成，为研究院发展提供战略指导，还拥有循环经济领域多家国内先锋企业，品牌企业和上市公司。研究院拥有循环经济、塑料再生和产品、设备制造、建筑规划、环境保护、碳核查和交易、绿色金融等方面的机构和国际国内专家资源和合作伙伴，为企业提供可持续发展和 ESG、循环再生、减污降碳、协同增效方面的国际国家政策咨询和技术解决方案，特别是消费产品供应链。

研究院 2023 年在联合国气候大会 COP28 上发起“中国循环再生‘100 倡议计划’，实现 100%循环，100 个案例和产品。研究院研究院拥有‘绿色低碳 循环创新峰会’行业系列主题论坛，从 2020 年以来，已召开供应链、汽车电子电器、产品设计、循环纺织等不同行业多场论坛，并作为上海气候周的成员参与企业出海，参加 2024 年上海-吉隆坡气候行动周论坛。研究院还举办循环经济溯源、碳减排、ESG 等企业培训，在循环经济领域发表文章超过 50 篇，塑料包装替代材料和海洋废弃渔具溯源等相关团标 7 项。拥有‘碳姐访谈’自媒体品牌，播放量达到 10 万人次以上。

联系青合循环经济与碳中和研究院：cgci@icnce.com

全球气候学院球气候学院（Global Climate Academy, GCA）作为联合国训练研究所繁荣联盟上海（UNITAR PAS）的运行平台，携手上海气候周与联合国训练研究所（UNITAR），助力推进和落实联合国可持续发展目标。全球气候学院以加速可持续投资、商业与治理常态化为愿景，秉承“共创、共生、共荣、共赢”的理念，汇聚政府、企业、金融、学术与社会组织等多方资源，聚焦治理能力、系统转型能力与协同创新能力的提升，支持利益相关方实现从合规到创新的转型升级。

学院提出“战略 - 治理 - 数据 - 技术 - 金融 - 产品 - 生态”七位一体的能力体系，通过“气候护照”数字化平台建立可信的指纹系统，以能力“提升、重构、创新”为核心，系统记录和传播各方在气候与可持续发展中的行动与价值。

作为全球性能力建设与创新平台，全球气候学院以诚信、包容、公正、良治与卓越为核心价值观，致力于促进政策、资本、技术与人才的深度融合，赋能系统性转型，为实现净零碳与自然向正未来、落实联合国可持续发展目标注入新动能。

全球气候学院在中国香港和上海设立运行机构，并积极拓展至中国其他城市和全球区域，通过能力建设与协同创新，推动跨区域、跨行业的绿色清洁低碳智慧转型。

联系全球气候学院：contactus@globalclimateacademy.org