万科公益基金会
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北京市企业家环保基金会

2021

企业气候行动

BUSINESS CLIMATE ACTION

案例集 / CASES

致　　谢 | ACKNOWLEDGEMENT

感谢中国工业经济联合会、商道纵横、保尔森基金会等中国企业气候行动（CBCA）伙伴机构推荐案例。感谢万科公益基金会的资助与支持。

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如有问题或建议，请联系邮箱：CBCA@cteam.org; 电话：010 62561869。

For further information, please contact CBCA@cteam.org, +86 10 62561869.

编者按 | EDITOR'S NOTE

2021 年 11 月，《联合国气候变化框架公约》第二十六届缔约方大会（COP26）虽迟但到。中国企业气候行动（CBCA）秘书处将于 COP26 中国企业馆展示成员企业和伙伴机构近两年来的部分成果，并以《2021 企业气候行动案例集》为媒介，促进国际交流，吸纳前沿思想、输出经验与实践。

2021 年我们秉持一贯理念，在遴选案例上侧重企业自身的节能减排成效和企业提供的应对气候变化解决方案这两个角度。这些案例，基于企业的探索与实践，努力做到用有说服力的数据说话。

我们也了解到，很多企业已经紧锣密鼓地投入到碳中和目标和方案的研究当中；我们期待，2022 年的案例集能够对企业的碳中和行动方案有更全面、准确的展示。秘书处也将继续携手平台内外志同道合的伙伴，为各行业、各领域的双碳具体措施提供支持，协助企业制定科学、切实的减碳目标和行动方案。

让我们携手共创、笃定前行，为遏制全球气候变化、构建人类命运共同体做出更大贡献。

中国企业气候行动（CBCA）秘书处

2021 年 10 月

The 26th UN Climate Change Conference of the Parties (COP26) will finally unveil itself in November 2021, after a one-year delay. The China Business Climate Action (CBCA) Secretariat will showcase the efforts and outcomes of our members and partners in the past two years at the China Corporate Pavilion. By presenting *2021 Business Climate Action Cases*, we hope to enhance international communication and exchange cutting-edge ideas and best practices.

This year, the cases we selected fall into two categories in general: emission reduction and energy saving projects taken by enterprises and climate change solutions offered by businesses. These cases speak for themselves using numbers and statistics derived from their respective exploration and practices.

We have also learnt that many Chinese enterprises have already kicked off their corporate net zero pathway research and planning process; we expect that the 2022 business case collection has a more accurate and inclusive representation of corporate carbon neutral roadmap and actions. Meanwhile, the CBCA Secretariat will continue to closely work with our partners both in and out of the CBCA platform, to assist industries and enterprises in developing their science-based and practical carbon reduction targets and action plans.

Let us join in efforts and forge ahead to make greater contributions to combating global climate change and building a community of shared future for mankind.

China Business Climate Action Secretariat

October 2021

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抱朴再生
资源零废弃全流程一站式解决方案

◎ 案例概述

「抱朴再生」整合了国内饮料瓶安全回收及再生产业资源，经由智能回收机、专业分拣中心、以及合作伙伴的业务场景安全回收并专业处理；从投瓶返利、粉碎清洗、聚酯切片、环保长丝到设计剪裁，历经 12 道专业工序，以可控闭环的形式，实现了生产环节的安全可追溯，并已通过 GRS 全球回收标准认证及 ISO9001 国际质量体系认证。抱朴结合可计量的减碳数据、可定制的面料与设计，打造再生资源利用的全流程创新模式。

抱朴再生是中国第一家把“碳减排计算”融合到环保再生产品上面的创新品牌，仅 2020 年，约 9,895,376 个塑料瓶被抱朴再生赋予新生。

成立两年半，抱朴已服务超过 100 家国内外知名企业、机构，包括星巴克、宝马、百事、财新峰会、世界自然基金会、国家地理、人民网等。其中，为星巴克持续提供再生产品创新点，赋能成功商业案例，辐射人群 300 万 +；联合阿迪达斯打造”来自海洋的礼物“再生套装，助力终结海洋垃圾，辐射人群 200 万 +；联合摩登天空打造草莓音乐节“循环世界”，辐射人群 100 万 +。

2019 年，抱朴曾获得联合国邀请赴纽约参加联合国青年气候峰并做主题发言及为中国代表团提供官方礼品。

◎ 企业简介

成立于 2019 年的「抱朴再生」，是一个致力于探索中式可持续生活方式的环保国潮品牌。提供回收再生解决方案，并将废弃资源改造为潮流商品。实现效法自然，生生不息。

抱樸再生
BOTTLOOP

「抱朴再生」品牌灵感源自老子《道德经》第十九章“见素抱朴”，英文名“BOTTLOOP”则有“瓶子的循环”之意。抱朴再生受到传统中国文化启发，怀抱对大自然的敬畏与感恩，秉持“回归本真，拥抱纯朴，循环再生，生生不息”的可持续生活方式理念，试图还原塑料制品未开发时的朴质本真，结合现代科技和时尚创意，将其循环再生为潮流商品，赋予废弃资源第二次乃至无限的生命。

作为可持续生活方式的创意平台，「抱朴再生」针对政府、企事业单位及大型活动，提供零废弃全流程解决方案，促进行业标准建立，探索中国现代绿色生产与生活方式的实践方向；同时面向终端消费人群推出深入生活场景的再生潮流商品，并与各界伙伴携手打造联名设计、艺术展演、公益活动等，激励全社会的低碳环保行为。

◎ 项目产出

- 经核算，抱朴再生产品利用废弃饮料瓶回收再生成涤纶（RPET）切片，从投瓶回收、到清洗再到切片整个过程中，对比基准线情景 *，每生产 1 克 RPET 切片对应的温室气体减排量为 2.109g CO_2e。
- 每一件抱朴再生打造的环保商品，皆附有一个可追溯碳足迹的二维码。消费者可通过扫码查询商品在生产过程中折算的碳减排量 **。例如 1 件使用 RPET 材质的成人雨衣，约可减排 3.72kg 的碳排放，相当于种树约 0.7 棵；1 个手提包约可实现 1.24kg 的碳排放，相当于种树约 0.25 棵。
- 经核算，2020 年全年，抱朴再生合计利用回收塑料瓶 247.38 吨，二氧化碳减排量为 521.73 吨，相当于减少标煤 200.67 吨，汽油 171.06 吨，节电 855161 度，种树 104347 棵。

* 对比场景为“以原油、天然气等化石原料，经过炼油、合成等工艺而获得的聚酯切片”。
** 产品碳足迹算法由第三方专业机构“碳阻迹”提供。

◎ 项目实施

近年来，伴随着经济发展，我国环境污染的严峻形势逐渐引起社会关注：

首先，以废旧塑料回收再利用为例，我国塑料瓶的过度使用和其较低的回收率之间的矛盾极为突出，公开数据显示我国废弃塑料及包装物回收利用率不到 10%；同时，部分塑料瓶经由不当回收流入“黑作坊”，处理过程对水源和土壤造成严重污染。国内市场缺乏具备安全技术、高附加值、可推广性的商业模式，未能有效通过商业手法解决行业问题。

第二，我国各行各业均面临发展与污染之间的矛盾，公开数据显示，2010 年，纺织产品基于终端能源消费而产生的 CO_2 排放量约为 2.05 亿吨。我国急需控制高能耗、高污染产业的低层次扩张，转变发展方式，调整产业结构。

为了解决上述两个社会问题，抱朴再生依托母公司（北京盈创再生资源回收有限公司）的饮料瓶智能回收机具以及回收网络资源；并以国际回收标准（GRS）为基础，整合中国再生纺织工业上下游生产链，将物联网技术与再生资源回收体系结合，进行了 RPET 再生商品模式探索。

通过抱朴再生的零废弃全流程解决方案，PET 饮料瓶一等次性物料经过专业的回收与清运流程，由粉碎清洗、聚酯切片、深层分离清洁、环保长丝、再生面料等 12 道工序，最终被赋予第二次生命，再生成可持续使用的环保商品。全流程安全可追溯，不仅能减少白色污染，相较传统的纺织行业，还能减少资源消耗和碳排放。

部分合作案例如下：

1. **环保再生防护服项目：**2020 年武汉疫情期间，抱朴再生有感于防疫物资短缺，发挥再生资源利用行业的技术优势，开发了国内第一批环保再生材质的非医用防护服，并携手合作伙伴向武汉等地区捐助 6000 余套环保再生防护服。海外疫情肆虐期间，抱朴再生联合远洋集团，将防护服捐赠至日本医护机构，事件获得了《日本经济新闻》的报道。在北京疫情发生反弹后，抱朴再生向公共场所捐助防护服，协助防疫站点开展工作。首批防护服已在北京远洋未来广场购物中心落地使用。
2. **“禁塑”航班项目：**2020 年世界环境日，海南省生态环境厅、海航、抱朴再生三方联手，以 HU7281 航班执行“禁塑”飞行，全面替换客舱一次性耗材，在万米高空举行环保科普快闪活动，倡导绿色出行理念。这是国内首个“禁塑”航班。
3. **星冰粽项目：**2020-2021 年端午节，星巴克推出星冰粽，附赠由抱朴再生倾协力助打造的潮酷礼袋。抱朴再生回收星巴克部分门店冰杯，协同安全渠道回收的饮料瓶，再生成为 RPET 环保面料，并提供了礼袋的碳足迹数据。两款礼袋以潮酷色彩混搭传统元素，践行可持续生活方式。
4. **跑出蔚蓝活动：**2021 年，阿迪达斯联合抱朴再生将原本可能流入海洋的塑料垃圾回收再造成为时尚单品，化身成为一份“来自海洋的礼物”，赋予废弃塑料二次生命。“跑出蔚蓝”活动，全国落地城市 200+ 座，参与人数 2690000+ 人，回收塑料垃圾 10000+ 公斤，生成废弃塑料再生礼品 5000 套，共计减碳 23.9 吨。

经核算，2020 年全年，抱朴再生合计利用回收塑料瓶 247.38 吨，二氧化碳减排量为 521.73 吨，相当于减少标煤 200.67 吨，汽油 171.06 吨，节电 855161 度，种树 104347 棵。

◎ 项目重要影响及可持续性

为推动循环再生整体产业链的绿色转型，抱朴再生以国际回收标准（GRS）为合作基础，整合中国再生纺织上下游生产链，逐步建立中国特色的零废弃指导原则与评价体系，为传统的环保产业增添附加价值，增加就业，提升人员收入，提升尊严感与荣誉感，从长远促进中国环保产业综合发展。 同时，抱朴再生正在尝试将区块链技术与政府、企业客户减碳信息相结合，构建全社会的绿色信用体系，为中国民族环保产业的价值推广创造一种全新模式。

抱朴再生的零废弃全流程解决方案，旨在为政府机构与企业提供标准化的资源回收与再生服务。同时以品牌化的运营模式，推翻环保再生行业的刻板印象，进而吸引年轻一代的加入，通过创意力量改善城市的景观环境，促进国家生态文明建设，将中式环保智慧播撒至世界各地，为子孙后代留下绿色遗产。



BOTTLOOP

Zero Waste One Stop Whole Process Solution

Case Overview

BOTTLOOP integrates domestic beverage bottle safe recycling industry resources and realizes safe recycling and professional processing through intelligent recycling machine, professional sorting center, and partners' business scenarios. BOTTLOOP's safe and traceable processing which consists of 12 major steps, including crush and clean, transfer to flakes, separate and deep clean, extend as fiber and recycled fabric, etc., has been certified by Global Recycle Standard (GRS) and ISO9001. BOTTLOOP combines quantifiable carbon reduction data, customizable fabric and design to create a whole-process innovation model for renewable resource utilization.

BOTTLOOP is the first brand in China that integrates "carbon emission reduction calculation" into environmental-friendly recycling products. Only in 2020, about 9,895,376 plastic bottles were given new life by BOTTLOOP.

Since its establishment two year ago, BOTTLOOP has successfully cooperated with 100+ famous enterprises and organizations such as Starbucks, BMW, Pepsi, Caixin Summit, WWF, National Geographic, People's Daily Online, etc.. BOTTLOOP has been continuously providing to Starbucks product innovation on recycling material to secure its commercial success with an audience coverage of 3 million people; has assisted adidas to create a "gift from the ocean" package to reduce ocean plastic waste with a coverage of 2 million people and has jointly created Strawberry Music Festival "Loop World 2019" with a coverage of 1 million people.

In 2019, BOTTLOOP was invited by the United Nations to deliver speech on the UN Youth Climate Summit in New York, and supplied uniforms and official gifts to the Chinese delegation.

Company Profile

BOTTLOOP, founded in 2019, is a sustainable lifestyle brand inspired by Chinese traditional culture, who provides recycling solutions and transforms waste resources into trendy products.

抱樸再生
BOTTLOOP

Inspired by Laozi's "Tao Te Ching", BOTTLOOP cherishes the gratitude of nature, to realize the reduction of waste plastic bottles, devoting ourselves to combining technology, art and fashion to pursue a sustainable solution for modern society and arising a Chinese sustainable fashion trend among young generations.

As a creative platform for sustainable lifestyle, BOTTLOOP provides zero-waste whole-process solutions for governments, enterprises, public institutions and large-scale events, promotes the establishment of industry standards, and explores the practical direction of modern green production and lifestyle in China. At the same time, BOTTLOOP provides to customers trendy products made from recycled material and with its partners from various sector to create joint design, art exhibitions, public welfare activities, to inspire the whole society to practice low-carbon production and lifestyle.

Project Outcome

- Compared with baseline scenario, the process of recycled polyester (RPET) pellet production by BOTTLOOP from bottle smart recycling, cleaning, to cutting, reduces 2.109g CO_2e for every 1g RPET pellet produced.
- On each BOTTLOOP's product, there is a QR code to trace its carbon footprint*. For example, one adult raincoat made from RPET reduces carbon emissions by about 3.72 kg; One handbag achieves about 1.24 kg of carbon emissions reduction.
- In 2020, BOTTLOOP recycled 247.38 tons of plastic bottles, and achieved 521.73 tons of CO_2 emission reduction.

*Baseline scenario: polyester pellets produced trough refining and synthesis process from fossil material such as crude oil.
**Carbon footprint calculation methodology provided by third party "Carbonstop".

◎ Project Implementation

In recent years, along with economic growth, the severe situation of environmental pollution in China has gradually aroused social concerns:

First, take the waste plastics recycle as an example, the contradiction between the overuse of plastic bottles and its low recovery rate is very prominent. Public data shows that the recovery rate of waste plastics and packaging in China is less than 10%. At the same time, some plastic bottles have been improperly recycled into "dirty workshops", and the treatment process has caused serious water and soil pollution. In the domestic market, there is lack of an effective business model with safe technology, high added value and popularization to solve such industry problems.

Secondly, industries in China are facing the contradiction between growth and pollution. According to public data, the CO_2 emission from textile products based on end-use energy consumption was about 205 million tons in 2010. China urgently needs to control the low-level expansion of high energy consumption and high pollution industries, change the development mode, and adjust the industrial structure.

In order to solve the above two social problems, BOTTLOOP has developed the RPET recycled products business model which relies on the smart beverage bottle recycling machines and network resources of its parent company (Beijing INCOM Recycle Co., Ltd.). Based on the Global Recycled Standards (GRS), BOTTLOOP has integrated the upstream and downstream production chains of China's recycled textile industry and combined the technology of internet of things with the recycling system of renewable resources.

Through the zero waste whole process solution of BOTTLOOP, disposable materials such as PET beverage bottles are given a second life and recycled into sustainable environmental products after a safe, professional and traceable recycling and cleaning process, which consists of 12 major steps, including crush and clean, transfer to flakes, separate and deep clean, extend as fiber and recycled fabric, etc..

Some of BOTTLOOP's typical cooperation cases are as below:

1. **RPET Protection Suit:** during the 2020 Wuhan COVID epidemic, aware of the shortage of epidemic prevention supplies, BOTTLOOP has given play to its technological advantages in the industry of renewable resources utilization, to develop the first batch in China, the non-medical protective clothing made from recycled materials. Together with enterprise partners, more than 6,000 sets of protective clothing were donated to Wuhan and other regions.

   During the outbreak abroad, BOTTLOOP and Cosco have jointly donated the protective clothing to medical institutions in Japan. The donation was reported by the local media Nihon Keizai Shimbun. When the outbreak rebounded in Beijing, BOTTLOOP provided protective clothing to staff working in public places.
2. **"Plastic Ban" Flight:** on the World Environment Day of 2020, Hainan Provincial Department of Ecology and Environment, HNA Group and BOTTLOOP have jointly launched the "Plastic Ban" flight with Flight HU7281. All disposable plastics on the flight were replaced while a flash event on environmental protection science was held at a height of 10,000 meters to promote green travel. This was the first flight in China to ban plastics.
3. **Starbucks Icy Dumplings:** prior to the 2020 and 2021 Dragon Boat Festival, Starbucks launched star icy dumplings package with trendy gift bags made with the help of BOTTLOOP. BOTTLOOP recycled ice cups at Starbucks stores, mixed with other recycled beverage bottles to produce RPET fabrics. BOTTLOOP also disclosed carbon footprint data of these gift bags.
4. **Run for The Oceans:** In 2021, BOTTLOOP assisted adidas to launch the "Run for The Oceans" program to collect plastic waste which was later transformed into trendy products called "a gift from the ocean". "Run for The Oceans" was conducted in more than 200 cities with about 2.7 million people's participation, recycled more than 10 tons of waste which was transformed into 5000 sets of messenger bags, with a total of 23.9 tons of carbon reduction.

In 2020, BOTTLOOP recycled 247.38 tons of plastic bottles, and achieved 521.73 tons of CO_2 emission reduction, which is equivalent to 200.67 tons of standard coal reduction, 171.06 tons of gasoline reduction, 855,161 kWh of electricity saving, and 104,347 trees planted.

◎ Impact & Sustainability

With the vision of promoting the green transformation of the whole recycle industry and with GRS (Global Recycled Standard) as the cooperation basis, BOTTLOOP can effectively integrate the upstream and downstream of the recycle and textile industry, to gradually establish the Chinese characterized zero waste guiding principles and evaluation system and to add additional value to the traditional environmental protection industry, thus the employment and staff income can be increased, dignity and honor can be enhanced, and in the long run to promote the overall development of the Chinese environmental protection industry.

Our zero-waste whole-process solution aims to provide standardized resource recycling services to government agencies and enterprises. At the same time, the brand operation mode overthrows the stereotype of environmental protection and regeneration industry, thus attracting young generations to join in, improving the urban landscape environment through creative power, promoting the construction of national ecological civilization, spreading the Chinese environmental protection wisdom to the world, and leaving a green heritage for future generations.

比亚迪股份有限公司
“零碳园区”项目

◎ 案例概述

作为全球新能源整体解决方案提供商，比亚迪以解决社会问题为导向，以技术创新为驱动，在解决问题的过程中实现企业自身发展。比亚迪在坪山总部园区从三个方面开展减碳工作。一是绿色运营，将比亚迪开发的太阳能、储能电站、电动车、云轨、云巴等绿色技术和产品运用到园区日常运营中。二是绿色办公，提升员工环保意识，合力打造零碳园区。三是绿色生产，注重自身的节能减排，在坪山总部开展系统性节能减排改造项目，2019 年至今，累计投入超 1.3 亿元开展节能改造，助力坪山总部成为首个零碳园区。

◎ 项目产出

- 坪山总部园区节能改造项目节能量超 1502 吨标准煤（2019-2020）；
- 比亚迪节能改造项目累计减少二氧化碳排放 33454.02 吨（2019-2020）；
- 获得深圳市坪山区节能改造项目政策优惠。

◎ 企业简介

比亚迪股份有限公司，总部位于广东省深圳市坪山区。比亚迪致力于用技术创新促进人类社会的可持续发展，助力实现“碳达峰、碳中和”目标。二十六年来，比亚迪通过强有力的市场布局、坚定推动全球可持续发展的战略举措，赢得了“扎耶德未来能源奖”、“联合国能源特别奖”以及《财富》杂志“改变世界的公司”等系列赞誉。2021 年 5 月，比亚迪第 100 万辆新能源车下线，是全球唯二、中国唯一的新能源汽车交付量达到百万级别的车企。截止 2021 年 9 月底，累计销售新能源汽车 124 万辆，减少 8,091,062,254kg 二氧化碳，相当于植树 647,255,188 棵树；比亚迪光伏累计出货量超 10GW，减少 7086824,768kg 二氧化碳，相当于植树 118113746 棵。

◎ 项目亮点

2019 年至今，比亚迪不断完善能源管理体系，获得 ISO50001 认证，多个节能改造项目节能减排成果显著并获得政府政策优惠。

2021 年 2 月，比亚迪宣布启动企业碳中和规划研究，探索新能源汽车行业碳足迹标准。

◎ 项目实施

在“碳达峰”“碳中和”目标与“汽车强国”蓝图的要求下，比亚迪坚持技术创新，积极推动中国汽车工业高质量发展，助力零碳目标。

为实现企业自身节能减排，比亚迪进行统一规划，从三个方面进行全面改造。

一是绿色运营，利用自身在新能源领域的独特优势，将电动车、储能系统、太阳能电站、电动叉车、LED 灯、云巴、云轨等绿色产品应用到自身的生产活动中。深圳坪山园区装机量为 6.4MW 的太阳能光伏每年发电约 800 万度用于园区日常生产。截至 2020 年，比亚迪合计使用 884 台新能源车用于公务出行及员工交通，累计使用 2851 辆电动叉车替换传统的燃油叉车，运用于园区车间物流，园区新能源汽车使用率 100%。

二是绿色办公，比亚迪注重提高员工的环保意识，通过日常培训、会议、宣传栏、活动竞赛等方式，向员工宣传环保知识，践行绿色办公，合力打造零碳园区。

三是绿色生产，自 2019 年起，投入超 1.3 亿元用于节能改造项目，主要项目如下：

一、冲压自动化线改造项目

项目点为深圳焊接工厂，采用机器人焊接和大量滚床等自动化设备代替人工转运和焊接，焊接设备改为变频伺服焊机，将原来生产每小时生产 20 辆车提升至每小时生产 35 辆车以达到提高生产效率，降低能源消耗。

二、电池生产设备系统优化改造项目

项目将电池生产系统高耗能三相异步电动机用伺服电机替代，单面焊接改为双面，生产效率提升 100%，大大提高自动化程度和产品良率。

三、空压机余热回收利用项目

项目通过给每台空压机安装一套余热回收装置，回收油冷却器中热量，实现把这些空压机产生的热量 90% 回收利用。将空压机产生的热能回收加热热水，为坪山宿舍、食堂等提供热水，不单实现了热能回收利用，同时减少了冷却水和电能的使用。

四、整车性能测试方法节能项目

项目为提高整车验证的实验成效，建立虚拟试验环境，替代试验车辆在真实路面的行驶，减少了车辆的油耗及碳排量。道路模拟试验设备已分别应用在大巴车和乘用车中。

五、坪山燃油动力系统试验台架余能回收节能项目

项目为购买了包括双模车动力系统实验台架、发动机试验台架、双模车动力总成试验台架等设备，改进和提升了动力系统的性能，有效提高了能源的使用效率。并对燃油动力系统试验台架的余能进行回收再利用，减少了能源的损耗。

节能项目名称	项目资金（万）	节能效益（吨标准煤）	年减少碳排放量（tCO_2）	其他效益
冲压自动化线改造项目	3,999	435	3,356.587	2019 年获得深圳坪山区节能减排专项。
电池生产设备系统优化改造项目	547.8	306	2,364.539	年节电量为 2491874kWh
空压机余热回收利用项目	551	319	2,463.074	年节电量为 2595715kWh
整车性能测试方法节能项目	3,541	370.99	2,864.3808	2020 年获得深圳坪山区节能减排专项
坪山燃油动力系统试验台架余能回收节能项目	4,405.53	71.3	550.31	2021 年获得深圳坪山区节能减排专项
合计	13,044.33	1,502.29	11,598.8908	

* 以上数据均由第三方评估。

◎ 项目重要影响及可持续性

未来，比亚迪继续争当可持续发展先锋，加强企业自身碳减排行动，进一步完善能源管理体系，逐步减少化石能源的使用，增加清洁能源使用占比，将在 2022 年实现比亚迪坪山总部“零碳园区”，并逐步推广至比亚迪全球范围的其他工业园。

同时，进一步通过比亚迪绿色技术、绿色产品和解决方案，与全球客户及伙伴加速推动交通运输行业和制造业绿色低碳转型发展，为保护人类的共同家园、实现人类可持续发展贡献力量。

BYD

Net-Zero Industrial Estate

◎ Case Overview

As a global provider of turnkey new energy solutions, BYD prioritizes the resolution of social issues and seeks to achieve its own development in the process using a technological innovation-driven model. BYD approaches carbon reduction efforts at its Pingshan hub from three angles. First, green operation, where solar energy, energy storage power plants, electric vehicles, SkyRail, SkyShuttle and other green technologies and products developed by BYD are applied in the daily operations of the site. Second, green office, the aim of which is to enhance the environmental awareness of employees for the joint development of a net zero industrial park. Third, green production, where the focus is placed on BYD's own energy saving and emission reduction through a systematic remodeling project at its Pingshan headquarters. From 2019 to date, upwards of CNY130 million has been invested in the endeavor to shape the Pingshan hub into the first net zero industrial park.

◎ Company Profile

Headquartered in the Pingshan district of Shenzhen City in Guangdong Province, BYD Company Limited is committed to promoting the sustainable development of human society through technological innovations and furthering the "carbon peak and carbon neutrality" targets. Its 26 years of operations have been accompanied by a succession of industry acclaim and awards, including the Zayed Future Energy Prize, the UN Energy Special Award, and Fortune Magazine's "Companies Changing the World" list thanks to BYD's powerful market presence and robust strategic initiatives to promote global sustainable development. In May 2021, BYD rolled out its one millionth new energy vehicle (NEV), making it one of two automakers worldwide and the sole automaker in China to have delivered one million new energy vehicles. As of the end of September 2021, BYD had sold an aggregate of 1.24 million new energy vehicles, reducing CO_2 emissions by 8,091,062,254 kg, the equivalent to planting 647,255,188 trees; the cumulative BYD PV shipments exceeded 10 GW, reducing 7,086,824,768kg of CO_2, the equivalent to planting 118,113,746 trees.

◎ Project Outcome

Energy savings of over 1,502 tons of standard coal through the energy-saving remodeling of its Pingshan headquarters (2019-2020);

Cumulative reduction of 33,454.02 tons of CO_2 emissions from the remodeling (2019-2020);

Recipient of policy concessions for the retrofit project from the government of Pingshan District, Shenzhen.

◎ Project Highlights

From 2019 to date, BYD has constantly improved its energy management system, which has secured the ISO50001 certification; significant energy-saving and emission reduction results have been achieved across several of BYD's energy-saving retrofit projects, which are the recipients of government policy concessions.

In February 2021, BYD announced the launch of a corporate carbon-neutral planning research program to explore carbon footprint standards for the new energy vehicle industry.

◎ Project Implementation

In light of the government mandates of "carbon peak and carbon neutrality" targets and the blueprint for an "automotive powerhouse", BYD has stayed the course of technological innovation and actively promoted the high quality development of China's automobile industry, in furtherance of the net zero goal.

BYD has made centralized plans for an overhaul of its operations to support the emissions reduction initiative, which will be carried out on three frontiers.

First, green operation. Leveraging its unique edge in the new energy sector, BYD has applied green products such as electric vehicles, energy storage systems, solar power plants, electric forklifts, LED lights, SkyRail and SkyShuttle to its own production activities. The solar photovoltaic generators with an installed capacity of 6.4MW at its Shenzhen Pingshan site generates about 8 million kWh of electricity p.a. to power the daily production at the site. As of 2020, BYD has mobilized a total of 884 NEVs for business travel and employee shuttle services, and a total of 2,851 electric forklifts to replace traditional fuel forklifts, which are used in workshop logistics, with 100% utilization rate of new energy vehicles on site.

Second, green office. BYD values the raising of environmental awareness of its employees and has been disseminating knowledge on environmental protection to its staff through daily training, meetings, bulletin boards, activities, and competitions. Green office practices are promoted on site to foster a joint effort in the creation of a net zero industrial park.

Third, green production. Since 2019, BYD has invested over CNY130 million in energy-saving retrofitting projects, mainly as follows:

I. Automated stamping line retrofit

BYD's Shenzhen Welding Factory is the project site, where robot welding and a large number of automatic equipment such as roller beds are applied in lieu of manual transfer and welding, and the welding machines are upgraded to inverter servo welding machines to increase the efficiency of production from 20 cars per hour to 35 cars per hour with lower energy consumption.

II. Systematic optimization and retrofit of battery production equipment

The project will replace the high energy-consuming three-phase asynchronous motors with servo motors in the battery production system, change single-sided welding to double-sided, which will increase production efficiency by 100%, and greatly improve the degree of automation and product yields.

III. Air compressor residual heat recycling

By installing a set of residual heat recovery devices for each air compressor and recovering the heat in the oil cooler, the project could recover 90% of the heat generated by these air compressors, which is used to provide hot water to the dormitories and canteens at the Pingshan site. The project both recycles residual heat and reduces the use of cooling water and electricity.

IV. Energy conservation in vehicle performance testing

The project has established a virtual test drive environment in place of real-road driving of test vehicles, which not only improves the experimental effectiveness of the whole vehicle, it reduces the fuel consumption and carbon emissions of the test vehicles. Road simulation test drive equipment has been applied to coaches and passenger vehicles respectively.

V. Residual energy recovery and energy conservation of Pingshan fuel power system test stand

Equipment purchased for the purposes of the project include a dual-mode vehicle power system test stand, engine test stand, dual-mode vehicle powertrain test stand, which improve and enhance the performance of the power system and effectively improves the efficiency of energy use. Furthermore, the residual energy of the fuel power system test stand is recycled and reused, reducing the loss of energy.

Project	Investment (10k)	Energy savings (standard coal, tonnes)	Carbon emissions reduction p.a. (tCO_2)	Other benefits
Automated stamping line retrofit	3,999	435	3,356.587	Special grant for energy conservation/emission reduction projects, Pingshan, Shenzhen, 2019
Systematic optimization and retrofit of battery production equipment	547.8	306	2,364.539	2,491,874 kWh of power saved p.a.
Air compressor residual heat recycling	551	319	2,463.074	2,595,715 kWh of power saved p.a.
Energy conservation in vehicle performance testing	3,541	370.99	2,864.3808	Special grant for energy conservation/emission reduction projects, Pingshan, Shenzhen, 2020
Residual energy recovery and energy conservation of Pingshan fuel power system test stand	4,405.53	71.3	550.31	Special grant for energy conservation/emission reduction projects, Pingshan, Shenzhen, 2021
Total	13,044.33	1,502.29	11,598.8908	

*Based on third-party appraisals.

◎ Impact & Sustainability

BYD will move forward with its quest to become a pioneer in sustainable development, strengthen its own carbon emission reduction efforts, further improve its energy management system, gradually reduce the use of fossil fuels and increase the use of clean energy as part of its energy solutions. BYD plans to turn its Pingshan hub into a "net zero estate" by 2022, followed by the rest of BYD's industrial parks worldwide.

BYD will also continue to pursue green and low-carbon transportation and manufacturing industries under synergistic collaborations with its clients and partners across the globe through ramped-up green technology, green products and solutions, to safeguard the homeland shared by mankind, and enable the sustainable development of mankind.

第一人居
合肥 · 当代天鹅湖万国府全过程绿色建筑管理

◎ 案例概述

由第一人居作为设计咨询、建设施工和能源运维单位，合肥当代天鹅湖万国府自规划设计起，即按照三星级绿色建筑标准进行定位，严格控制施工品质，并在运行使用阶段倡导绿色物业管理及节能运行体制，实现从设计、施工到运行的全过程绿色建筑管控。本项目于 2018 年 11 月获取绿色建筑评价标准三星级设计标识，2019 年 12 月获取 HIH 健康建筑金级标识，2021 年 5 月获取绿色建筑评价标准三星级运行标识。

定位于高端舒适住宅，本项目将绿色健康与智慧科技完美融合，整合运用了可持续发展建筑科技的最新成果与当代建筑艺术理念，沿用当代置业地源热泵、天棚辐射、外围护结构保温系统、外遮阳系统、同层排水系统、置换式全新风、雨水回收系统等多项绿色建筑技术，实现了高舒适度、微能耗的理想居住环境。

◎ 企业简介

第一摩码人居环境科技（北京）有限公司（简称：第一人居），2014 年 12 月成立，是行业领先的建筑科技解决方案服务商。第一人居具备流程创新和全过程服务能力，业务主要覆盖建筑舒适节能咨询与 EPC、能源站建设与运营、建筑科技产品三大业务板块。 第一人居在营造高舒适人居环境和建筑能源高能效应用方面具有丰富的实践经验和标准化实施流程，交付项目覆盖北京、山西、陕西、山东、河北、河南、上海、江苏、浙江、湖南、湖北、江西、安徽、广东、贵州等近 20 个省，40 余个城市，横跨多个差异化气候分区，为“绿色科技，环境向美”的目标不懈努力。

第一人居企业文化开放包容，鼓励积极进取和工匠精神。拥有的建筑科技专家团队、丰富的项目案例和运行数据、工程和运营的执行能力、严格的管理体系和基于客户需求的技术创新能力，是我们的五大核心竞争优势。

第一人居致力于应用技术和商业创新改善城市人居环境，做中国建筑科技服务行业的引领者。

◎ 项目产出

- 本项目执行《合肥市居住建筑节能设计标准》DB34/T 5059-2016，节能率大于 65%。
- 节材设计。采用预拌混凝土、预拌砂浆，实现土建与装修一体化设计施工。
- 项目采用以地源热泵为主，风冷热泵调峰的能源形式。以 2020 年冬季为例，减少碳排放折合标准煤 945.1 吨。
- 在屋顶和地下一层分别设置带有全热回收的新风机组，分别从高低区两个方向送风，全热回收效率不低于 65% 。
- 雨水回收系统用于绿化浇灌、道路冲洗、洗车，不足部分采用自来水补水。结合雨水回用系统，场地年径流总量控制率 ≥70%。
- 合理选择绿化方式，科学配置绿化植物。种植适应当地气候和土壤条件的植物。并采用乔、灌、草结合的复层绿化，绿地配植乔木不少于 3 株 /100m^2。
- 荣获绿色建筑评价标准三星级设计标识、绿色建筑评价标准三星级运行标识，以及由国家住宅与居住环境工程技术研究中心颁发的住宅类全项金级“HIH 健康”标识。

◎ 项目亮点

项目整体属于恒温恒湿恒氧的高端住宅，对于夏热冬冷的合肥地区而言，可实现夏季凉爽，冬季温暖而不干燥；系统配置再热装置，再湿冷的天气仍可对温湿度提供稳定保障，且使用过程中无噪音，处理后的空气优质，系统整体舒适性高。项目在使用过程中，亦获得业主高度认可。通过搭配自控系统，大大降低了人员工作强度，数据记录更加及时精准，指导管理人员及时调控；地源热泵系统运行安全风险低，运行操作简单，便于调节管控，有效提供保障性。

◎ 项目实施

当代天鹅湖万国府是 2018 年起由第一人居作为设计咨询、建设施工和能源运维单位，在合肥市政务区打造的第二个大型高端住宅项目。项目位于合肥市政务区祁门路与石台路交口东北侧，总用地面积 98931.28m^2。本项目地块内设有配套商业、物管用房，配套商业向周边居民开放；周边一公里范围内设有幼儿园、银行、商业、社区中心等设施。

第一人居在设计过程中与各专业紧密配合，精细化计算，有效降低成本；在采购过程中，执行标准化技术标体系，落实精确选型；在施工过程中规范施工要求，达到精细化施工，实现减噪降震安全高效。从产品配置、关键技术措施、实施要点、质量把控、工作流程等角度，有针对性地保障项目落地。

规划设计

- **BIM 技术。**本项目的规划设计贯彻“以人为本”的思想，全面以绿色健康住宅的设计要求进行规化与设计。在设计阶段采用 BIM 技术，在提高生产效率、节约成本和缩短工期方面都有重要作用。利用 BIM 的三维技术在前期进行碰撞检查，优化工程设计，减少在建筑施工阶段可能存在的错误损失和返工的可能性，而且优化净空 ，优化管线排布方案。最后施工人员可以利用碰撞优化后的三维管线方案，进行施工交底、施工模拟，提高施工质量，同时也提高了与业主沟通的能力。
- **场地生态设计。**合理选择绿化方式，科学配置绿化植物，种植适应当地气候和土壤条件的植物，选用少维护、耐候性强、病虫害少、对人体无害的植物。并根据当地的气候条件和植物自然分布特点，栽植多种类型植物，采用乔、灌、草结合的复层绿化，种植区域覆土深度和排水能力满足植物生长需求。绿地配植乔木不少于 3 株 /100m^2。

建设施工

- **节材设计。**现浇混凝土采用预拌混凝土，建筑砂浆全部采用预拌砂浆，实现土建与装修一体化设计施工。
- **卷帘式电动调节外遮阳。**外遮阳完全嵌入外立面系统中，形成整体有效的外遮阳系统，可以有效地减少建筑因太阳辐射和室外空气温度通过建筑围护结构的传导得热以及通过窗户的辐射得热，对于改善夏季室内热舒适性具有重要作用。

运行维护

- **地源热泵系统。**本项目在选择能源系统时，经过多轮方案讨论，决定尽量多地使用可再生能源。项目采用高效地源热泵为主，风冷热泵调峰的能源形式提供空调冷热源和生活热水，性能系数比《公共建筑节能设计标准》（GB 50189-2015）的要求提升 6% 以上。地源热泵系统环境效益显著，所有部件不是埋在地下便是安装在室内，机组紧凑、节省空间，从而避免受到室外恶劣气候的影响；且自动控制程度高，可无人值守。同时，地源热泵的机组运行性能系数（COP ）值较高，经济节能，以 2020 年冬季为例，对比传统锅炉采暖，减少碳排放折合标准煤 945.1 吨。
- **混凝土天棚辐射末端系统。**通过嵌入楼板层内的管道系统进行小温差辐射采暖、制冷。效率高，舒适度好。
- **置换式新风系统。**本项目考虑送风温度及竖向热压效应影响，采用全置换式新风系统。各房间通过敷设于室内地面垫层的送风管路获得新鲜的空气，回风系统利用各户卫生间、厨房的回风立管集中至新风处理空调机组内。新风机组设有初效过滤段 (G4)、热回收段、中效过滤段 (F7)、表冷（加热）段、再热段、加湿段、再热段、送风段、亚高效段（H0）、排风段等功能段组成。对新风进行加热、制冷、加湿、除湿、消声等空气处理。热回收段要求在夏热冬冷地区选择板翅式全热回收装置，全热回收效率应不低于 65% 。
- **雨水回收系统。**雨水回收用于绿化浇灌、道路冲洗、洗车，不足部分采用自来水补水。结合雨水回用系统，场地年径流总量控制率≥ 70%。

本项目在节能、节水、节电、节材、环保等方面采用的绿色建筑技术路线还包括：良好的围护结构保温隔热系统，公共区域 LED 红外感应节能控制，节水器具、节水灌溉、同层排水等节水技术，CO 监控系统，及智能化技术等。第一人居在技术经验丰富、成本优化的条件下，不断总结经验、坚持品质、提升技术细节、实现了天鹅湖万国府项目绿色健康与智慧科技的完美融合。

◎ 项目重要影响及可持续性

第一人居作为创新型技术科技公司，为项目提供了全过程的设计咨询、建设施工和能源运维一体化服务，保证了项目质量，实现高标准交付，得到开发单位的高度认可。此后，利用这种商业模式的创新，在诸多新建建筑与既有老旧小区的改造项目中进行实践，并将机制持续更新。例如，西安梧桐公寓项目作为典型既有建筑改造项目，第一人居为其提供全流程服务，利用深层地热技术实现了良好的经济效益，为能源结构的改善与环境质量的提升做出了突出贡献。全流程一体化的服务，也打破了设计、施工、运维之间的管理壁垒，提高了各阶段的作业精准程度，保障了后期客户使用的体验与满意度，无论是在既有项目或新建项目中，此类机制与模式均值得推广使用。

First Living Environment Tech

Omni-Process Green Building Management for MOMA at Swan Lake Hefei

◎ Case Overview

With First Living Environment Tech acting as the design advisory, construction and energy O&M services provider, Hefei MOMA at Swan Lake has been positioned since the planning stage under the 3-star green building standards, with stringent control over building quality and advocating green property management and energy-saving operating systems post-occupancy to enable omni-process green building control throughout design, construction and occupancy. The project was awarded certifications and honors including the National Building Evaluation Standard 3-Star for Design (November 2018), the HIH Health Building Gold (December 2019), and the National Building Evaluation Standard 3-Star for Operation (May 2021).

The project, positioned as a high-end comfortable residence, features an apt fusion of green health and intelligent technology, as well as integrated applications of a myriad of green building technologies such as MOMA ground source heat pump, canopy radiation, exterior envelope insulation system, exterior shading system, same-level drainage system, replacement fresh air system, rainwater recycling system, all inspired by the latest advancements in sustainable building technology and contemporary architectural art philosophies, delivering the ideal living environment that boasts of extreme comfort and minimal energy consumption.

◎ Company Profile

第一人居
First Living Environment Tech

Established in December 2014, First Living Environment Tech is a leading building technology solution provider in the industry. First Living Environment Tech has process innovation and omni-process service capabilities in situ, and it primarily operates in three business segments: building comfort and energy saving consulting and EPC, energy station construction and operation, and building technology products. First Living Environment Tech has sound field experience and a standardized implementation process for creating high-comfort residences and efficient building energy applications, with delivered projects spanning close to 20 provinces and more than 40 cities (covering Beijing, Shanxi, Shaanxi, Shandong, Hebei, Henan, Shanghai, Jiangsu, Zhejiang, Hunan, Hubei, Jiangxi, Anhui, Guangdong, Guizhou) and multiple climate zones. The company is steadfast in its pursuit of its aim of "green technology-enabled natural beauty".

First Living Environment Tech advocate an open and accepting company culture that encourages aspiration and craftsmanship. We pride ourselves in our key competitive edge on five fronts: a team of building technology experts, a wealth of project cases and operational data, engineering and operational execution capabilities, a rigorous governance system, and the ability to innovate technology based on customer needs.

First Living Environment Tech is committed to applying technology and business innovation to improve urban environments and become a leader in China's building technology services industry.

◎ Project Outcome

- Complies with the *Energy-Saving Design Standards for Residential Buildings in Hefei* (DB34/T 5059-2016), with an energy-saving rate of more than 65%.
- Material-saving design. Ready-mixed concrete and mortar are used to allow for the integrated design and construction of both civil construction and interior fit-outs.
- Fueled primarily by ground source heat pump, with the supportive peak demand coverage by air-cooled heat pumps. Carbon emission equivalent reductions in the winter of 2020 amounted to 945.1 tonnes of standard coal.
- Fresh air units with full heat recovery are installed on the roofing and lower-ground floor respectively, and air is delivered from both high and low locations, with full heat recovery efficiency of at least 65%.
- The rainwater recycling system is used for irrigation, road and vehicle cleansing, and the tap water is used to make up the difference. The application has enabled a total annual runoff control rate of ≥ 70% on site.
- Has been awarded the National Building Evaluation Standard 3-Star for Design, National Building Evaluation Standard 3-Star for Operation, and the HIH Health issued by the China National Engineering Research Center for Human Settlements.

◎ Project Highlights

In contrast to Hefei's natural climate, the project offers upscale residences with stable temperature, humidity, and oxygen levels, enabling cool living spaces in summer and warm ones in winter. The buildings are equipped with warming system to keep temperature and humidity stable no matter how cold and wet the weather gets, with zero noise throughout; the treated air is of high quality, enabling a high level of overall comfort for residents, who have spoken highly of the features. The accompanying autonomous control system has greatly reduced manual workload and enhanced the timeliness and accuracy of data recording, enabling timely intervention by management personnel; the ground source heat pump system boasts low safety risks and streamlined operations that facilitate manual control and enhanced security.

◎ Project Implementation

MOMA at Swan Lake is Hefei's second major high-end residential development since 2018, with First Living Environment Tech serving as the design advisory, construction, and energy O&M services provider. The project site, with a total land area of 98,931.28 sqm, is located on the northeast side of the intersection of Qimen Road and Shitai Road. On-site retail amenities and property management buildings are designed, with the former accessible by residents in neighboring communities. Amenities including kindergartens, banks, retail, and community center can be found within a 1km radius of the site.

First Living Environment Tech engages in close inter-disciplinary partnerships in the design process and refines calculations to effectively reduce costs; for procurement, First Living Environment Tech implements an institutionalized technical standard system for precise model selection; and construction work is subjected to tight scrutiny to enable safe and efficient noise and vibration reduction. Tailored safeguards are in place to cover, among others things, product configuration, key technical measures, implementation highlights, quality control and workflow.

Planning and Design

- **BIM technology.** This project's planning and design upholds the "people-oriented" philosophy and fully meets the design requirements of green and healthy housing. BIM technologies adopted during the design stage have played a pivotal role in improving productivity, saving costs and speeding up construction. 3D BIM technology is employed in early stages for collision checks, optimizing the engineering design and reducing the possibility of building error-induced loss and rework; the technology also enables improved pipe and wiring plans, resulting in better overhead views. Construction staff have also been able to use the collision-optimized 3D piping plans in construction clarification and mockup to improve the quality of building works and their ability to communicate with the owner.
- **On-site ecosystem design.** Rational choice of greening approach and science-informed placement of greening plants, where plants that are chosen are adaptive to local climates and soil conditions, low-maintenance, resilient and non-hazardous to humans. An assortment of plants are planted under a hybrid, multi-layered, tree-bush-grass model, catering to local climates and plant distribution traits, in areas with soil depth and drainage capacity in line with plant needs. Green spaces are planted with not less than three trees per 100 sqm.

Construction

- **Material-saving design.** Pre-mixed concrete is used for cast-in-place concrete and pre-mixed mortar is used for all construction work to enabled integrated design and building works for civil construction and interior fit-out.
- **Electric rolling shutter exterior shading.** The shading is fully built into the façade, resulting in a comprehensive exterior shading system that effectively reduces heat gain from solar radiation and outdoor air temperature through the building envelope as well as heat gain from radiation through the windows, which is crucial in improving indoor thermal comfort in summer.

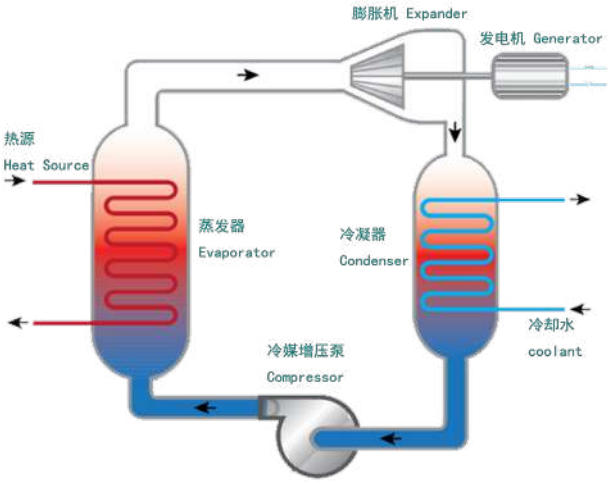
Operation and Maintenance

- **Ground source heat pump system.** The project decided to use renewable energy wherever possible after extensive discussions about energy system selection. The cold/heat source for air conditioning and domestic hot water is supplied on site mainly by a high-efficiency ground source heat pump, which is supported by air-cooled heat pumps during peak demand, and has a performance coefficient that is over 6% higher than that required by the Energy Conservation Design Standard for Public Buildings (GB 50189-2015). The ground source heat pump system has significant environmental benefits because all components are either buried underground or installed indoors, making the unit compact and space-saving and avoiding the impact of harsh outdoor climate; the system also features high degree of automatic control and can be left unattended. At the same time, the pump has a high coefficient of operation performance, which makes the units economical and energy-saving. In winter 2020, carbon emissions were reduced by 945.1 tonnes standard coal equivalent compared with traditional boiler heating.
- **Concrete canopy radiant terminal system.** Radiant heating and cooling with small temperature variation using a duct system embedded in the flooring layer. High efficiency and good comfort.
- **Fresh air replacement system.** The project adopts a full-replacement fresh air system on account of the effect of air supply temperature and vertical heat pressure. Each room gets fresh air through the air supply pipeline laid on the indoor flooring mat layer, and the return air system concentrates in the fresh air treatment air-con unit via the return air riser of each household bathroom and kitchen. To enable fresh air heating, cooling, humidifying, dehumidifying, muffling and other treatment, the fresh air unit is equipped with functional sections such as primary filtration section (G4), heat recovery section, intermediate filtration section (F7), surface cooling (heating) section, reheating section, humidification section, reheating section, air supply section, sub-efficient section (H0), and exhaust section. In locations with extreme winter and summer weather, the heat recovery section requires the selection of a panel-wing full heat recovery device with a full heat recovery efficiency of no less than 65%.
- **Rainwater recovery system.** The rainwater recycling system is used for irrigation, road and vehicle cleansing, and tap water is used to make up the difference. The application has enabled a total annual runoff control rate of over 70% on site.

In terms of energy, water, electricity, materials, and environmental protection, other green building technologies adopted in the project include: a good insulation system for envelope structure, LED infrared induction energy saving control in public areas, water saving technology such as water saving appliances, water saving irrigation, and same-level drainage, a CO monitoring system, and intelligent technology. First Living Environment Tech has upheld high quality standards and a keen eye for detail, enabling a perfect fusion of green health and intelligent technology at MOMA at Swan Lake by leveraging its technological expertise and cost optimization experience.

◎ Impact & Sustainability

First Living Environment Tech, a tech company known for its innovative technologies, has provided turnkey services to the project, ranging from design consulting, to construction to energy O&M, ensuring a high standard of delivery quality and developer recognition. Thereafter, the company has reproduced the innovative business model across a number of green- and brownfield building projects, updating the mechanisms in play along the way. The case in point is the Xi'an Wutong Apartment. First Living Environment Tech provided omni-process services to this typical brownfield retrofit, using deep geothermal technology to achieve good economic benefits while also making outstanding contributions to improving the energy structure and environmental quality on site. The turnkey services broke down management silos between design, construction and O&M, improved operational accuracy at each stage, and guaranteed post-occupancy user experience and satisfaction. Moving forward, there could be value in rolling out the mechanisms and models employed in this case in both green- and brownfield projects.



国网（苏州）城市能源研究院
物尽其用——低温余热发电技术助力高耗能行业碳达峰

◎ 案例概述

钢铁企业的烧结环冷机三段烟气和石灰窑烟气属于典型的低温烟气，平均温度均在200℃以下，一直以来，钢铁行业对于这两部分余热的回收都很有限，大量余热通过直接排放的方式放散至大气中，造成了严重的浪费。

为实现低温余热的高品质利用，国网（苏州）城市能源研究院采用高效的磁悬浮 ORC 发电机组，回收上述低温烟气中的余热进行发电。2021 年该技术开始应用于目前全国单体规模最大的钢铁企业——位于江苏张家港的江苏沙钢集团有限公司。

项目根据现场热源点分散的特点，对机组进行模块化设计、一体化组装，在现场根据热源点的实际位置采用分布式的配置方案，将总共配置 100 台 125kW 余热发电机组。项目先期 2 台 125kW 示范机组于 2021 年 1 月投入运行后，至今已持续稳定运行 9 个月。预计后续项目将于 2023 年全部建成，届时项目每年可发电 5200 万度（由沙钢负责消纳），相当于减排二氧化碳 3.7 万吨 / 年。

项目创新地采用合同能源管理 + 融资租赁的商业模式，解决了传统低温余热发电类项目投资回收期长、客户投资意愿低的问题。

◎ 项目产出

- 解决了钢铁业低温余热利用不足的问题，大大提升钢铁企业综合能效。
- 先期 2 台示范机组平稳运行 9 个月，发电量 113.4 万度，减排二氧化碳 814.4 吨。
- 项目全部建成后，预计年发电量 5200 万度，相当于减排二氧化碳 3.7 万吨。

◎ 企业简介

国网（苏州）城市能源研究院有限责任公司（简称城市能源院）由国家电网公司和苏州市人民政府联合出资组建，2017 年 8 月正式挂牌成立，是中国首个城市能源研究院。

国家电网 STATE GRID
国网(苏州)城市能源研究院
STATE GRID (SUZHOU) CITY & ENERGY RESEARCH INSTITUTE

城市能源院以“建设高端智库与国际合作双重驱动的能源产业创新孵化平台”为核心，牢牢把握城市能源研究主攻方向，开展城市能源理论、战略、技术、政策、市场和商业模式研究，支撑苏州建设国际能源变革发展典范城市，致力于成为城市能源变革整体解决方案的战略倡导者、规划引领者、实践推动者。

◎ 项目亮点

项目技术人员：“能见证低温发电技术从实验室到商业运行，对于能源电力行业的从业者来说无疑是一件兴奋的事情。”

沙钢：“本项目是在技术创新与商业模式创新共同推动下完成的，企业、投资方、社会都从中获益，项目的技术与模式值得在钢铁行业进行推广。”

◎ 项目实施

位于江苏张家港的江苏沙钢集团有限公司是目前全国单体规模最大的钢铁企业，其烧结环冷机三段烟气和石灰窑烟气属于典型的低温烟气，平均温度在 200℃以下。由于热源温度过低，传统的余热发电技术已无法进行回收。一直以来，钢铁行业对于这两部分余热的回收都很有限，沙钢原来仅对烧结环冷机三段烟气进行了部分回收，用于供应生活热水。但实际生活热水的使用量有限，每年有约 7 万吨标准煤当量的余热通过直接排放的方式放散至大气中，造成了严重的浪费。

国网（苏州）城市能源研究院针对目前的问题，针对上述低品位余热利用的问题进行了整体的项目策划。

- 以技术创新解决钢厂低温余热利用问题

本该厂的余热资源主要分布在 7 条烧结环冷机第三段、8 条石灰窑烟气及其它零星的地点，特点是余热品位低、热源点分散。

针对现场余热的特点，项目采用了高效磁悬浮有机朗肯循环（ORC）发电技术，对 200℃低温余热回收发电。针对现场余热点较为分散的问题，项目采用了模块化设计方案，每台发电机组模块额定功率为 125kW，集成在集装箱大小的空间里，可以针对现场各热源点的不同产热量进行灵活的组合。将有总计 100 台发电机组，利用热源点附近的小块空闲场地进行分布式地配置。

项目全景图

分布式模块化发电机组

100 台机组分布在厂区的不同地点，给后期的运行监测带来了一定的麻烦。为此，项目团队开发了一套智慧化的远程集采系统，所有设备的运行状态通过现场传感器采集后，实时远程传送至运维人员手机上的 APP 终端，可实现一个团队同时对多个机组的统筹精细化管理。

- 以商业模式创新解决项目投资回收期长、业主投资意愿低的问题

目前同类的 ORC 余热发电机组，投资回报期普遍在 5 年以上。在这种情况下，无论采用业主方自投，还是由第三方投资，回报期都过长。国网（苏州）城市能源研究院作为项目的总策划者，创新性地设计了一套 “合同能源管理 + 融资租赁”的商业模式，由第三方的节能公司负责项目的运营与管理。由节能公司与沙钢签订合同能源管理合约，同时与融资租赁公司签订设备融资租赁合约，由融资租赁公司购买设备并交由节能公司进行安装。设备投运后，沙钢负责消纳所发的全部电力，并按照合同约定的电费及发电量向节能公司支付电费，节能公司向融资租赁公司支付租金，待融资租赁合约期满后，再由融资租赁公司将设备所有权转交至节能公司手中。该模式避免了业主方或节能公司前期大规模资金投入，利用融资租赁的低成本资金进行建设，使得投资回收期较长的项目也具有了经济上的可实施性。

- 项目减排效益明显

项目首期建设的两台 125 示范机组自 2021 年 1 月投产至今 9 个月，运行情况良好，共发电 113.4 万度，相当于减排了二氧化碳 814.4 吨。全部 100 台机组建成后，按照每台机组净输出电量 105kW，年利用 5000 小时计算，每年可发电 5200 万度度，以华东电网碳排放系数 0.7182kgCO_2/kWh 计算，每年可减排二氧化碳 3.7 万吨。

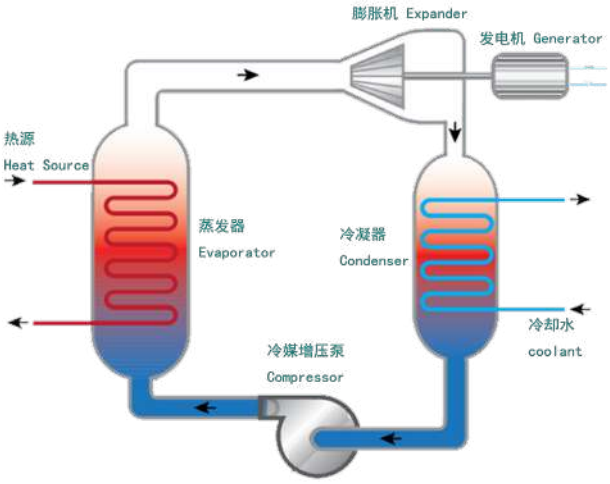
◎ 项目重要影响及可持续性

项目采用了高效的磁悬浮 ORC 发电技术，将钢铁行业中难以利用的 200℃以下低温余热进行了回收再利用，项目采用的磁悬浮发电机组，热电转换效率可达传统螺杆式发电机组的 2 倍，并且省去了润滑系统的维护，大大降低了后期运维的成本。

项目采用的模块化设计、一体化组装、分布式配置的方案，充分地适应了钢铁企业生产特点和现场条件，为项目的顺利实施提供了保证。

项目创新采用了“采用合同能源管理 + 融资租赁”的商业模式，解决了传统低温余热发电类项目投资回收期长、客户投资意愿低的问题，有利于技术的大规模推广。

除钢铁行业以外，ORC 发电技术还可用于石化、化工、冶金、水泥等高耗能行业领域。我国高耗能行业每年能源消费达 20 亿吨标准煤，产生低温余热约 3.2 亿吨标准煤当量，按照 10% 可回收余热量计算，年二氧化碳减排潜力可达 1.18 亿吨，相应市场规模在 60000 亿元以上。



State Grid (Suzhou) City & Energy Research Institute

Low-Temp Residual Heat Power Generation Technology in Aid of Carbon Peaking in High Energy-Consuming Industries

◎ Case Overview

The third-section flue gas and lime kiln flue gas from sintering ring coolers of steelmaking plants are typical low-temperature flue gas with average temperature below 200°C. Steelmakers have historically had limited capacity for recovering waste or residual heat from these two areas, with a large amount of waste heat discharged into the atmosphere by direct emission, resulting in serious wastage.

State Grid (Suzhou) City & Energy Research Institute has adopted high-efficiency magnetic levitation ORC generator sets to recover the waste heat from the low-temperature flue gas described above for power generation in order to improve the quality of low-temp waste heat usage. This technology has since been applied to Jiangsu Shagang Group Co. Ltd., China's largest steelmaking plant, in 2021.

The project has catered to the scattered heat sources on site with a modular design and integrated assembly of the units, where a distributed configuration plan is adopted on site based on the actual location of the heat sources, covering a total of 100 125kW waste heat generating units. Since their launch in January 2021, the first two 125kW demonstration units have been in stable operation for nine months. The subsequent waves are expected to be completed in 2023, by which time the project will have a power generation capacity of 52 million kWh per annum (consumption of which will be the sole responsibility of Shagang), equivalent to a 37,000 tonnes of CO_2 reduction per year.

The project has been carried out using an innovative business model that included contract energy management plus financing leasing, addressing the long payback period of traditional low temperature waste heat power generators and apprehension of prospective investors.

◎ Company Profile

State Grid (Suzhou) City & Energy Research Institute (CEI) is the first urban energy research institute in China, funded in August 2017 by State Grid Corporation and the Suzhou Municipal People's Government.

国家电网
STATE GRID
国网(苏州)城市能源研究院
STATE GRID (SUZHOU) CITY & ENERGY RESEARCH INSTITUTE

CEI's mission is to "build an incubation platform for high-end think tank-driven innovation in the energy industry", and it is committed to facilitating Suzhou become a model city for international energy reform and growth through research in urban energy theory, strategy, technology, policy, market and business model.

◎ Project Outcome

- It addresses insufficient utilization of low-temperature waste heat in the steel industry and greatly improves the overall energy efficiency of steelmakers.
- For the past nine months, the first two demonstration units have been running smoothly, generating 1.134 million kWh of electricity and reducing 814.4 tonnes of CO_2.
- Upon full completion, annual power generation is expected to reach 52 million kWh, which is equivalent to a reduction of 37,000 tonnes of CO_2.

◎ Project Highlights

"It is undoubtedly an exciting event for professionals in the energy and power industries to witness the cryogenic power generation technology to go from the laboratory into commercial application."

----- on-site technician

"The project was completed as a result of technology and business innovation, from which businesses, investors and society as a whole profited. Rolling out the technologies and business model to the steelmaking industry could potentially pay dividends."

----- Shagang

◎ Project Implementation

Jiangsu Shagang Group Co. Ltd., located in Zhangjiagang of Jiangsu province, is by far the largest steelmaker in China. The third-section flue gas and lime kiln flue gas from its sintering ring coolers are both typical low-temperature flue gases with average temperature below 200°C. Due to the low-temperature nature of the heat source, the residual heat could no longer be recovered using the traditional waste-heat power generation technology. Steelmakers historically have had limited capability for recovering waste or residual heat from these two areas, and Shagang originally only collected a portion of the flue gas from the third section of the sintering ring cooler to supply domestic hot water. However, the actual use of domestic hot water is limited, and every year, approximately 70,000 tonnes of standard coal equivalent waste heat is discharged into the atmosphere through direct emissions, resulting in serious waste.

In response to the problem at hand, CEI has devised an overarching plan to address the above-mentioned low-grade waste heat utilization problem.

- Using technological innovation to address low-temp waste heat utilization in steel mills

  The plant waste heat includes mainly flue gas from the third section of seven sintering ring coolers and eight lime kilns and other scattered locations with low grade and scattered heat sources.

  In this context, the project has adopted high-efficiency magnetic levitation organic Rankine cycle (ORC) power generation technology to recover low temperature waste heat at 200 for power generation. To address the problem of scattered waste heat sources on site, a modular design scheme was used, with each generator set module rated at 125kW and integrated in a container-sized space, allowing for flexible combinations based on the varying levels of heat produced at individual heat sources on site. A total of 100 generator sets will be mobilized in a distributed configuration at a small vacant site near the heat source.

Panoramic view of the project site

Distributed modular generating units

  The 100 units are distributed across the plant, which could cause some monitoring trouble once the site goes operational. As such, the project team has developed a set of intelligent remote collection system, where the operating status of all equipment is collected by on-site sensors and remotely transmitted in real time to the APP terminal on the cell phones of operation and maintenance personnel, enabling simultaneous, coordinated and granular management of multiple units by one team.

- Using business model innovation to address long payback periods and owner-investor apprehension

  Currently, the payback period of similar ORC waste heat generating units is five years or more, which is excessive from the standpoint of both owner-investors or third party investors. As the mastermind behind the project, CEI has devised an innovative business model featuring contract energy management with financing leasing, whereby a third-party energy-saving company is responsible for the operation and management of the project and signs an energy management contract with Shagang, an equipment financing leasing contract with a financial leasing company, which will purchase the equipment and hand it over to the energy-saving company for installation. Following the installation of the equipment, Shagang will be responsible for consuming all of the generated electricity and covering the cost of electricity for the energy-saving company at the contracted power rate for the amount of electricity generated, while the energy-saving entity pays rent to the finance leasing company, which will transfer title to the equipment to the energy-saving entity upon the expiration of the financial leasing contract. This model avoids exorbitant capital outlays by the owner or energy-saving company, and leverages the low-cost capital via financing leasing for construction, turning projects with a long payback period financially viable.

- Visible emission reduction benefits

  The two 125 demonstration units built in Phase I have been operating well for nine months since they went operational in January 2021, generating a total of 1,134,000 kWh of electricity and reducing emissions by 814.4 tonnes of CO_2. Upon the completion of all 100 units (assuming a net output of 105kW per unit and annual utilization of 5,000 hours), 52 million kWh of electricity can be generated per annum, which works out to 37,000 tonnes less CO_2 emissions each year based on East China Power Grid's carbon emission factor of 0.7182kg CO_2/kWh.

◎ Impact & Sustainability

The project adopts the highly efficient magnetic levitation ORC power generation technology, which recovers and reuses low-temperature waste heat below 200°C, which has traditionally been a challenge in the steelmaking industry. The magnetic levitation generator set used in the project can have a thermoelectric conversion efficiency twice that of a traditional screw generator set, without the need for maintenance of the lubrication system, greatly reducing the cost of maintenance once the sets are operating.

The project's modular design, integrated assembly and distributed configuration are fully adapted to the production traits and site conditions of steelmakers, safeguarding the smooth implementation of the project.

The project adopts an innovative business model featuring contract energy management with financing leasing, which solves the problems of long payback period and investor apprehension of traditional low-temperature waste heat power plants and facilitates the wider rollout of the technology.

In addition to the steelmaking sector, the ORC power generation technology could be applied in petrochemical, chemical engineering, metallurgical, cement and other high energy-consuming industries. China's high energy-consuming industries consume 2 billion tonnes of standard coal each year, generating 320 million tonnes of low-temperature waste heat. Assuming that 10% of waste heat is recoverable, this indicates to a possible decrease in CO_2 emission of up to 118 million tonnes per year, and the corresponding market scale of over CNY6 trillion.

杭州超腾能源技术股份有限公司
COP15 大会碳中和行动方案

◎ 案例概述

杭州超腾能源技术股份有限公司自 2020 年起积极参与协助 COP15 大会（《生物多样性公约》缔约方大会第十五次会议）筹备工作，全力配合云南省、昆明市 COP15 大会筹备工作组，开展会议碳中和顶层谋划工作。杭州超腾承担了本次 COP15 大会碳中和计划、绿色办会工作指南等编制工作。

在 COP15 大会筹备阶段，我方就大会筹备阶段与举办阶段的温室气体排放进行了预估，预计产生二氧化碳 2.4 万吨左右，并将在大会第一阶段和第二阶段结束后分别进行实际产生温室气体排放量的核算工作。大会的碳中和将通过新建林业项目的方式实现，目前规划和已实施的人工造林项目总规模达 36073 亩。大会在筹备与举办阶段采取了积极的绿色办会措施，从而降低交通、会场、住宿等多个领域的排放。

◎ 企业简介

杭州超腾能源技术股份有限公司成立于 2006 年，注册资金 3990 万元。公司从成立之日起，以“气候经济先行者、低碳综合服务商”为目标，专注于低碳服务行业，是一家面向政府和企业提供信息服务 + 平台建设整体解决方案的创新科技型企业。经过 15 年的发展，公司形成了遍布华东、华南、华北、华中、西南的全国性服务网络，现设有 20 余个分子公司，为客户提供优质全面的服务，取得了耀眼的成就，已成为行业领跑者。

◎ 项目产出

- 完成了昆明市 COP15 碳中和行动方案编制和对二氧化碳排放情况预估，并提出了解决方案；
- 完成了 COP15 绿色办会工作指南的编制工作，为会议筹备工作提供了碳减排方面的技术参考；
- 为 COP15 提供了全程碳中和服务保障。

◎ 项目亮点

项目通过核算会议碳排放并购买新建林业项目碳配额进行抵消的方式、以及开展绿色会场、绿色交通、绿色住宿、绿色城市建设以及绿色宣传等减排行动，实现云南昆明 COP15 的碳中和及绿色办会目标，也为国内其他大型活动碳中和提供了示范样本。

◎ 项目实施

项目背景：

COP15 大会实施会议碳中和行动，一方面是落实联合国生物多样性大会的相关要求与规定，尽量减少并酌情抵消会议对环境的影响。另一方面是践行此次大会绿色、安全、智慧、节俭的理念。受全球疫情影响，COP15 大会延期，整个筹备阶段跨度为 2019 年至 2021 年，大会第一阶段于 2021 年 10 月 11 日 -15 日成功举办，第二阶段会议将于 2022 年 4 月 25 日 -5 月 8 日在昆明举行，届时将达成 2020 年后全球生物多样性框架。

项目方案实施内容：

1. **COP15 大会碳排放量预测**

本次 COP15 大会温室气体排放量预估的排放边界界定为大会筹备阶段、举办阶段（阶段一、阶段二），排放源包括因本次大会筹办、举办所产生的交通、住宿、餐饮、会场用电、会议消耗品和废弃物等产生的温室气体排放。根据预估测算，COP15 期间预计共产生约 23962 吨二氧化碳。其中，航空运输、道路运输等整个交通运输预计共产生约 18950 吨二氧化碳，酒店住宿预计产生约 3597 吨二氧化碳，餐饮预计产生约 1277 吨二氧化碳，会场用电及会议用品预计产生约 95 吨二氧化碳，废弃物预计产生约 43 吨二氧化碳。针对预估的碳排放量，我们准备了 COP15 大会的碳中和行动方案和绿色办公工作指南。

同时，COP15 大会筹备办鼓励通过开展绿色交通、绿色住宿、绿色会场、绿色宣传等手段，降低会议举办阶段能源消耗，提高用能效率，减少温室气体排放。

2. **COP15 绿色办会工作指南编制**

低碳办会是昆明 COP15 大会碳中和工作的重要组成部分，昆明作为会议主办方秉承绿色低碳可持续发展的精神，将绿色、安全、智慧、节俭的理念贯穿筹办、举办和会后利用全过程。杭州超腾组织编制《COP15 绿色办会工作指南》，在绿色交通、绿色住宿、绿色餐饮、绿色会场、绿色会务、绿色宣讲等方面提出相应的减排措施，包括：大会会场将提供桶装饮用水，玻璃杯或陶瓷杯，并鼓励与会人员自带水杯，尽量减少塑料饮用水瓶和一次性纸杯的使用；选用新能源或清洁能源车辆、公共交通和共享单车等为与会代表提供交通服务；通过会议官网、APP、微博等社交媒体定期推送绿色、环保、生态办会的理念、方法和成效等。目前，在 COP15 大会第一阶段减排措施落实到位，成效显著。

3. **COP15 大会碳排放量核算**

会议举办结束后，我方将对会议涉及的交通、住宿、餐饮、会场、废弃物等各个领域实际产生的碳排放数据进行收集与核算，完成《COP15 碳中和核查报告》，并配合相关机构完成《昆明 COP15 碳中和计划第三方评价报告》。截至 2021 年 10 月，COP15 大会第一阶段已经落幕，第一阶段温室气体排放核算工作正在进行当中。第二次核算工作将于第二阶段结束后开展，将根据《COP15 碳中和核查报告》的排放量，通过新建碳汇林的方式来抵消本次会议筹备、举办过程中产生的温室气体排放量，最终实现 COP15 大会碳中和，践行零碳办会理念。

◎ 项目重要影响及可持续性

从国际角度，实施 COP15 会议碳中和是落实联合国生物多样性大会的相关要求。中国政府与《生物多样性公约》秘书处关于《生物多样性公约》缔约方大会第十五次会议达成的东道国协议第三条第 6 款的要求“尽量减少并酌情抵消会议对环境的影响”。因此云南省昆明市 COP15 大会为履行该要求，对大会开展碳中和项目。同时这也是用实际行动践行此次大会的“生态文明”主题，保护我们的共同家园，为实现人类可持续发展作出贡献，向国际社会展现中国精神，彰显中国担当。

从国家角度，实践会议碳中和是对国家应对气候变化工作与力争 2060 年实现碳中和工作的落实。以生态环境部颁布的《大型活动碳中和实施指南（试行）》为规范标准，积极贯彻落实 COP15 大会绿色办会理念，开展相关节能减排工作，打造零碳会议，为云南省乃至国家大型活动碳中和提供示范样本。

从云南省与昆明市角度，开展会议碳中和是昆明市作为主场城市对绿色生产和生活方式的积极践行，对带动全国发展绿色低碳文化具有示范作用。

Hangzhou Chaoteng Energy Technology Co., Ltd.

Carbon Neutrality Action Plan for COP15 UN Biodiversity Conference

◎ Case Overview

Hangzhou Chaoteng Energy Technology Co, Ltd. has been actively participating in the preparations for COP15 UN Biodiversity Conference since 2020, during which, it fully cooperated with the preparatory group of COP15 in Yunnan Province and Kunming City, and carried out the overall planning work for the event's carbon neutrality. Specifically, Hangzhou Chaoteng undertook the development work of the Carbon Neutrality Plan and the Green Conference Implementation Handbook for COP15.

In the preparatory stage of COP15, Hangzhou Chaoteng estimated the all-phase carbon emissions of the Conference, which is expected to be 24,000 tons. We will calculate the actual CO_2 emissions respectively after the first and second parts of the Conference. Carbon neutrality will be achieved through new forestry projects. At present, the total scale of artificial afforestation projects planned and implemented has reached 24 km2. In addition, in the preparatory stage and during the first part of the COP15, a set of green events measures were adopted to reduce emissions in transportation, venue, accommodation and other areas.

◎ Project Outcome

- Completed Kunming COP15 CO_2 emissions estimates and developed the Carbon Neutrality Action Plan with solution proposed;
- Developed the Green Conference Implementation Handbook, providing technical assistance to emission reduction measures for COP15;
- Provided omni-process carbon neutral services for COP15.

◎ Company Profile

Hangzhou Chaoteng Energy Technology Co., Ltd. was established in 2006, with a registered capital of 39.9 million yuan. Since its establishment, the company has aimed at becoming the pioneer of climate economy and low-carbon integrated service, with full focus on low-carbon service. It is now an innovative technology-based enterprise, offering information services and platform development of the overall solution to government and enterprises. After 15 years of development, the company has formed a national service network throughout East, South, North, Central and Southwest China, providing customers high-quality comprehensive services through more than 20 molecular companies.

◎ Project Highlights

This project achieved Carbon Neutrality and Green Conference objectives of Kunming COP15 through carbon emission accounting and cancelation, and measures including green venue, green transportation and accommodation, green urban construction as well as green advocacy. It provides a carbon-neutral event demonstration for other large-scale activities nationwide.

◎ Project Implementation

Project Background

The Carbon Neutrality Action Plan of COP15, on the one hand, is to fulfill the requirements and regulations of the United Nations Biological Diversity Conference that asks to minimize and offset the impact of the conference on the environment. One the other hand, it is a practice of the green, safe, intelligent, and frugal concepts of the conference. Due to the impact of the global pandemic, COP15 was postponed, and the preparation work spans from 2019 to 2021. The first part of COP15 was successfully held from October 11 to 15, 2021, and the second part will take place from April 25 to May 8, 2022 in Kunming, where the post-2020 global biodiversity framework is expected to be reached.

Project Implementation

1. **COP15 carbon emissions estimation**

   The carbon emission accounting boundary of COP15 is defined as the preparatory stage and the conference stage (Part I and II). Its sources of emissions include transportation, accommodation, catering, venue electricity use, conference consumables and waste generated from the preparation and organization of the conference. The total CO_2 emission is estimated to be 23,962 tons, consisting of 18,950 tons from transportation including air and road, 3,597 tons from hospitality and accommodation, 1,277 tons from catering, 95 tons from electricity use and conference supplies, and 43 tons from waste. Based on the estimates, we developed the COP15 Carbon Neutrality Action Plan and Green Conference Implementation Handbook.

   In addition, the COP15 Preparatory Office encourages the practice of green transportation, green accommodation, green venues and green campaigns to reduce the energy consumption and carbon emission during the conference.

2. **Green Conference Implementation Handbook developmen**

   Emission reduction is a key component is of the COP15 Carbon Neutrality Action Plan. Upholding the principles of green, low-carbon and sustainability, the host City Kunming has been preparing and holding COP15 in a green, safe, intelligent, and frugal manner. Hangzhou Chaoteng developed the Green Conference Implementation Handbook for COP15, and proposed emission reduction measures in areas of transportation, accommodation, catering, venue, conference service, and education. A few examples are: minimize the use of plastic bottles and disposable paper cups by providing glass and cups at the venue and encouraging participants to take their own cups; use new energy vehicles, publish transport and shared bicycles to provide transportation service to conference attendees; leverage COP15 official website, APP, Weibo account and other social media to promote green and low-carbon practices. As of the conclusion of the first part of COP15, the emission reduction and green conference measures had been successfully implemented.

3. **COP15 carbon emission accounting**

   Hangzhou Chaoteng is responsible for calculating the overall carbon emission of COP15, compiling the COP15 Carbon Neutrality Verification Report, and working with a third party to complete the Kunming COP15 Carbon Neutrality Plan Assessment Report. As the first part of COP15 wrapped up in October 2021, we have taken off the carbon accounting process for Part I. the carbon accounting work for Part I will begin as soon as the second part of COP15 is concluded. The verified carbon emissions of COP15 in the preparation and conference phase will be canceled through new forestation projects.

◎ Impact & Sustainability

From an international perspective, the carbon neutrality project of COP15 meets the requirements and regulations of the United Nations Biological Diversity Conference. In order to fulfill the requirements of Article 3, Paragraph 6 of the agreement between the host country and the Secretariat of COP 15, Kunming City of Yunnan Province, carried out the COP 15 Carbon Neutrality Action Plan. Meanwhile, this project is part of the “ecological civilization” theme of COP15, showing the initiative and responsibility of China to the international community.

From a national perspective, the carbon neutrality project is a response to the national 2060 carbon neutrality target and China’s efforts in address climate change. Following the "Carbon Neutrality Implementation Guidelines for Large-scale Events (Trial)" released by the Ministry of Ecology and Environment, Kunming COP15 implemented energy saving and emission reduction measures to deliver a zero-emission conference, which sets an example to provincial and even national level events.

From a regional perspective, the carbon neutrality project is a practice of green production and green lifestyle culture of the COP 15 host city, Kunming. It plays a demonstrative role in cultivating the culture of green and low-carbon development nationwide.

南京天加环境科技有限公司
建筑制冷系统综合能效提升与投资创新模式

◎ 案例概述

《中国高效空调制冷机房发展研究报告（2021）》显示，建筑能耗占社会总能耗 35%，制冷系统占建筑能耗 50%，制冷用电量占全社会用电量 15% 以上，且耗电量年均增速 20%。在大型建筑和工业环境中，制冷行业普遍存在综合能效低的现状。天加针对大型建筑与工业环境制冷机房系统能效低这一重大难题，创新建筑制冷系统综合能效提升与投资创新模式，克服制冷行业能效低与投资回收期长的两大问题。以广州地铁新塘车站为样本单元，推广至轨道交通，大型市政建筑，大型场馆（如机场、高铁站等）、并延伸至大型建筑楼宇（如医院、商场、写字楼、酒店等），以及应用于专业工业制程环境的新建与旧项目改造中。本项目 2019 年获得国家发改委节能中心颁发的《重点节能技术应用典型案例（2019）》证书，是全国所有行业中，申报 356 个的项目中评选出的 16 个典型节能案例之一，是暖通行业中唯一获奖的典型项目。

◎ 企业简介

天加创立于 1991 年，致力于成为全球领先的智慧洁净环境及绿色能源的系统供应商和服务商，是空气洁净极端环境制程的中国市场领导者，建筑以及工业环境节能的践行者，低温发电和绿色再生能源的开拓者。旗下拥有全球最大磁悬浮冷水机组加拿大品牌 SMARDT，并已成为世界第三的 ORC 低温发电企业。天加以绿色减排为己任，积极响应“双碳”政策，为客户提供高效经济的节能解决方案，是中国地铁最大的中央空调供应商，市场占比高达 30%。天加注重绿色发展，首家荣获住建部“绿色工业建筑三星认证”，联合国首批“淘汰 HCFC”的签约企业，引领清洁能源转型。

◎ 项目产出

1. 节能减排，收益明显

（1）轨道交通如，广州地铁新塘站年节约用电约 76.4 万度，单个站点每年可减少碳排放约 636 吨。

（2）建筑环境如，南京金鹰旧楼改造，全年节能超 35%，全年节电约 142 万度，减少碳排放 1181.44 吨，按照工业用电 0.9 元 / 度的标准，每年可以节约电费 128 万元，数据得到三方（金鹰，天加，国家通用检测院）监测。

（3）工业环境如，长春金赛药业（生物制药工厂）中央空调系统经过天加改造后，节能率达到 44%，单日节电 4000 度。

2. 减少冷媒使用量，减少温室气体排放

（1）2015 年，天加成为工商制冷空调行业 HCFCs 淘汰管理计划下，第一家通过环保部验收完成履约的企业。

（2）2017 年，《关于消耗臭氧层物质的蒙特利尔议定书》缔结三十周年纪念大会上，天加受联合国组织的高度赞扬，荣获保护臭氧层认可荣誉证书。

◎ 项目亮点

中国勘察设计协会建筑环境与能源应用分会会长罗继杰表示，该项目第一追求实用性创新、落地式创新的理念，产生了节能减排、绿色环保的积极影响；第二是该制冷系统充分利用了各个节点的数据采集，创新大数据利用，改善了系统组合、配置，值得全行业学习。

◎ 项目实施

天加关注空调设备自身的能效，更重视系统其他方面的节能潜力。天加模式从通过设备技术优选、系统设计优化、系统电控集成、主动寻优电控对部分负荷管理、BIM 建模与工程工厂化预制、多方共同实时监测等多方面考虑，提出了全生命期角度的超高效节能制冷系统。以 2019 年启动的南京新街口金鹰改造机房项目为例：

- 原有六台开利离心机，将其中一台替换成能效更高的 SMARDT 磁悬浮冷水机组；
- 更换高效水泵，降低水泵自身的能耗；
- 更换原有冷却塔填料，提高冷却塔能效；
- 水泵增加变频器，实现变频控制功能；增加系统必要的传感器，实现实时数据采集功能；增加必要阀门，实现对应系统设备管路调节和截止控制；
- 增加空调冷源机房深度节能控制系统，实现一键控制、主动寻优、数据记录分析等功能。

整个制冷季节能率达到 35.19%（超过当时理论计算的 31.53%）。

磁悬浮冷水机组

空调冷源机房深度节能控制系统

1. 创新的超高效制冷系统节能技术解决方案

经过中国制冷工业协会主导的国家级专家团队（中国科学院院士何雅玲、中国勘察设计协会建筑环境与设备分会理事长罗继杰，合肥通用机电产品检测院院长李江等）鉴定，机房年平均综合能效比大于 6.7（目前国内 SCOP 值 3.0-4.2，美国 SCOP 值 3.5-4.5），被评定为国内首创、国际领先。

（1）创建了一种自主寻优控制算法。可自动预测负荷变化趋势，控制系统自动连接国家气象网，结合云端自学习算法，自动预测负荷变化趋势。基于机组运行的大数据分析和创新的控制算法，实现了自主寻优节能运行和维护控制。

（2）创新的提出了 EC 风机技术 + 可变风路式相结合的技术。独创轨交行业首个超高效组合式空调机组，攻克了大风量段空调机组漏风率高、能效不高、过渡季运行内部阻力不可减少的关键技术难题。

（3）全直流磁悬浮冷水机组是全球最先进的磁悬浮冷水机组产品，在部分负荷运转时比传统螺杆或离心式冷水机节能 35%，维护成本节省 50%。磁悬浮冷水机组 100% 无油润滑，维护简单、高效节能，代表行业未来的发展方向。

（4）系统设计最优化：国内首次采用了基于负荷预测的压缩机容量和台数直接控制技术；并对蒸发器、冷凝器、冷却塔、水泵、末端等部件进行深度优化，综合能效显著提升。

2. 创新的财务投资理念

天加全生命期成本最低解决方案，采用“合同能源管合（EMC）”的商业模式，与愿意进行成本最低改造的客户签订节能服务合同，向客户提供能源效率审计、节能项目设计、原材料和设备采购、施工、培训、运行维护、节能量监测等一条龙综合性服务，并通过与客户分享项目实施后产生的节能效益成果来赢利和滚动发展。

3. 创新的监测机制及灵活财务投资机制

为了建立行业信用机制，该模式建立了由用户方、系统及设备供应方、权威第三方共同监测的平台，使节能数据真实且透明。客户可选择全部或部分使用设备一次性买断模式或 “合同能源管理（EMC）”模式，通过灵活的投资方式与客户风险共担、节能收益共享。节能是最大的新能源。

◎ 项目重要影响及可持续性

国内与国际的建筑环境与工业环境，普遍存在综合能效低的状况，制冷改造空间大。该模式提出的创新性超高效制冷系统节能技术解决方案、监测机制和灵活财务投资机制以及成功运用的案例实践具有普遍的国内与国际推广价值，可有效降低电网负荷解决限电问题并推动行业诚信体系建设。

1. 目前中国建筑的制冷机房的平均综合能效（SCOP）仅有 3.0-4.2，均值为 3.6，而美国平均综合能效（SCOP）也仅为 3.5-4.5，均值为 4.0。天加通过高效冷水机组与系统优化设计、高效运维结合，实现综合能效（SCOP）达 6.7，相比中国平均水平可，提升 80% 的节能效率，相比美国，提升 65% 的节能效率。

2. 建立由用户方、设备方、国家级第三方检测机构（如：合肥通用研究院检测院）三方共同云端不间断的数据监测以及视频监控平台，所有相关运营数据无法篡改，让客户的节能数据真实可见。并可采用“合同能源管理（EMC）”的商业模式，与用户签订节能服务合同，投资回收期可缩短至 3 年左右。

目前与全国 70 多条地铁线路的建筑环境项目接洽中，在全国几百个建筑楼宇与工业制程环境，以及境外十余个国家的项目中，拟复制天加高效机房的成功模式。国际上，应用天加系统旗下 SMARDT 的新加坡 Alexandra Point 大厦改造项目，获新加坡绿色建筑最高荣誉——绿色建筑铂金奖（BCA Green Mark Platinum）。

TICA

Innovating HVAC System and Investment Pattern to Boost Energy Efficiency

◎ Case Overview

In accordance with the Development Report on China's Equipment Rooms Equipped with Highly Efficient Air Conditioner (2021), building energy consumption accounts for 35% of total energy consumption in society. Heating Ventilation Air Conditioning (HVAC) systems consume 50% of building energy. Electricity consumption for HVAC accounts for more than 15% of total electricity consumption in society, with a 20% annual growth rate on average.

The HVAC industry generally has a low energy efficiency in large buildings and industrial environments. This project offers a sustainable solution to low efficiency in HVAC plant room systems in large buildings and industrial environments. To address the two major challenges the HVAC industry is facing—low efficiency and long investment payback periods—the project presented innovative approaches to improve energy efficiency and apply innovative investment patterns. By using the Xintang Station of Guangzhou Metro as an example, the model can be further applied in rail transit, large civic buildings, large venues (such as airports and high-speed rail stations), large buildings (such as hospitals, shopping malls, office buildings, and hotels), and even professional scenarios. The National Energy Conservation Center of the National Development and Reform Commission awarded this project the "2019 Typical Cases of Application for Key Energy-Saving Technologies" certificate. It is one of 16 award winners from 356 competing projects from all industries in China. It is also the only award-winning project in the HVAC industry.

◎ Company Profile

TICA, established in 1991, is committed to becoming the world's leading system supplier and service provider for smart clean environment and green energy. It is the Chinese market leader in the production of extreme environments with clean air, the practitioner of energy conservation in construction and industrial environment, and the pioneer of low-temperature power generation and green renewable energy. It owns the world's largest maglev chiller Canadian brand SMARDT, and has grown to become the world's third ORC cryogenic power generation company. TICA's aim is to reduce green emissions and actively responds to carbon peak and neutrality to provide customers with efficient and cost-effective energy-saving solutions. It is China's largest central air-conditioning supplier, with a market share of up to 30%. TICA pays attention to green development and leads the transition to clean energy. It is the first company to be awarded the "Three-Star Green Building Label" from the Ministry of Housing and Urban-Rural Development (MOHURD) and the first batch of contracted enterprises to "eliminate HCFC" from the United Nations.

◎ Project Outcome

1. **Obvious benefits from energy conservation and emissions reduction**
   (1) Rails: Xintang Station of Guangzhou Metro, for instance, has achieved annual electricity savings of about 764 MWh. Carbon emissions from a single station were reduced by about 636 tonnes (national average). By the end of 2020, the total operating mileage of Guangzhou Metro reached 510 km, covering 14 lines and 271 stations. If all stations adopt this solution, annual greenhouse gas emissions might be reduced by about 170,000 tonnes.
   (2) Buildings: One example is the reconstruction of Xinjiekou Golden Eagle Center in Nanjing. Three bodies monitor the data (Golden Eagle, TICA, and Hefei General Machinery & Electrical Products Inspection Institute). Annual energy consumption was reduced by more than 35 percent, with about 1420 MWh of electricity saved.
   (3) Industrial environments: For example, TICA modified the central air-conditioning systems at GenSci (biopharmaceutical facilities). Energy savings reached 44%, with a daily electricity savings of 4,000 kWh.
2. **Less refrigerant, fewer carbon emissions**
   (1) In 2015, TICA became the first enterprise in China to meet the HCFC Phase-out Project's standards.
   (2) TICA was highly recongized by United Nations organizations in 2017 during the 30th anniversary conference of the Montreal Protocol on Substances that Deplete the Ozone Layer (the Montreal Protocol) for its relentless efforts and valuable contributions to ozone protection. It was awarded a certificate of honor.

◎ Project Highlights

According to Luo Jijie, president of the Building Environment and Energy Utilization Branch of China Engineering and Consulting Association, the project pursues the concept of practical innovation and ground-based innovation, which has a positive impact on energy saving, emission reduction, and green environmental protection. This HVAC system fully utilizes data collecting from various nodes and makes novel use of big data, which improves system combination and configuration. It is worth learning for the whole industry.

◎ Project Implementation

People usually only focus on the energy efficiency of air-conditioning devices, ignoring the energy-saving potential of other aspects within the entire system. This project proposed a lifecycle super-high-efficiency HVAC system that considers a broad range of factors, such as equipment and technology optimization, system design optimization, system electric control integration, electric control dynamic optimization for partial load management, BIM, and prefabrication, and multi-party real-time monitoring.

Take Nanjing Xinjiekou Golden Eagle Reconstruction Computer Room Project (launched in 2019) as an example:

- One of the six original Carrier centrifuges was replaced with a more energy-efficient SMARDT oil-free inverter centrifuges chiller;
- The high-efficiency water pump was replaced to reduce the energy consumption of the water pump itself;
- The original cooling tower packing was replaced to improve the energy efficiency of the cooling tower;
- Increase the frequency converter of the water pump to realize the frequency conversion control function; increase the necessary sensors of the system to realize the real-time data collection function; increase the number of valves required to realize pipeline adjustment and cut-off control for the corresponding system equipment;
- Install a deep energy-saving control system for the air conditioning cold source computer room, allowing for one-button control, active optimization, data recording, and analysis.

The entire cooling season energy rate was 35.19% (more than 31.53% theoretically calculated at that time).

1. **Innovative, super-high-efficiency, energy-saving technical solution**

   Based on evaluations by national experts led by the China Refrigeration and Air-conditioning Industry Association (Academician of Chinese Academy of Sciences He Yaling, Director-General of Building Environment and Equipment Branch of China Engineering and Consulting Association Luo Jijie, President of Hefei General Machinery & Electrical Products Inspection Institute Li Jiang, and others), the average annual SCOP of the plant room is higher than 6.7. (Currently, the SCOP in China and the US is 3.0-4.2 and 3.5-4.5, respectively.) As a result, it is accredited as the best in China and leads at an international level.

   (1) TICA developed the solution with a dynamic optimization control algorithm. The control system can automatically predict load change trends because it automatically connects to the national meteorological network and employs the cloud's self-learning algorithm. Based on big data analysis of unit operations and an innovative control algorithm, the project can implement dynamic optimization that saves energy and facilitates maintenance and control.

   (2) The project ingeniously proposed a model based on "EC fan technology + variable ventilation circuit". The ground-breaking high-efficiency modular unit used in rail transportation addresses the technological challenges of large air flows, including high air leakage rates, low energy efficiency, and internal resistance that are difficult to reduce during transitional seasons.

   (3) The Full DC magnetic suspension water chiller is the world's most advanced. Under a partial load, it saves 35% more energy than conventional screw chillers and centrifugal chillers, reducing maintenance costs in half. The magnetic suspension water chiller does not require a lubricant and features easy maintenance and energy efficiency, promising future developments in this field.

   (4) The water chiller also features an optimized system design. The system, which is being used for the first time in China, directly controls the compressor capacity and quantity based on a predicted load. Components such as the evaporator, condenser, cooling tower, water pump, and air-side devices are all optimized to substantially improve the overall energy efficiency.

2. **Investment and cost savings**

   Focusing solely on maximising energy efficiency will lead to high investment costs and long payback periods, making the solution difficult to replicate and generally infeasible. This solution ensures compatibility between general units and high-efficiency units (general units carry two-thirds of the load, while high-efficiency units carry one-thirds of the load) for a more reasonable financial investment. Users immediately observe an improvement in energy efficiency and the lowest lifecycle cost for the HVAC system. This applies to both plant room construction and retrofitting for both new and existing building and industrial environments.

3. **Innovative monitoring and flexible investment mechanisms**

   To establish an industrial credit mechanism, this project set up a jointly monitored platform by the user, the system and equipment provider, and an authorized third party to ensure the authenticity and transparency of energy efficiency data. Customers can choose the equipment from a one-time buyout model (in whole or part) or a "Energy Performance Contracting (EMC)" model. Based on this credit mechanism, a flexible investment method was generated, allowing all kinds of investors to participate with a transparent decision tool and share the risks and benefits of energy efficiency with customers. Energy conservation is the largest source of new energy.

◎ Impact & Sustainability

The domestic and international HVAC industry has generally low energy efficiency in large buildings and industrial environments, resulting in a huge market for HVAC renovation. This project will have a positive impact on the power curtailment problem via its innovative efficient HVAC system high-tech solution and contribute to the establishment of an industry norm of credibility through its innovative monitoring and flexible investment mechanisms.

1. Nowadays, the average System Coefficient of Performance (SCOP) of HVAC plant rooms in Chinese buildings is only 3.0–4.2 (mean: 3.6). In the US, it is only 3.5–4.5 (mean: 4.0). Using efficient chillers, optimized system design, and efficient O&M, TICA can achieve a SCOP of up to 6.7, which equates to an 80 percent energy efficiency improvement in China and a 65% energy efficiency improvement in the US (compared to the mean value, respectively).
2. A cloud-based platform managed by users, equipment providers, and state-run institutions (for example, Hefei General Machinery & Electrical Products Inspection Institute) has been established to allow for 24-hour data monitoring and video surveillance, preventing the falsification of operational data. This ensures the accuracy of energy conservation data. Additionally, using an Energy Performance Contracting (EMC) model, in which the energy-saving service contract is linked to the user, can shorten the investment payback period to about three years.

More than 70 building environment projects are currently under construction around the country. TICA plans to replicate the success of the high-efficiency plant room to several buildings and industrial processing environments in China, as well as projects in other countries and regions. TICA's Alexandra Point reconstruction project, which adopted SMART technology, won the BCA Green Mark Platinum Award, the highest honor awarded to green buildings in Singapore.

ROEHL
循环经济模式让计划性报废成为过去式

◎ 案例概述

计划性报废，作为工业上常用的一种策略，有意为产品（尤其是电子产品）设计有限的使用寿命，促使产品在一定时间后报废，消费者不断购买新品。显而易见，计划性报废策略带来了巨大的资源浪费、电子垃圾等问题。

ROEHL 从家电行业入手，依据循环经济理念，使用可持续的、模块化的产品设计、“只租不卖”的商业模式、可完全重复使用的包装解决方案等，改变计划性报废模式。

作为中国首家针对旗下产品发布产品碳足迹和减碳潜力的家电品牌，ROEHL 首款自主研发循环经济产品——Madeleine 空气净化器，在同等净化效果下，每台产品的碳足迹比行业基准少 67% 的碳排放 *。

自 2020 年成立至今，ROEHL 已为 B 站、瑞安办公、超竞体育、龙旗集团等公司提供了低碳的空净服务，帮助减少碳排放 47,323kgCO_2e（相当于种植了 473,230 平方米的阔叶林）。

* 经调研以及第三方“碳阻迹”的科学测算，Madeleine 空气净化器，每台产品的碳足迹为 0.156kgCO_2e/ 天，对应行业基准，减排量可达 0.318kgCO_2e/ 天。

◎ 项目产出

截至 2021 年 9 月 30 日，项目重要产出如下：

- Madeleine 空气净化器获得了 2021 年德国 iF 产品设计大奖；
- 产品通过智能物联网 IoT 系统，可根据环境的空气质量调节功率大小，为客户累计节电 72919 度；
- 包装和配送均使用 ROEHL 与顺丰合作推出的中国首个面向消费者的可完全重复使用的包装解决方案 “N 次方盒”，较一次性包装减少 91% 材料废弃，共计节省 1296 公斤的塑料；
- 迄今共成功租出约 1000 台 ROEHL 空气净化器，共计减少碳排放 47,323kgCO_2e，减排量相当于种植了 473,230 平方米的阔叶林。

◎ 企业简介

ROEHL 于 2020 年在上海成立，源于 Revolution of Environmental Home Lifestyle，致力于以循环经济为立足点进行产品设计和商业模式革新，为下一代创造更环保的生活环境。产品设计以“可持续”为核心，配套 Lifestyle. as. a. Service 商业模式，产品以 “只租不卖” 的方式带给终端用户，将一次性购买转变成长期客户服务关系。

作为中国首家发布碳足迹和减碳潜力的家电品牌，首款产品 Madeleine 空气净化器，除了解决了传统除醛的痛点，还成功展现了以循环经济理念设计的产品可以如何大幅度减少碳排放。我们的愿景是佐证一个循环经济概念的产品以及其带来的服务，是可以规模化的盈利的，并让计划性报废逐渐成为过去式。

◎ 项目亮点

不管是在产品设计、材料选择，以及公司本身的运营，对环境问题的关注一直是 ROEHL 的首位，也希望能让更多人看到循环经济模式的可能性。

ROEHL 帮助瑞安办公践行其 “5C 可持续发展战略”，成为其“绿色办公”的渠道供应商。其中 ROEHL 提供的租赁服务让租户随租随用，大大减少了物品的闲置和资源的浪费，并帮助租户减少了一次性购买的昂贵支出。

◎ 项目实施

工业上常用的“计划性报废”策略，带来了巨大的资源浪费和大量的电子垃圾。ROEHL 决心改变这一恶性现象，于 2020 年从家电行业入手，通过自主研发，成功打造国内第一款完全基于循环经济设计理念和商业模式的家电产品：Madeleine 空气净化器，颠覆了传统计划性报废的模式，并成功通过用户实践实现碳减排。ROEHL 的产品所遵循的可持续设计和循环经济模式如下：

- **模块化、可升级、持久耐用 25 年**

  在产品设计上，完全摒弃传统计划性报废的设计理念，将设计成本集中在核心、易损部件，从源头采用模块化设计，方便快速维修，有效延长产品的设计使用寿命（可比行业内同等级产品提升至少 50% 的寿命），在单个产品的整体生命周期内，减少塑料使用 5.56kg。同时，模块化设计有利于未来的再升级，随着行业技术升级，仅通过更换最少的零部件即可有效延长产品的使用寿命，降低整机报废的几率。

- **使用对环境造成最低影响的可循环材料**

  在选材上，我们综合考虑材料对于环境的可持续影响，选择可长期使用或便于回收的材料，并尽可能轻量化设计，减少材料的使用。例如：坚持使用热塑性材料而非热固性材料，更耐用，且方便回收，确保材料可重复使用。

- **可翻新并重复使用**

  基于租赁模式的需求，产品设计需考虑到易翻新、可重复使用。对于外露部件、人体可接触部件，从结构上做好易于更换，从材料选择上做到可翻新、易翻新，降低翻新过程中的零部件更换率。

- **智能物联网 IoT 设计**

  通过各类传感器的设计和云计算，提供给用户更智能的使用方式。行业中的空气净化器滤网使用寿命几乎全都是用计时器进行计算，很多滤芯在尚未达到使用寿命时，消费者即被告知需要替换滤网，从而造成大量的材料浪费。而 ROEHL 首创了智能化云计算，通过不同的环境变量和传感器数据来进行精确计算，让耗材得到最大化利用。同时，该设计有助于智能调节功率，能够更好地提高能源效率，帮助节约用电（该设计正在申请专利的过程中）。

- **可循环包装与配送流程**

  包装和配送均使用 ROEHL 与顺丰合作推出的中国首个可完全重复使用的包装解决方案“N 次方盒”，较一次性包装减少 91% 材料废弃。同时与顺丰制定循环配送流程：开箱 --> 取出机器 --> 回收包材 --> 再次利用，成功减少大量的包装浪费。

以上可持续设计 + 循环运营模式，获得了客户的认可和支持。部分已成功进行合作的客户如下：

客户名称	合作起始日	合作状态	租赁台数	累计减排量（截至 2021 年 9 月 30 日）
B 站电竞	2020 年 10 月	持续进行中	103	约 11955.2 $kgCO_2e$
瑞安办公	2021 年 3 月	持续进行中	30	约 2003.4 $kgCO_2e$
超竞体育	2021 年 7 月	持续进行中	500	约 14310 $kgCO_2e$
龙旗集团	2021 年 8 月	持续进行中	89	约 1698.1 $kgCO_2e$
其他客户	/	持续进行中	278	约 17356.3 $kgCO_2e$
合计			1000	47323$kgCO_2e$

总结：对比行业基准，ROEHL 空气净化器降低碳排放约 67%，项目迄今共计帮助客户减少碳排放 47323$kgCO_2e$，减排量相当于种植了 473230 平方米的阔叶林，这证明了一个基于循环经济原则所设计的产品的碳减排效益。

◎ 项目重要影响及可持续性

ROEHL 从产品设计、循环包装配送，租赁型运营模式各个环节，大幅降低对原物料供给需求的同时，减少了碳足迹，以最高经济价值、最少浪费的方式达到资源的持续使用。ROEHL 是极少数能够完成循环经济三大原则并且实现闭环的企业。

ROEHL 创始人叶强生先生所联合发起的非盈利社群组织“循环派”与瑞安办公签订了战略合作协议，将与低碳办公相关的企业共同创立“低碳办公联盟”。该联盟成员将通过自身影响力和企业业务实践，使办公领域尽可能低碳，减少对环境的破坏。通过互相协作，优化办公领域中各个场景和流程的每一环，包括办公家具、办公用品、员工出勤等，共同营造低碳的办公环境，同时向广大办公场景使用者推广循环经济、可持续办公方式等理念。

ROEHL 立志成为循环经济领域的革新者、代名词、标杆企业，要通过自身的实践，吸引更多价值观相符的企业共同参与低碳环境的打造，打通上下游供应链，推动产品材料回收、加工、再利用，优化成本控制的同时，更好地达成材料循环的闭环管理。未来，我们还将为企业提供更多服务，如整合内容创新、循环经济模式咨询业务、可持续设计服务等。通过聚集更多企业的影响力，让可持续设计“Design for Sustainability”成为新的潮流，最终让计划性报废逐渐成为过去式。

ROEHL

Circular Economy Makes Planned Obsolescence A Thing of The Past

◎ Case Overview

Planned obsolescence is a common industrial design policy in which a product is designed with an artificially limited service life so that it becomes obsolete after a certain amount of time. The strategy features the deliberate shortening of the lifespan of a product to force users to purchase functional replacements, which has evidently engendered tremendous resources waste and electronic waste, among other problems.

Inspired by the circular economy philosophies, ROEHL handled this challenge in the home appliance market by following a "rental only" business model, adopting sustainable and modular designs of its products and 100% reusable packaging solutions in pursuit of a fundamental shift of the planned obsolescence model.

As the first home appliance brand in China to disclose the carbon footprint and carbon reduction potential for its products, ROEHL's first self-developed circular economy product, the Madeleine air purifier, has a carbon footprint that is 67% less than the industry benchmark for the same purification effect*.

Since its establishment in 2020, ROEHL has supplied low-carbon air purification services to corporate clients such as Bilibili, Shui On WORKX, SuperGen and LongCheer, helping to reduce carbon emissions by 47323kg CO_2e (equivalent to planting 473,230 sqm. of broadleaf forest).

*Based on survey results and science-based estimations by the third party organization, Carbon Stop, the Madeleine air purifier has a carbon footprint of 0.156kgCO_2e/day per unit, corresponding to an emission reduction of up to 0.318kgCO_2e/day as per industry benchmarks.

◎ Project Outcome

Key project outcomes as of September 30, 2021:

- The Madeleine air purifier won the iF Design Award 2021 in Germany;
- The product is equipped with an intelligent IoT system that adjusts power levels according to ambient air quality, resulting in cumulative power savings of 72,919 kWh for customers;
- Its packaging and distribution adopt ROEHL's first 100% reusable packaging solution tailored to consumers in China, the "Xn Box", launched in cooperation with the courier provider SF Express, which reduces material waste by 91 % relative to disposable packaging and saves a total of 1,296 kg of plastic;
- To data, around 1,000 ROEHL air purifiers have been rented, resulting in a reduction of 47,323kg CO_2e in aggregate carbon emissions, which is equivalent to planting 473,230 square meters of broadleaf forest.

◎ Company Profile

ROEHL stands for Revolution of Environmental Home Lifestyle, and it was established in Shanghai in 2020. ROEHL is dedicated to product design and business model innovation under a circular economy model, with the goal of creating an eco-friendly living environment for the next generation. With "sustainable" at the core of its product design and adopting the Lifestyle-as-a-Service business model, ROEHL provides products to end-users in a "rental only" arrangement, transforming one-time purchases into long-term customer service relationships.

As the first home appliance brand in China to disclose the carbon footprint and carbon reduction potential of its products, ROEHL's maiden launch, the Madeleine Air Purifier, both addresses the traditional pain point of aldehyde elimination and successfully demonstrates how products designed with the circular economy philosophy help reduce carbon emissions in a material way. Our vision is to prove that a product inspired by the circular economy concept, and the related services can achieve profitability of a substantive magnitude and come to consign planned obsolescence to history.

◎ Project Highlights

ROEHL has always prioritized the environment in its product design, material selection, and day-to-day business operations, and the company endeavors to bring visibility to the endless possibilities of the circular economy model to a wider audience.

ROEHL has assisted Shui On WORKX in the implementation of its "5C Sustainability Strategy" and has become its vendor of "Green Office" supplies, whereby ROEHL offers a leasing service to tenants on a rent-as-you-go basis, greatly reducing unwanted items and wasted resources while lowering the out-of-pocket expenses for tenants.

◎ Project Implementation

The common practice of "planned obsolescence" in industrial design has resulted in huge resource wastage and electronic waste. ROEHL embarked on independent research and development in 2020, determined to break the vicious circle first in the home appliance industry, and managed to create the first domestic home appliance product designed based on both the concept and business model of the circular economy: the Madeleine Air Purifier. It overturned the traditional planned obsolescence model and successfully reduced carbon emission through user practices. The following are the examples of how ROEHL's products embody sustainable design and circular economy model:

- **Modular, scalable and durable for 25 years**

  The product design has moved away from the traditional design concept of planned obsolescence and focused the cost on the core and wearable parts, adopting a modular approach throughout for ease of repairs, effectively prolonging the useful life of the products (by at least 50% longer relative to rival offerings of similar price points) and reducing the use of plastic by 5.56kg throughout the lifecycle of individual products. The modular design is also future proof. With technological advancements, the life of the product can be extended with minimal replacement of parts, reducing the probability of scrapping the entire unit.

- **Use of recyclable materials with minimal impact on the environment**

  We take into account the impact of materials on environmental sustainability when selecting materials, and use materials with a long use life or that are easily recyclable, adopting light-weight design wherever possible to reduce the use of materials. Examples include using thermoplastic materials instead of thermoset materials, which are more durable and easier to recycle, to ensure the reusability of the materials.

- **Refurbishable and reusable**

  Under the leasing model, products need to be designed to allow for potential refurbishment and reuse. Components that are exposed to the elements or could come into contact with the human body must have a replacement-friendly structure and easily refurbishable materials to lower the replacement rate of parts in the refurbishment process.

- **Intelligent IoT design**

  Users benefit from a more intelligent mode of application due to the design of a myriad of sensors and cloud computing. Almost all commercially available air purifiers use timers to calculate the service life of filters, and consumers are oftentimes alerted to replace filters before the cartridges have reached their service life, resulting in widespread waste of materials. ROEHL has pioneered intelligent cloud computing technology in its services, allowing for accurate calculations based on different environmental variables and sensor data to maximize consumable use. At the same time, the design (patent pending) facilitates intelligent power adjustment, leading to better energy efficiency and electricity savings.

- **Recyclable packaging and delivery process**

  Its packaging and distribution adopt ROEHL's first 100% reusable packaging solution tailored to consumers in China, the "Xn Box", which was created in cooperation with courier operator SF Express and reduces material waste by 91 % relative to disposable packaging. A circular delivery process has also been developed with SF Express, consisting of the following steps: open the box --> take out the machine --> recycle the package materials --> reuse, resulting in a significant reduction in packaging waste.

This "sustainable design + circular operations" model has earned praise and client support. Below is a list of select businesses that have come onboard thus far:

Client	Partnership since	Status of partnership	Units leased	Aggregate emissions reduced (as of Sept. 30, 2021)
E-sports section, bilibili.com	October 2020	Ongoing	103	Approx. 11,955.2 kg CO_2e
Shui On WORKX	March 2021	Ongoing	30	Approx. 2,003.4 kg CO_2e
SuperGen	July 2021	Ongoing	500	Approx. 1,4310 kg CO_2e
Long Cheer	August 2021	Ongoing	89	Approx. 1,698.1 kg CO_2e
Other	/	Ongoing	278	Approx. 17,356.3 kg CO_2e
Total			1000	47,323kg CO_2e

In summary, ROEHL air purifiers reduce carbon emissions by approximately 67% relative to industry benchmarks, and the project has enabled a total reduction of carbon emissions by 47,323 kg CO_2e for its customers, which is equivalent to planting 473,230 square meters of broadleaf forest, demonstrating the carbon reduction benefits of a product designed following the circular economy philosophies.

◎ Impact & Sustainability

Through its efforts of reducing carbon footprint by significantly paring back the demand for raw materials throughout product design, circular packaging delivery and a leasing operating model, ROEHL has made the sustainable use of resources a reality through a maximally economical and minimally wasteful approach. The company is one of the rare that can fulfill the three chief principles of circular economy and reflect them in a closed-loop system.

"Circular Pie", a non-profit community organization co-founded by ROEHL's founder, Mr. Johnson Yap, has forged a strategic partnership with Shui On to create a "Low Carbon Office Alliance" with businesses operating in related sectors. Members of the alliance will wield their influence and business practices to turn the office sector as low-carbon as possible and to mitigate the environmental damages. The collaboration will optimize every facet of office scenarios and processes, including furniture and fixtures, office supplies and employee attendance, for the purposes of creating a low-carbon office environment and promoting the concept of circular economy and sustainable office practices to all office users.

ROEHL aspires to be an innovator, a byword and benchmark enterprise for the circular economy. Through its own practice, the company aspires to attract more businesses that share its values to get involved in the creation of a low-carbon environment by linking up the upstream and downstream of the supply chain, promoting the recycling, processing and reuse of manufacturing materials, optimizing cost control, whilst better enabling the closed-loop management of material recycling. Going forward, we intend to provide a wider range of To-B services, encompassing integrated content innovation, circular economy model advisory, and sustainable design. By leveraging the influence of more business participants, we will establish "Design for Sustainability" as a new trend and, hopefully, gradually phase out planned obsolescence.

四川永祥股份有限公司
高纯晶硅生产过程蒸汽使用零碳化路径

◎ 案例概述

光伏行业上游的多晶硅，在生产过程中会消耗大量蒸汽，以前的蒸汽主要来源于燃煤锅炉，不但产生大量碳排放，而且产生二氧化硫、氮氧化物等空气污染物。为降低蒸汽使用方面的碳排放，永祥新能源通过燃料替代、节能增效、再生能源电力使用等方式降低碳排放，最终实现蒸汽使用的近零排放。

在燃料替代方面，公司于 2018 年新上 2 台 50t/h 的燃气锅炉代替原有 4 台 35t/h 的燃煤锅炉，在 2019 年的新建项目则直接采用了 1 台 50 吨的电极锅炉。实现了蒸汽生产燃料的煤改气、气改电的迭代。

在减少蒸汽消耗方面，永祥从 2018 年 2 月开始进行新型还原炉底盘和尾气热能回收节能技术创新、氯硅烷精馏热能梯级利用技术等一系列的技术研发和改造，使得吨硅料的蒸汽消耗从 30 吨以上降低到 15 吨以内。不仅如此，永祥还计划在未来几年内，通过进一步的技术改造，最终实现蒸汽近零输入。

在新能源电力使用方面，永祥从 2018 年开始通过售电公司直购水电等新能源电力，实现电力使用的清洁化与零碳化，进而使得蒸汽使用的零碳化，截至目前，永祥已经实现 3 个子公司电力使用的 100% 清洁化，公司总电力使用的清洁电力比例达 65% 以上。

◎ 企业简介

四川永祥股份有限公司是通威集团控股的通威股份有限公司旗下的一家大型民营科技型企业，公司形成了从“盐卤、烧碱、聚氯乙烯到电石渣水泥”和从“氯化氢、三氯氢硅到多晶硅新能源”的新能源与化工完整结合的循环经济产业链。2020 年，永祥股份高纯晶硅产量超过 8 万吨，出货量全球第一，约占全球市场份额 18%。随着四川乐山二期、云南一期以及内蒙二期项目的建成投产，永祥股份在 2022 年将形成 23 万吨高纯晶硅产能，进一步巩固全球高纯晶硅的龙头地位。

永祥新能源 YONGXIANG Newenergy

◎ 项目产出

- 单位蒸汽的碳排放强度从 0.11tCO_2e/GJ 下降到目前的 0.06tCO_2e/GJ 左右；
- 单位产品蒸汽消耗从 30 吨以上降低到 15 吨以内；
- 实现年二氧化碳减排 40 万吨以上、二氧化硫减排 250 吨、氮氧化物 250 吨；
- 实现年节约成本 3000 万以上。

◎ 项目亮点

作为清洁能源光伏制造业的上游多晶硅生产企业，我们在减少自身碳排放，实现产品碳中和方面更加严格要求自己。蒸汽曾经是我们消耗化石能源的大头。为实现蒸汽消耗的零碳化，我们从源头减碳、用量减少和余热资源化等方面综合考虑，将蒸汽减排做到了极致。

◎ 项目实施

2018 年 1 月，蒸汽零碳化项目启动后，公司领导高度重视，组织公司内外专家制定蒸汽零碳化方案。经过近 3 年的项目实施，主要从燃料替代、节能增效和新能源电力直购三个方面开展相关工作，具体项目实施过程如下：

1. 燃料替代

（1）公司于 2018 年斥资 3000 万元，引进国外先进的低氮燃烧技术的燃气蒸汽锅炉两套，采用当今具有领先技术的热力除氧器、吸收塔、扩容器等主要装置，用于替换原来的 4 台燃煤锅炉。

（2）2019 年公司启用了更加绿色环保的浸没式电极锅炉，将燃气锅炉作为备用，实现了蒸汽生产燃料的煤改气、气改电的零碳化迭代。

2. 节能增效

（1）为了实现降低蒸汽消耗、增加余热利用的目标，从 2018 年起，持续实施了以下 6 个项目。

（2）采用高效、综合回收的精馏系统并采用热耦合技术，有效降低蒸汽消耗；

（3）采用还原热能综合利用技术，将还原炉循环热水采用闪蒸制取低压蒸汽供其他工段和系统使用，降低了蒸汽消耗，提高了热能的利用率；

（4）针对不同的用热设备采用不同压力等级的蒸汽；同样，根据不同的工艺要求及用户，考虑不同的冷却介质；

（5）利用反应热加热某些需要高温的设备，剩余反应热副产蒸汽；

（6）对生产装置操作温度偏离环境温度的设备、管道等，按规范采取绝热措施；

（7）采用先进的 DCS 自动控制系统，过程产量、质量控制更稳定，有利于降低物耗和能耗。

3. 再生能源电力直购

为实现电力使用的零碳化，从 2018 年 1 月开始，公司积极参与当地的再生能源电力直购。目前已经实现公司下属三个子公司 100% 使用再生能源电力，再生能源电力占公司总用电量比例达 65% 以上。

措施	节能量（tce）	减排量（tCO_2e）
煤改气	7,000	165,000
节能增效，余热利用	114,167	154,000
气改电 + 再生能源电力	0	92,400
合计		446,369

虽然通过上述措施，使得公司的蒸汽碳排放实现了大幅度降低，但我们并未止步于此，根据我们的内部分析和以往的项目实施经验，我们提出了在 2023 年前实现蒸汽近零输入的目标，即整个生产过程中所需要的蒸汽几乎全部由内部的余热回收产生，不再使用任何的煤炭、天然气以及电力。

◎ 项目重要影响及可持续性

通过项目的实施，使得在多晶硅生产过程中的蒸汽消耗从以前的碳排放大户逐渐降低为近零排放。在整个项目实施的过程中，我们考虑了可降低蒸汽碳排放的所有手段，最终取得了既定的效果。在这个项目的实施过程中，我们形成了对于既定排放源实现零碳化的一整套解决方案，这种方案不仅可以用于蒸汽使用的零碳化，还可以用于其它排放源、整个公司甚至整个行业的零碳化。

下一步我们将进一步通过技术改造降低蒸汽消耗，同时增加余热利用的蒸汽产量，最终实现不需要任何外部能源输入，仅通过内部的余热蒸汽就能满足生产需要的目标。

Sichuan Yongxiang Co., Ltd.

Zero-Carbon Pathway of Steam Utilization in Polysilicon Production

◎ Case Overview

As an upstream sector of photovoltaic industry, polysilicon manufacturers would consume a lot of steam during their production process. In the past, the steam was mainly produced by coal-fired boilers. It not only emits a large amount of carbon dioxide, but also produces air pollutants including sulfur dioxide and nitrogen oxides. Yongxiang New Energy has reduced carbon emissions from steam utilization by means of fuel substitution, energy saving, efficiency enhancement and renewable energy consumption, and is attempting to achieve net zero emissions from steam utilization at last.

In terms of fuel substitution, in 2018, our company imported and installed two 50t(gas)/h gas-fired boilers to replace the original 4 35t(coal)/h coal-fired boilers. In 2019, the company directly adopted 1 set of 50 ton electrode boilers for the new project. Hence, we have realized the upgrading from coal to gas then to electricity for steam fuel production.

Since February 2018, Yongxiang has reduced the steam per ton of silicon material from more than 30 tons to less than 15 tons through a series of technical R&D and application, such as the innovation of new-type reduction furnace chassis and energy-saving technology of exhaust heat recycling, and the cascade utilization technology of chlorosilane rectification heat power. Moreover, Yongxiang plans to achieve the goal of near-zero steam input through further technological transformation in the coming years.

In terms of new energy power usage, Yongxiang has realized clean and zero carbonization of power use since 2018 through direct purchase of hydropower and other new energy power by power sales companies, so as to achieve zero carbonization of steam use. Up to now, Yongxiang has achieved 100% clean power consumption in three subsidiaries, and the proportion of clean power used by the company's total power has exceeded 65%.

◎ Company Profile

Sichuan Yongxiang Co., Ltd. is a large private scientific and technological enterprise under the administration of Tongwei Co., Ltd. The company has built a circular economy industrial chain integrating new energy and chemical industry from "brine, caustic soda, PVC to carbide slag cement" and "hydrogen chloride, trichlorosilane to polysilicon new energy". In 2020, Yongxiang's output of high-purity crystalline silicon reached over 80,000 tons, ranking first in the world and accounting for about 18% of the global market share. With the completion and operation of Sichuan Leshan phase II, Yunnan phase I and Inner Mongolia phase II projects in 2022, Yongxiang will have a production capacity of 230,000 tons of high-purity crystalline silicon, further consolidating its global leading position of high-purity crystalline silicon.

永祥新能源 YONGXIANG Newenergy

◎ Project Outcome

- The current carbon emission per unit steam decreases from 0.11tCO_2e/gj to about 0.06tCO_2e/gj;
- The steam consumption per unit product is reduced from more than 30 tons to less than 15 tons;
- Achieved annual CO_2 emission reduction of more than 400,000 tons, SO_2 of 250 tons, and NOx of 250 tons
- and Annual cost savings of more than 30 million CNY.

◎ Project Highlights

As an upstream polysilicon manufacturer of clean energy photovoltaic manufacturing industry, we are strict with ourselves in reducing our own carbon emissions and realizing product carbon neutralization. Steam used to be the bulk of our fossil energy consumption. To achieve zero carbonization of steam consumption, we have extremely reduced steam emissions by comprehensively considering the source carbon reduction, consumption reduction and waste heat recycling.

◎ Project Implementation

After the launch of the zero-carbon steam project, Yongxiang's leaders prioritized it and organized internal and external experts to develop a zero-carbon steam scheme. After nearly three years of project implementation, the company mainly focused on three aspects: fuel substitution, energy conservation & efficiency enhancement and direct purchase of new energy power. The specific project implementation process is as follows:

1. Fuel substitution

(1) In 2018, the company invested 30 million yuan to introduce two sets of foreign advanced gas-fired steam boilers with low nitrogen combustion technology, and adopted the main devices such as thermal deaerator, absorption tower and flash tank with leading technology to replace the original four coal-fired boilers.

(2) In 2019, the company started using a more sustainable and environment-friendly submerged electrode boiler and used the gas-fired boiler as a standby to realize the zero-carbonization upgrading from coal to gas then to electricity.

2. Energy conservation & efficiency enhancement

Since 2018, the following six projects have been continuously implemented to achieve the goal of reducing steam consumption and increasing waste heat utilization.

(1) A high efficiency and comprehensive recovery distillation system and thermal coupling technology are adopted to effectively reduce steam consumption;

(2) Adopting the comprehensive utilization technology of reduction heat energy, the circulating hot water of the reduction furnace is flashed to produce low-pressure steam for other sections and systems, which reduces steam consumption and improves the utilization rate of heat energy;

(3) Steam with different pressure levels shall be adopted for different heat consuming equipment; also, different cooling media shall be considered according to different process requirements and different users;

(4) Use reaction heat to heat some high-temperature-required equipment, and remaining reaction heat to make by-product steam;

(5) For the equipment and pipelines whose operating temperature deviates from the ambient temperature, thermal insulation measures shall be taken according to the specifications;

(6) With advanced DCS automatic control system, the process output and quality control are more stable, which contributes to lower material and energy consumption.

3. Direct purchase of new energy power

In order to realize zero carbonization of power use, the company has actively participated in the local direct purchase of renewable energy power since January 2018, and has realized that 100% of the company's three subsidiary companies use renewable energy power, which accounts for more than 65% of the company's total power consumption.

Process	Energy Saving (tce)	Emissions Reduction (tCO_2e)
Coal-to-gas	7,000	165,000
Energy saving and efficiency increasing	114,167	154,000
Gas-to-electricity + Sustainable energy power	0	92,400
Total		446,369

Although the above measures have greatly reduced the company's steam carbon emissions, we are not stopping there. According to our internal analysis and previous project implementation experience, we put forward the goal of steam input in the next five years, that is, all of the steam required in the whole production process is generated by internal waste heat recovery, which is no longer applicable to any coal, natural gas or electricity.

◎ Impact & Sustainability

Through the implementation of the project, the steam consumption in the polysilicon production field has been gradually reduced from a previous high carbon emission to nearly net zero emission. In the whole project implementation process, we considered all means to reduce steam carbon emission, and finally achieved the ideal consequence. During the implementation, we developed a complete set of solutions to achieve zero carbonization for the existing and fixed emission sources. This solution can be used to zero-carbonize not only steam, but also other emission sources, the whole company, and even the whole industry.

As a next step, we will further reduce steam consumption through technical transformation and increase the steam output of waste heat utilization, with the ultimate goal of meeting production needs only through internal waste heat steam without any external energy input.

丝芙兰
搭建绿色消费生态

◎ 案例概述

丝芙兰作为 LVMH (Moet Hennessy-Louis Vuitton) 路威酩轩集团旗下高端美妆零售商，深耕中国市场 16 年，在不断加码本土投资的同时，亦积极践行集团 LIFE 360 环境计划。从生产端的绿色生产研发，到运输环节的绿色仓储物流，再到消费端的绿色门店，丝芙兰将“搭建绿色消费生态”作为重要战略行动。

过去两年，丝芙兰通过研发绿色产品、扩大绿色电动车配送的直径范围，开发设计融合可持续、环保理念的未来概念门店，使用可再生循环的包装材料等举措，践行可持续发展战略。丝芙兰作为高端美妆零售行业领先者，亦希望将可持续理念传达至消费者侧，通过各类举措号召更多人加入绿色可持续美妆的生活方式。

◎ 企业简介

丝芙兰是 1969 年由多米尼克·曼东诺德（Dominique Mandonnaud）在法国创立的高端美妆零售商，主营业务涵盖香水、化妆品、个人护理用品和其他相关产品，隶属于世界领先的奢侈品集团——法国路威酩轩 LVMH 集团。追求卓越、突破创新和企业家精神引领丝芙兰将开拓美力的信念传递至 35 个国家，为广大消费者提供体验美及学习美的良好环境。

迄今为止，丝芙兰已进入大中华区 87 座城市，拥有 311 家线下尊享门店，线上渠道覆盖 800 多个城镇，包含丝芙兰官方网站及 APP、微信小程序、天猫旗舰店、天猫国际海外旗舰店、京东旗舰店、京东到家以及抖音小店等。

深耕中国市场 16 年来，丝芙兰始终致力于洞察国内消费者不断升级的消费需求，通过恪守“本真零售”理念，开展全渠道零售创新及可持续举措，致力美力社区的构建，不断引领美妆潮流风向，定义行业新标杆，焕发品牌无限活力。

◎ 项目产出

- 自有品牌丝芙兰愉悦护肤系列产品包装全程使用可回收材质，截至 2020 年，丝芙兰已成功减少 100 公吨塑料用量；
- 50% 门店货运实现电动节能车配送；运输过程减少塑料填充物；
- 电商包装采用可回收快递纸箱，对现有发货纸箱减重 10%，包装内填充物升级为可循环回收蜂巢纸；
- 全国 300 多家门店 100% 使用节能 LED 灯。通过优化照明与空调使用，2020 年，全国 250 多家门店全年节电 963 万度，减少碳排量 7,748 吨；
- 2021 年 5 月揭幕的北京太古里三里屯旗舰店荣获 LEED 金牌认证；
- 门店推广使用 FSC 认证环保纸质材料购物袋，减少纸张的使用量，1 年节约用纸 30 吨；
- 礼品盒采用 FSC 认证纸质材料，从 2020 年 10 月起取消覆膜工艺，礼品盒 100% 可回收；
- 2021 年 7 月，由《南方周末》主办的第 13 届中国企业社会责任年会上，丝芙兰中国荣获“2021 年度绿色企业”奖项。

◎ 项目亮点

从生产端的绿色生产研发，到运输环节的绿色仓储物流，再到消费端的绿色门店，最终转化为用户的绿色消费，这是美妆零售行业为了全渠道践行可持续发展理念， 搭建绿色消费生态的体现。作为路威酩轩集团的高端美妆零售商，丝芙兰近年来正是沿着这样的链条推动自身绿色发展，并号召行业共同携手创造可持续美好未来。

◎ 项目实施

丝芙兰将“搭建绿色消费生态”作为重要战略行动，该战略的核心是顺应消费模式的改变，上下游齐力推动变革，建立更加绿色环保的研发、生产、供应体系。丝芙兰不断地沟通和影响消费者、供应链伙伴、商业生态伙伴、去获得他们的同步认知。在公司高层的一致支持下，制定战略和落地实施计划来加速转型、促进可持续发展，并联动商业伙伴构建可持续生态价值。

丝芙兰全渠道践行可持续发展战略，过去两年在以下三方面取得显著成效：

绿色产品研发、生产

- 丝芙兰自有品牌 Sephora Collection 愉悦护肤系列采用了 90% 以上的天然成分，部分产品容器由生物质材料制成，洁面产品包装瓶由再生塑料制成。截至 2020 年，丝芙兰已成功减少 100 公吨塑料用量。

绿色物流

- 50% 门店货运实现电动节能车配送；在物料快递到门店的过程中，从塑料质地包装填充物改进为用纸板结构卡住需运输的部件，以减少塑料填充物。
- 电商包装采用可回收快递纸箱，对现有发货纸箱减重 10%，对纸箱进行回收处理，包装内填充物亦升级为可循环回收蜂巢纸。

绿色门店

- 丝芙兰全国 300 多家门店 100% 使用节能 LED 灯。通过优化照明与空调使用，2020 年为止全国 250 多家门店全年节电 963 万度，减少碳排量 7,748 吨。2021 年，丝芙兰启动第二阶段减灯改造工作。
- 2021 年 5 月揭幕的北京太古里三里屯旗舰店荣获 LEED 金牌认证。
- 在购物环节，推广使用 FSC 认证环保纸质材料购物袋，保证性能的前提下使用更轻薄纸张，减少纸张的使用量，1 年节约 30 吨用纸。礼品盒亦采用 FSC 认证纸质材料，从 2020 年 10 月起取消覆膜工艺，礼品盒 100% 可回收，如全部回收，再生纸率可达 85%。

◎ 项目重要影响及可持续性

2020 年 9 月中国明确提出双碳目标后，低碳绿色发展已经成为各行各业共识。路威酩轩集团在 2020 年推出“LIFE 360 环境计划”，该计划由此前一直坚持的 LIFE 计划（LVMH Initiatives for the Environment）升级而来，LIFE 计划致力于减少产品制造对环境的影响，产品原材料可塑性更环保更合规，同时设立明确的碳排放指标，截至 2020 年底大部分得以实现。

丝芙兰做为 LVMH 集团的一员，以集团全球可持续发展的战略目标“360 计划”为时间轴（2023，2026，2030），将“美力由我”的美好理念作为可持续发展的源动力；以“美”为载体将可持续发展融入品牌主张，运营模式，业务生态。赋予美更多的“力”量，为更可持续的世界与未来全力以赴。

除了在生产制造源头开展绿色低碳实践外，在整个实施环节以下两点也得到了充分重视。

一是在消费模式改变的当下，美妆零售行业的减碳行动特别需要和网购行为相配合，美妆零售企业需要关注到线上线下这一条完整的购物链条当中的碳足迹，比如对网购发货纸箱作减重和可回收处理，改进包装填充物等，丝芙兰将与国内领先的物流快递企业一同配合改造。

二是引导消费者。绿色供给最终要成为绿色消费，这样企业才有更持久的动力，也才能真正实现绿色生活。对于消费者来说，减碳也不是浮在表面的口号，可以从每一次消费做起。

SEPHORA

Building A Green Consumption Ecology

◎ Case Overview

As a high-end beauty retailer of LVMH (Moet Hennessy-Louis Vuitton) Group, Sephora has been deeply developing the Chinese market for 16 years. While increasing local investment, Sephora actively fulfills the group's LIFE 360 Environment Plan and is committed to environmental protection practice. From green product R&D at the production end, to green warehousing and logistics during the supply chain link, to green stores at the consumer end, Sephora regards "building green beauty industry ecology" as an important strategic initiative.

In the past two years, Sephora has fulfilled the sustainable development strategy by developing green products, expanding the diameter range of distribution by green electric vehicle, developing and designing future concept stores integrating sustainable and environmental protection concepts, and using recyclable packaging materials. As the representative of high-end beauty retailer, Sephora hopes to call consumers to pay attention to and encourage more people to participate in the green and sustainable beauty cosmetics lifestyle.

◎ Company Profile

Sephora is a high-end beauty makeup retailer founded by Dominique Mandonnaud in France in 1969. Its main business covers perfumes, cosmetics, personal care products and other related products, and it is part of the LVMH Group in France, a global leader in the luxury industry. Sephora spreads the belief in developing beauty power to 35 countries by pursuing excellence, making breakthroughs, innovation, and entrepreneurship to provide consumers with a good environment to learn and practise beauty.

SEPHORA 丝芙兰

Sephora has 311 physical exclusive stores in 87 cities in Great China, and its online channels cover more than 800 towns, including Sephora's official website and APP, WeChat applet, Tmall flagship store, Tmall Crossboard flagship store, JD flagship store, JD Home and Tik Tok store, etc.

Within 16 years of deep development of the Chinese market, Sephora has always been committed to learning about the continuous upgrading consumption demand of domestic consumers. By adhering to the concept of "Omnitude", it has carried out whole-channel retail innovation and sustainable measures, committed to the construction of beauty power community, constantly led the trend of beauty cosmetics, created a new benchmark in the industry and rejuvenated its brand.

◎ Project Outcome

- The self-owned brand Sephora Collection products use recyclable materials throughout the packaging process. By 2020, Sephora has successfully reduced its plastic consumption by 100 metric tons;
- 50% of store freight can be realized by electric energy-saving vehicles and the usage of plastic fillers is reduced during transportation;
- E-commerce uses recyclable courier carton box for packaging, which reduces the weight of existing delivery cartons by 10%, and upgrades fillers inside the package to recyclable honeycomb paper;
- More than 300 stores nationwide all use energy-saving LED lamps. By optimizing the use of lighting and air conditioner, more than 250 stores nationwide saved electricity by 9.63 million kWh and reduced carbon emissions by 7,748 tons in 2020;
- The flagship store in Sanlitun, Taikoo Li, Beijing, opened in May 2021, has received LEED gold certification;
- Stores promote the use of shopping bags certified by FSC, which reduce the use of paper by 30 tons per year;
- The gift boxes are made of paper materials certified by FSC, and the lamination has been removed since October 2020. The gift boxes are 100% recyclable;
- Sephora China won the "2021 Green Enterprise" award at the 13th Annual Conference of China Corporate Social Responsibility hosted by Southern Weekend in July 2021.

◎ Project Highlights

From green production research and development at the production end, to green warehousing and logistics at the transportation link, to green stores at the consumer end, and finally green consumption of users, this is the embodiment of the beauty retail industry to fulfill the concept of sustainable development in all channels and build green consumption ecology. Sephora, a high-end beauty makeup retailer of LVMH Group, has promoted its own green development along this chain in recent years, and has called on the industry to work together to create a sustainable bright future.

◎ Project Implementation

Sephora regards "building green consumption ecology" as an important strategic action, with the goal of adapting to changing of consumption patterns, promoting reform in upstream and downstream, and establishing a more green and environmental protection research and development, production and supply system. Sephora is constantly communicating with and influencing consumers, supply chain partners and business ecosystem partners to gain their synchronous cognition. With the unanimous support of senior management of the company, Sephora formulates strategies and launches plans to accelerate transformation and promote sustainable development, and cooperates with business partners to build sustainable ecological value.

Sephora implements the sustainable development strategy in all channels, and has achieved remarkable results in the following three aspects in the past two years:

Green product research, development and manufacturing

- Sephora's self-owned brand Sephora Collection Pleasant Skin Care Series contains more than 90% natural ingredients, some product containers are made of biomass materials, and facial cleansing packaging bottles are made of recycled plastics. By 2020, Sephora has successfully reduced the plastic consumption by 100 metric tons.

Green logistics

- The freight of 50% of stores can be realized by electric energy-saving vehicles. In the process of delivering materials to stores, the plastic packing filler is improved to employ a cardboard structure to clamp the parts to be transported to reduce the plastic filler.
- E-commerce packaging uses recyclable express cartons, which reduces the weight of the existing delivery cartons by 10%, recycles the cartons, and upgrades the packing filler to recyclable honeycomb paper.

Green stores

- More than 300 stores nationwide all use energy-saving LED lighting. By optimizing the use of lighting and air conditioner, more than 250 stores nationwide saved electricity by 9.63 million kWh and reduced carbon emissions by 7,748 tons in 2020. In 2021, Sephora has started the second stage of lamp reduction remodelling.
- The flagship store in Sanlitun, Taikoo Li, Beijing, opened in May 2021, has received LEED gold certification.
- In the shopping link, Sephora promotes the use of environmental protection paper shopping bags certified by FSC, uses lighter and thinner paper to ensure performance, reduces the amount of paper used and saves 30 tons of paper in a year. The gift boxes are made of paper materials certified by FSC, and the film coating process has been canceled since October 2020. The gift boxes are 100% recyclable. If they are all recycled, the recycled paper rate can be up to 85%.

◎ Impact & Sustainability

Since China's clear announcement of "double carbon targets" in September 2020, low-carbon and green development has become the consensus of all social sectors. In 2020, LVMH Group launched the "LIFE 360 Environment Plan", an improvement to the previously existing LIFE Plan (LVMH Initiatives for the Environment). The LIFE Plan is dedicated to reducing the environmental impact of product manufacturing, making the plasticity of raw materials more environmentally friendly and compliant, and setting clear carbon emission targets, most of which have been met by the end of 2020.

As a member of LVMH Group, Sephora will take the "Life 360 Plan", the group's strategic goal of global sustainable development, as the timeline (2023, 2026, 2030), and make the concept of "beauty power by me" a better source power for sustainable development. Sephora will also use "beauty" as a carrier to integrate the sustainable development into brand concepts, operation models and business ecology, giving beauty more "power" and making every effort to create a more sustainable world and future.

Besides carrying out green and low-carbon practices at the source of manufacturing, Sephora also pays close attention to the following two aspects in the whole implementation process.

Firstly, in an era that consumption patterns are changing, the carbon reduction actions of the beauty makeup retail industry must be coordinated with online shopping, and beauty makeup retail enterprises must pay attention to the carbon footprint in the entire shopping chain, including online and offline, by reducing the weight and recycling the delivery cartons for online shopping and improving the packing fillers. Sephora will cooperate with the leading domestic logistics and express delivery enterprises to transform.

Secondly, consumers should be guided. Green supply will eventually become green consumption, allowing enterprises to have more long-term motivation and a fully green living to be realized. Carbon reduction is not a gimmick for consumers and they can reduce their carbon footprint with every consumption.

星巴克中国
全球首家环保实验店“向绿工坊”

◎ 案例概述

自 1971 年创立以来，星巴克就致力于成为一家与众不同的企业。星巴克有个简单的愿景：种植可持续的咖啡，以可持续方式开展经营，致力于成为一家对自然资源回馈多于使用的资源积极型企业。为实现这一目标，星巴克基于科学依据设定了初级目标——到 2030 年碳排放、水资源使用、废弃物排放各减少 50%。同时计划到 2030 年实现碳中和绿色咖啡，并在咖啡生豆加工过程中减少一半的用水量。星巴克将采取全面举措减少我们对环境的影响，着眼于“从一颗生豆到一杯咖啡”旅程中的每一个环节。

在成立 50 周年之际，星巴克将“减少碳足迹、减少水浪费和废弃物浪费”这三大目标和可持续生活方式相结合。作为星巴克全球首家绿色环保实验店，星巴克向绿工坊于 2021 年 9 月 30 日在上海开业。向绿工坊全方位探索可循环的绿色零售新模式，鼓励更多顾客一起践行更可持续的生活方式。在设计建造、日常营运、顾客体验的全生命周期中，其可持续发展的理念、举措贯穿始终。向绿工坊的开业，也标志着星巴克实现“环境向绿”蓝图的进程迈入了全新阶段。

◎ 企业简介

星巴克咖啡公司成立于 1971 年，始终致力于商业道德采购并烘焙世界上高品质的阿拉比卡咖啡。今天，门店遍布全球的星巴克已经成为世界上首屈一指的专业咖啡烘焙商和零售商。通过我们的星级咖啡师，星巴克始终坚持对卓越品质和服务的承诺，遵循我们的指导原则，通过每一杯优质的咖啡为我们的顾客每天营造独特的星巴克体验。

1999 年，星巴克进入中国内地市场，并在北京国贸商城开出第一家门店，如今已发展到在 200 多个城市拥有 5,300 家门店，有近 6 万名身着绿围裙的中国伙伴（员工）。中国目前已成为星巴克发展速度最快、最大的海外市场。

◎ 项目产出

设计建造：打造环境向绿的第三空间

- 全国首家获得“绿色门店”体系认证的星巴克门店
- 全国首家全面采用回收及环保建材的第三空间，约 50% 可在未来被循环利用、升级改造或是降解
- 全国首家使用模块化吧台及后区的星巴克门店

日常运营：通过手中咖啡，共创绿色生活

- 全国首次推出由回收塑料瓶合成纤维制成的环保绿围裙，每条减少全生命周期碳排放达 1 公斤
- 全国首次推出由星巴克各项赛事冠军、咖啡公使主持的“可持续咖啡教室”
- 全国首家 100% 回收自身产生咖啡渣的星巴克门店
- 全国首家通过全国绿证认购平台购买绿色电力，100% 使用可再生能源的星巴克门店

顾客体验：GOODGOOD 生活方式，可以很日常

- 全球首次推出名为“循环坊·创意坊”的环保主题展览空间
- 门店中超过 50% 食品及含牛奶类饮品，现使用植物基食材替代
- 推出大杯型可循环使用随行杯

◎ 项目亮点

“向绿工坊是我们探索绿色零售新模式的实验室，也是寄给星巴克顾客的一张通往绿色未来的邀请函。我们希望能在此实践门店可持续性的创意想法，与顾客一起在此体验新的生活方式，并与志同道合的团队联合创造，激发更多人，为我们的下一代留下更美好的地球。

——星巴克全球执行副总裁
兼星巴克中国首席执行官蔡德彝

◎ 项目实施

为践行可持续发展目标，星巴克中国于 2020 年启动向绿工坊项目，经过 500 多天的打磨，全球首家绿色环保实验店与 2021 年 9 月 30 日在上海开业。它将实践星巴克最前沿的环保举措，全方位探索可循环的绿色零售模式，鼓励更多顾客一起践行绿色生活方式。

1. 一杯咖啡的过去和未来

向绿工坊主吧台上方的微电影讲述着一颗咖啡豆在来到顾客手中之前的“过去”——“Bean to cup”的故事——从手边的一杯咖啡出发，带顾客云游云南、卢旺达等咖啡原产地，历览星巴克伙伴（员工）与咖农如何开展可持续种植、道德采购和烘焙加工。

- 从 2004 年开始，星巴克与保护国际基金会合作制定了咖啡与种植者公平规范 (C.A.F.E.)，要求咖啡种植者必须在社会责任和环境保护等方面都达到标准，并通过第三方机构认证。其中，对原生森林、珍稀动植物群落的评估、管理和保护是重要指标之一。另外，星巴克还帮助咖农和咖啡种植社区以可持续的种植方式开展生产活动。2021 年 3 月，星巴克中国启动为期三年的“共享价值”咖啡产业扶持三期智慧农业项目，在云南普洱地区引入水肥一体化、测土配方施肥等多项数字化手段，助力当地咖啡种植社区的可持续发展。
- 萃取完咖啡后的咖啡渣，也同样有绿色的“未来”。向绿工坊是中国首家 100% 回收再利用店内咖啡渣的星巴克门店。这些咖啡渣在进行堆肥处理后，作为农作物和商场花园的有机肥料使用。
- 向绿工坊还首次打造了名为“循环绿·创意坊”的展览空间，以咖啡渣等零售废弃物为主要材料，不定期举行新锐艺术家们呈现的绿色主题展览，并带来公开讲座与工作坊，带领并激发每个顾客思考可持续发展的无限可能。于 2021 年 9 月首次登场的，是由同济大学设计创意学院师生以“有机繁荣”为题的多件艺术作品。

2. 更绿色的 GOODGOOD 生活方式

截至 2019 年底，星巴克全国所有门店已经全部停止使用塑料吸管，每年大约可以减少 200 吨塑料使用。2020 年 4 月，星巴克中国发起“GOODGOOD 星善食 ™ 主义”行动以来，一系列植物基膳食产品及“渣渣管”等全新绿色包装相继问世。而在向绿工坊，GOODGOOD 的生活方式将得以不断演进和推广。

- 在向绿工坊，超过 50% 的食品及含牛奶类饮品均以植物基食材代替，含牛奶类饮品也将默认使用燕麦奶。同时，向绿工坊还推出 15 款全新的植物基膳食食品，涵盖多款烘焙产品、三明治以及蛋糕，给予顾客更丰富的美味和可持续消费兼具的享受。经测算，与常规含动物油脂的麦芬相比，每个星膳食燕麦乳巧克力麦芬减少 60g 温室气体排放，约相当于节电 0.1 度。
- 同时，以减废减塑和倡导循环利用的生活方式为指引，向绿工坊推出了一款可重复使用的随行杯，并鼓励堂食顾客尽量使用店用杯或自带杯，减少一次性餐具的消耗。

3. 约 50% 建筑材料“未来有用处”

店内约 50% 的建筑材料，都可在未来被循环利用、升级改造或是降解。

- 整家门店的吧台及后区采用了全新的模块化设计。整个吧台由功能各异的模块构成，可以根据需求拆卸、组装。如果门店在未来改造，旧模块也可以在其它门店“重新上岗”。同时，店内使用了大量回收再利用的建筑材料。例如，当星巴克在中国内地的第一家旗舰店——北京三里屯太古里店进行升级改造时，设计师便将二楼标志性的实木咖啡桌回收分解，重新制作成了向绿工坊的大门把手、吧台桌面、台阶等设施。
- 向绿工坊也采取了多项提升能效的措施。以店铺照明为例，光源全部实现智能化控制，无需手动调节。照明系统设置了白天、傍晚与深夜多个模式，有效减少电力消耗。经测算，相较 2019 年一家同等大小的普通星巴克门店，每年预计将额外减少约 15% 碳排放。
- 向绿工坊倡导无纸化营运。在这里，电子小票取代了纸质票据，而传统的印刷菜单板也由 LED 电子显示屏替代，将进一步减少一次性宣传物料的使用。
- 咖啡师所穿的绿围裙，是由回收的 PET 饮料瓶经过清洁加工、再生制成聚酯切片、纱线、面料，最后加工成为独一无二的星巴克环保绿围裙。这一回收项目不仅减少 PET 饮料瓶的废弃物产生量，相较传统纺织工艺还能减少能源和资源消耗，降低产品的碳排放。根据专业机构估算，这样一条绿围裙在它的生命周期里，可减少约 1kg 的温室气体排放。

以上这些验证有效的举措也将向全国 5,300 多家星巴克门店复制和推广。

4. “绿色门店”认证体系将在中国内地逐步推广

向绿工坊的开业，也标志着星巴克中国正式推出“绿色门店”认证体系。该套认证体系由星巴克与权威机构共同开发，考察范围覆盖门店的整个生命周期。其考察指标多达 40 项，分别聚焦于节约能源、水耗管理、废弃物处置等八大关键领域的审计与认证。

作为面向未来的新一代实体门店标准，“绿色门店”体系不仅聚焦水、电、环保冷媒等传统的门店设计建造环节，同时也关注更多与门店运营、消费体验相关的新角度：如室内降噪、室内空气质量、公共交通便利性、减少一次性包装、更健康低碳的植物基膳食等，体现了星巴克邀请更多消费者体验可持续生活方式的决心。

◎ 项目重要影响及可持续性

星巴克全球首家环保实验店“向绿工坊”是国内首家获得“绿色门店”体系认证的门店。以它为起点，计划于未来一年内，在中国内地开设 60 家获得认证的“绿色门店”，并逐步推广至中国内地市场，从而邀请更多消费者加入我们，共同践行可持续生活方式。

Starbucks China

Starbucks First Greener Store outside North America: The Shanghai Greener Store Lab

◎ Case Overview

Since 1971, Starbucks has been a different kind of company, grounded in its vision to create a sustainable future for coffee, it is committed to becoming a resource positive company that gives more than it takes from the planet, and has set science-based preliminary targets for 50 percent reductions of carbon, water, and waste globally by 2030. In addition, the company has committed achieve Carbon Neutral Green Coffee and conserve water usage in green coffee processing by 50%, also by 2030. It makes continuous efforts to reduce environmental impact at every stage of the coffee journey from 'bean to cup'.

As Starbucks celebrates its 50th Anniversary, the company is advancing green retail with the unveiling of the Greener Store Lab in Shanghai on September 30th, 2021. With a focus on circularity, the Greener Store Lab designed to immerse customers in Starbucks Planet Positive commitments, and incorporates leading sustainability solutions in store design, construction, and operations. The opening of Starbucks Greener Store Lab marks another step towards realizing a Planet Positive Future for Starbucks.

◎ Company Profile

Since 1971, Starbucks has been committed to ethically sourcing and roasting the highest quality arabica coffee in the world. Today, Starbucks is the world's premier specialty coffee roaster and retailer. Through its unwavering commitment to excellence and its guiding principles, it brings the unique Starbucks Experience to life for every customer through every cup.

In 1999, Starbucks entered the Chinese mainland with the opening of its first store in the China World Trade Building, Beijing. It currently has over 5,300 stores in more than 200 cities, with 60,000 partners proudly donning the Starbucks green aprons. The Chinese mainland has become the fastest growing and largest international market for Starbucks.

◎ Project Outcome

Design & Construction - Creating an environmentally-conscious third place:

- The first store outside North America to be certified under the Starbucks Greener Store Framework.
- The first Starbucks store in the Chinese mainland to use recycled and lower-impact building materials.
- The first Starbucks store in the Chinese mainland to feature a Modular Bar and Back-Of-House system

Daily Operations – Promoting responsible living through a cup of coffee:

- The iconic Starbucks green aprons are made from recycled Starbuck PET cups using advanced plastic-to-textile technologies. Each apron achieves approximately one kg of carbon reduction in its lifecycle.
- The first Starbucks store in the Chinese mainland to recycle coffee grounds for use as fertilizer.
- The first Starbucks store in the Chinese mainland to be powered by renewable energy purchased through a nationally certified platform.

Customer Experience – Making sustainability part of everyday lifestyles:

- The first Starbucks store to feature a 'Circular Lifestyle Lab' curating sustainability-themed exhibitions from artists advocating for a more sustainable future.
- Over half of the store menu will be plant-based, including the debut of 15 new food items.
- Customers without their own cups or tumblers can still do their part with the launch of Grande-sized reusable cup.

◎ Project Highlights

"The Greener Store Lab is a laboratory for exploring new models of operating green retail, and an invitation to Starbucks customers to embrace a greener future. We hope to bring creative sustainability ideas into reality, immerse customers in new lifestyles, and collaborate with like-minded teams to inspire more people to leave a better planet for future generations."

-- Leo Tsoi, executive vice president, Starbucks and CEO of Starbucks China

◎ Project Implementation

More than 500 days in the marking from ideation and design to construction and opening, the Greener Store Lab in Shanghai was opened on September 30th, 2021. It is designed in to showcase Starbucks leading environmental solutions and explore new models for operating green retail, while inviting customers to adopt greener lifestyles.

1. **The past, present and future of a cup of coffee**

   An inspiring micro film on Starbucks efforts in sustainability 'from bean to cup' is played on a digital screen above the Main Bar, bringing customers on a journey of the 'past' from farms at the coffee origin in Yunnan and Rwanda, to witness how Starbucks partner with farmers on sustainable agriculture, ethical sourcing and roasting.

   - Since 2004, Starbucks partnered with Conservation International Foundation (CI) to launch the Coffee and Farmer Equity (C.A.F.E.) Practices program that involves a third-party verification process, to support socially responsible coffee farming and protect the environment. A key indicator is the assessment, management and protection of native forests and rare fauna and flora. Starbucks also support the coffee farmers and their communities in practicing sustainable agriculture. In March 2021, Starbucks China launched its Smart Agriculture initiative, the third phase of its Yunnan poverty alleviation program, and introduced 'ferti-gation', soil-based fertilization and other digital tools in the Pu'er region of Yunnan province, to support the sustainable development of local coffee farming communities.
   - Used coffee grounds can have a green "future". The Greener Store Lab is the first Starbucks store in China to recycle 100% of the coffee grounds generated in store. The coffee grounds are composted and used as organic fertilizer for crops and gardens in the shopping mall.
   - The Greener Store Lab also houses a 'Circular Lifestyle Lab' which hosts sustainability themed exhibitions that showcase the works of like-minded designers and artists created through the imaginative use of coffee grounds and other retail waste materials. Kicking off the initiative is a collaboration with Tongji University's College of Design and Innovation on an exhibition titled "Organic Prosperity".

2. **Inspiring greener GOODGOOD lifestyles**

   Starbucks eliminated plastic straws from all its stores in the Chinese mainland by end of 2019, which reduced an estimated 200 tons of plastic waste a year. In April 2020, Starbucks China launched the "Starbucks GOOD GOOD™ movement with the introduction of a plant-based food and beverage menu and offerings and subsequent roll out of coffee ground straws and other sustainable packaging innovations. The GOOD GOOD lifestyle continues to evolve at the Greener Store Lab.

   - Over half of the store menu is plant-based, including the debut of 15 new food items such as pastries, sandwiches and cakes and two new limited time offer beverages. Oatmilk is used as the default option for most beverages. Compared with a conventional muffin containing animal fat, each Starbucks Good Good oatmilk chocolate muffin can reduce greenhouse gas emissions by 60g, equivalent to power saving of 0.1 kWh.
   - The store has also introduced a Grande-sized reusable cup. Customers are also encouraged to do their part to reduce single-use cups by using for-here cups or bringing their own cups or tumblers.

3. **Around 50% of the store interior can be "useful in the future"**

   Around 50%of the store interior can be recycled, upcycled or biodegraded.

   - The Greener Store Lab features a modular bar and back-of-house system constructed to enable reuse and recycling. Made of modules for different functions, the modular design allows the store to quickly adjust the bar layout, by adding, removing, or replacing bar modules to achieve different functional combinations, or to reuse the modules in other stores when the Lab is retrofitted in the future. Recycled materials are used throughout the store; for instance, wood reclaimed from the renovation of the Beijing Taikooli Sanlitun Flagship store was used to craft the countertop of the experience bar, steps of the "stadium seating", as well as door handles.
   - Energy efficient technologies can also be found in the store. Taking the lighting control system as an example, it features multiple modes such as daytime, dusk, and late night, which allow the brightness to be automatically adjusted. Through these technologies, the store is expected to reduce carbon emissions by around 15 percent, compared to a regular Starbucks store of the same size (2019 baseline scenario).
   - The Greener Store Lab promotes paperless operations. Paper receipts have been eliminated with the introduction of e-receipts, while LED menu boards have replaced paper menus.
   - The unique environmental-friendly green apron worn by store baristas are made from Starbucks PET cups. The cups undergo deep cleaning and processing to become recycled PET fragments, which are then made into polyester chips, yarns, and fabrics, before becoming a Starbucks apron. This recycling initiative not only helps to minimize white pollution caused by PET beverage bottles, but also reduces energy and resource consumption compared to the traditional textile industry. Based upon professional estimates, each apron achieves approximately one kilogram of carbon reduction in its lifecycle.
   - Initiatives proven to be successful will be gradually rolled out to the over 5,300 Starbucks stores across the Chinese mainland.

4. **Expanding "Greener Store" Framework in China**

   The Greener Store Lab also marks the introduction of Starbucks "Greener Store" Framework to China. This framework, co-developed with a credible independent organization, features performance-based standards that incorporate design and extend throughout the life of a store, with a comprehensive range of 40 performance criteria focused on energy efficiency, water stewardship, responsible materials, waste diversion and more.

   Aside from store design elements like water, power and refrigeration, this next-generation standard also pays consideration to the customer experience – by incorporating criteria such as indoor ambient noise levels, air quality, and public transport convenience, as well as promoting less single-use packaging and heathier and low-carbon plant-based menu, which demonstrates how Starbucks is inviting more customers to experience and lead more sustainable lifestyles.

◎ Impact & Sustainability

The Greener Store Lab is Starbucks first Greener Store in China to be certified by under the Starbucks Greener Store Framework. Starbucks aims to pilot 60 Greener Stores in the Chinese mainland over the next year before gradually rolling out to all new and renovated stores in the market, inviting more customers to join the company in exploring eco-friendlier lifestyles.

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