



2019中国境外可持续 基础设施项目案例集

2019 Best Practices of Sustainable
Infrastructure Projects Undertaken by
Chinese International Contractors



giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



Sino-German Center for
Sustainable Development



序言

Preface

《联合国2030可持续发展议程》将建设可持续的基础设施作为17个发展目标之一。国际多边金融机构纷纷制订或更新其环境、社会框架标准，对基础设施的开发建设提出广泛的可持续性要求。中国国家主席习近平在第二届“一带一路”国际合作高峰论坛上提出，要建设“高质量、可持续、抗风险、价格合理、包容可及”的基础设施。投资与建设可持续的基础设施是各国共同应对气候变化、资源短缺、人口增长等全球性挑战的需要，打造绿色、可持续的基础设施势在必行。

为顺应国内外各界对可持续基础设施的关注，帮助会员企业化解社会环境风险、实现业务转型升级，中国对外承包工程商会（简称“承包商会”）在行业内持续倡导可持续基础设施理念，引导会员企业不断加强ESG管理，提升可持续发展能力。2017年，承包商会发布了《中国企业境外可持续基础设施项目指引》（简称“《指引》”），组织了“中国境外可持续基础设施项目”评估及案例征集活动。2018年，该《指引》升级为“承包商会团体标准”，为企业增强可持续发展理念、提升项目全生命周期的ESG管理提供了行为指南。

2019年，承包商会组织开展了第二次“中国境外可持续基础设施项目”案例征集和评估活动。来自28家会员企业申报的近40个境外基础设施项目，均为中国企业在境外以投资、规划、设计、建设和运营等方式参与，且完工一年以上的基础设施类项目，项目金额在1亿美元以上。我们对照《指引》设定的经济可持续、社会可持续、环境可持续和可持续治理等四个维度的指标，对申报项目进行综合评估，最终评选出了19个符合可持续基础设施标准的工程项目。

为树立行业可持续基础设施项目的标杆，带动全行业提升可持续发展意识和能力，打造中国企业关注可持续发展的海外形象。我们收集整理了19篇可持续基础设施项目的实践案例，这些项目在经济可持续、社会可持续、环境可持续和可持续治理等四个维度整体表现良好，并且每个项目在不同维度都有其亮点实践和典型做法。基于这些亮点实践，我们编制了《2019中国境外可持续基础设施项目案例集》（简称“《案例集》”）。

《案例集》素材主要来自承包商会会员企业的项目申报材料，部分会员企业应承包商会要求补充了相关信息。作为承包商会在可持续发展领域的战略合作伙伴，德国国际合作机构（GIZ）在中德可持续发展中心的框架下，为《案例集》的编制出版提供了大力支持。在此，承包商会谨向各有关单位表示诚挚谢意！

未来，中国对外承包工程商会将持续推进会员企业在海外投资、建设或运营高质量、可持续的基础设施项目，与会员企业共同努力，不断提升项目的经济、社会、环境和治理绩效，持续贡献全球可持续发展。

《案例集》为中、英文版，如需获取纸质版，请联系：

中国对外承包工程商会战略与咨询部 电话：010-81130092
您也可在承包商会网站“信用建设”栏目下载本报告电子文档，
网址：www.chinca.org

序言

Preface

The development of sustainable infrastructure is one of the 17 SDGs that make up *the 2030 UN Agenda for Sustainable Development*. Worldwide, multilateral financial institutions have defined or renewed their environmental and social standards and set forth extensive mandatory sustainability requirements for each infrastructure project. As emphasized by Chinese President Xi Jinping at the Second Belt and Road Forum for International Cooperation, we must build “high-quality, sustainable, resilient, affordable, inclusive and accessible” infrastructure projects. Sustainable infrastructure development and investment is the mission of all countries as they rise up together to global challenges such as climate change, resource shortage, and population growth. Green and sustainable infrastructure is imperative.

To address the growing attention on sustainable infrastructure from at home and abroad, and help member companies reduce social and environmental risks during business transformation and upgrading, China International Contractors Association (CHINCA) has advocated sustainable infrastructure concepts in the industry, and offered guidance for member companies to strengthen ESG management and enhance sustainable development abilities. In 2017, CHINCA issued *Guidelines of Sustainable Infrastructure for Chinese International Contractors* (hereinafter referred to as the Guidelines). It also led the effort to review “China’s International Sustainable Infrastructure Projects” and identify best practices. In 2018, the Guidelines was upgraded to “CHINCA Group Standards”, offering guidance for companies to reinforce the concept of sustainable development and improve lifecycle ESG management of the projects.

In 2019, CHINCA collected and reviewed the candidates for the second set of “Best Practices of China International Sustainable Infrastructure Projects”. The candidates include nearly 40 overseas infrastructure projects undertaken by 28 Chinese member companies. All the projects, each of which is worth at least USD 100 million, took form of investment, planning, design, construction and operation, and have been over for no less than a year. Based on the four indicators of economic sustainability, social sustainability, environmental sustainability and sustainable governance set in the Guidelines, we selected 19 engineering projects up to the standards of sustainable

infrastructure.

The 19 projects not only perform well in the four dimensions across the board, but also feature outstanding practices in each of the dimensions. The *2019 Best Practices of China International Sustainable Infrastructure Projects* (hereinafter referred to as the “Practices”) thus compiled aim to set a benchmark for sustainable infrastructure projects in the industry, enhance the awareness and competence of sustainable development across the industry, and build an image of Chinese companies which attach great importance to sustainable development on the overseas market.

The *Practices* have drawn its contents from the project application materials submitted by CHINCA members as well as the supplementary information provided by some members at the request of CHINCA. GIZ, as strategic partner of CHINCA on sustainability, under the umbrella of the Sino-German Center for Sustainable Development, has provided great support in preparing the publication of these Practices. CHINCA hereby expresses its sincere gratitude to all the parties concerned.

In the future, CHINCA will continue to help member companies finance, build and operate high-quality sustainable infrastructure projects overseas. It will work together with member companies to constantly improve the projects’ economic sustainability, social sustainability, environmental sustainability and sustainable governance, thus contributing to the sustainable development of the world.

The Practices is prepared in both Chinese and English. For printed report, please contact:

Department of Strategy & Consulting, CHINCA Tel.: 010-81130092

You can also download the report through CHINCA’s website at www.chinca.org.

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1 打造经济、社会、环境可持续的 肯尼亚世纪铁路

——肯尼亚蒙内铁路项目

**Build Economically, Socially, Environmentally Sustainable
“Millennial” Railway of Kenya**
Mombasa-Nairobi SGR

项目简介 ABOUT THE PROJECT

蒙内铁路连接肯尼亚首都内罗毕和东非第一大港蒙巴萨，全长约 480 公里，客车时速 120 公里，货车时速 80 公里。蒙内铁路由中国路桥工程有限责任公司承建和运营，是肯尼亚独立以来首条最长的新铁路，是一条见证中肯两国紧密经贸关系的友谊之路，更是一条合作共赢之路、繁荣发展之路、生态环保之路。该铁路促进了肯尼亚以及东非地区国家经济的发展、东非立体交通网的建成和“三网一化”进程。

The Mombasa-Nairobi SGR, undertaken and operated by China Road and Bridge Corporation (CRBC), is a 480km railway stretching from west to east to link East Africa's largest port city of Mombasa to Kenya's capital Nairobi. With a designed speed of 80km/h and 120 km/h for freight and passenger trains respectively, it is the Kenya's longest railway since independence. It is a route that has witnessed the close economic and trade interactions between China and Kenya; it is also a path to win-win cooperation, to prosperity and development, and to ecological and environmental protection. It carries extensive significance to the economic progress of Kenya and East Africa, as well as the three-dimensional transportation connectivity and “the three networks and industrialization” projects in East Africa.

项目进程/Key Milestones

签约时间/Date of contract-signing	2012.07.17
开工时间/Date of commencement	2014.12.12
完工时间/Date of completion	2018.05.30
开通运营时间/Date of entry into operation	2017.06.01

可持续发展背景

肯尼亚宪法规定，享有健康的环境是每个公民“不可剥夺的权利”，肯尼亚 2030 年远景规划也明确了“以健康环境支持经济发展并实现减贫”的愿景，可见其对环境保护的重视程度。蒙内铁路沿线经过众多信仰各异的部族，社区关系较为复杂。在项目建设过程中，如何处理好发展与环境、发展与社区之间的关系，保障项目可持续性，是公司面对的重要课题。

解决方案

公司深入分析肯尼亚经济、社会、环境发展的特点和需求，不断加深员工对社会责任、可持续发展的理解，完善公司社会责任管理模式，与肯尼亚政府、项目所在社区、合作伙伴等相关方加强沟通与合作，努力维护各方权益，构建“中肯发展共同体”。

建立管理机制，设立社会责任专项基金

项目部建立了由项目领导统筹决策、外联部组织协调、多部门具体管理的社会责任管理架构，并建立三级沟通机制，加强利益相关方沟通和管理。通过与利益相关方的交流沟通，依据国际可持续发展相关要求，识别出野生动物保护、当地人才培养、带动供应商履责、社区建设与发展等可持续发展议题，并落实到项目的建设和运营中。

公司项目部编制《肯尼亚蒙内铁路项目社会责任管理办法》，将项目合同金额的 0.5% 设为社会责任专项基金，为社会责任相关工作

Sustainable Development - Background and Context

The Kenyan government attaches great importance to environmental protection. In addition to the Kenyan Constitution which grants all its citizens an “inalienable right” to a healthy environment, the Kenya Vision 2030 also sets a goal of “pursuing economic progress and poverty alleviation in a healthy environment”. The Mombasa-Nairobi Railway links up tribes with different beliefs, and involves the complexity of inter-community relationship. This rams home the need for CRBC to strike a proper balance between the environment and the project, and between the community and the project to ensure project sustainability.

Solutions

CRBC analyzed the economic, social and environmental characteristics and needs of Kenya, deepened the employees' understanding of social responsibility and sustainable development, improved CSR management practices, and strengthened communication and cooperation with the Kenyan government, the community where the project is located, the partners and other stakeholders to protect the rights and interests of all parties and build a community of shared development between China and Kenya.

Establishing a management mechanism and a CSR fund

The project team has established a CSR framework where the project leaders make decisions, the liaison office coordinates the interests of all parties, and various departments perform the management functions. A three-tier communication mechanism was established to strengthen stakeholder engagement and management. Through communication with stakeholders, the project team identified wildlife protection, local talent training, supplier CSR performance, community development and other sustainability issues, and accommodate them into project agenda.

The project team prepared the *Kenya SGR Project CSR Management Procedures*, specifying that 0.5% of the contract value will be appropriated to a special CSR fund to provide financial supports for CSR-related works. In addition, 2% of the contract value will be transferred to a fund for rewarding and sanctioning employees based on their daily evaluation, quarterly evaluation, final evaluation and special evaluation results.

肯尼亚标轨铁路项目三级沟通机制
The three-tier communication mechanism for Kenya SGR Project

高层对接: 建立集团与公司领导与肯方高层定期会晤机制。通过定期总统现场会、不定期集团公司高访会,从顶层设计层面进行沟通。

政府沟通: 搭建与肯尼亚铁路局、交通部、国土局等肯尼亚中央政府部门全天候沟通机制,确保部委对项目部的政策执行层面无缝衔接。

地方协调: 各个标段建立与沿线各地方政府的沟通协调机制,从政策落地的末端落实重要决策。

Top management: Establishing a regular meeting mechanism between senior management of the Company and the Kenyan counterparts; conducting communication between top executives of both sides through regular presidential site meetings and occasional visits and meetings between top management.

Kenya's national government: Setting up a comprehensive communication mechanism with Kenyan government agencies such as Kenya Railways Corporation, Ministry of Transport, Infrastructure, Housing and Urban Development, and National Land Commission, to ensure the smooth communication between the Kenyan management bodies and the Company's Head Office of Kenya SGR Project on the policy implementation.

Local governments: Establishing a communication and coordination mechanism between each section office and the local governments to ensure the implementation of policies at the local level.



肯尼亚标轨铁路项目连续四年发布项目层面的社会责任报告
Kenya SGR Project has released CSR reports for four consecutive years

的开展提供资金保障;明确将合同额的2%作为蒙内标轨铁路项目的考评奖励基金,并以日常考核、季度考评、最终项目考核以及专项考核等四种方式进行考核。

公司连续四年发布项目层面的社会责任报告,披露铁路在建设和运营过程中的可持续发展理念、实践和绩效,努力将利益相关方的期望和诉求落实到铁路建设和运营中,加强与当地利益相关方的透明沟通。

保护野生动物,让长颈鹿不低头通过铁路

蒙内铁路在设计和建设中多管齐下,尽最

CRBC has released project-specific CSR reports for four consecutive years, explaining its CSR concept, practices and performance during project construction and operation. The company has made every endeavor to meet the expectations and appeals of stakeholders in the process of railway development and operation, and strengthen transparency of communication with local stakeholders.

Protecting wild animals and keeping giraffes head up

Several measures were taken during project design and construction, exerting the best efforts to protect wild animals:

1. Optimal routes were chosen to bypass the Nairobi National Park and reduce the city's ecological footprint in strict alignment with Kenya's overall development strategy as well as the requirements of the Kenya Wildlife Service.
2. Where railway tracks pass through wildlife parks (such as Nairobi National Park, Tsavo National Park, etc.), a certain

大努力做好野生动物保护:

一、优化线路方案,尽量避让内罗毕野生动物园,注重保护城市生态,严格遵循肯尼亚整体规划,主动迎合肯尼亚野生动物管理局的相关要求。

二、在铁路通过野生动物保护区(如内罗毕国家公园、察沃国家公园等)时,根据沿线的野生动物迁徙种类和迁移路径,以及大象、长颈鹿等动物的活动习性,设置一定数量的野生动物通道,并设置引导设施,引导动物安全穿过铁路。

三、线路两侧设置隔离栅栏,避免动物爬行通过时与列车相撞。

四、考虑到一般小型动物的饮水习惯,在大河处适当延长跨河桥梁引桥,加高桥梁高度,方便动物通行,在小河沟等低洼处设置涵洞,方便斑马等动物饮水。

项目部通过以上措施确保动物自由迁徙,让长颈鹿穿过铁路可以不低头、不弯腰,让野生动物维持原有生活习性,营造出人与自然和谐相处的美好景象。蒙内铁路全线建设大型野生动物穿越通道14处、桥梁61处、涵洞600处。

加强人才培养,为当地发展注入活力

建设一方,造福一方。蒙内铁路在建设运营过程中,从当地人才需求出发,培养当地员工和供应商,与当地共赢发展。

项目部从开始就树立“实现对当地的技术转移”的目标,从岗位技能培训、铁路运营人才培养、铁路专业人才培养三个层面开展培训工作。目前,蒙内铁路调度指挥中心已有4名当地员工参与调度指挥工作;33个车站中已有25个车站的运输管理工作全部由当地员工负责;客运站的列车服务和客运管理人员属地化率达90%以上,为当地培养员工37959人,累计创造就业岗位46000个。

number of passages were built according to the migration patterns and paths as well as the habits of elephants, giraffes and other wild animals. Guidance facilities are in place to escort the animals safely through the tracks.

3. Isolation fences were put up on both sides of the railway to prevent animals from colliding with the train as they go across.

4. Given the drinking habits of small animals, the approach bridges were appropriately extended and raised to facilitate the passage of animals. At low-lying places such as shallow runnels, culverts were built to facilitate animals like zebras to drink water.

The above measures are to ensure the free migration of wide animals. Giraffes need not to duck to cross the rails. Other wild animals are also able to maintain their original habits in an environment where human beings live in harmony with nature. Along the Mombasa-Nairobi SGR, altogether 14 passages, 61 bridges, and 600 culverts have been built for large wild animals.

Strengthening talent training to invigorate local development

Aiming to “benefit local people while developing local resources”, the project team launched pertinent training programs for local employees and suppliers to realize win-win development.

The training programs were designed for general workers, operational specialists, and railway engineering professionals to serve the unswerving goal of “passing on technical know-how to the locals”. At present, four employees at the Mombasa-Nairobi SGR Commanding Center are from the local community; 25 out of the 33 stations are fully managed by local employees; over 90% of the train service and management jobs at passenger transportation stations are assumed by the locals. All told, the project team has trained 37,959 local employees and created 46,000 local jobs.

The project team put much effort on resource integration across all links of the entire industrial chain, and helped suppliers fulfill their social responsibilities to build sustainability across the supply chain by: (1) strengthening technical and equipment-related guidance for suppliers to improve their products and engineering services; (2) sending experienced managers to impart management knowledge to improve the profitability potential of subcontractors; (3) helping suppliers and subcontractors resolve the difficulties to ensure the soundness of the supply chain; and (4) helping suppliers and subcontractors improve CSR performance. Up to now, the project team has established partnership with 378 local subcontractors on engineering works, and directly purchased from 1,234 local suppliers for goods, equipment and materials needed for the project.

01 岗位技能培训 • Job Skills Training

让每位雇员掌握每一个工序的工艺技术和操作规程
Impart techniques and skills of each procedure to all employees

02 铁路运营人才培养 • railway Operation Training

为肯尼亚培养铁路运营技术人员
Cultivate technical experts for railway operation in Kenya

03 铁路专业人才培养 • engineering Professionals Training

帮助肯尼亚高校创建铁路工程专业,为肯尼亚培养铁路
高层次工程专业人才
Initiate railway engineering majors at Kenyan universities to train
high-caliber engineering professionals for Kenya

蒙内铁路从三个层面开展员工培训工作
Three-tier training programs

项目建设运营期间注重提高全产业链各环节的资源整合能力,引导供应商履行社会责任,打造可持续的供应链。一是加强供应商技术和设备指导,帮助提高产品和施工水平;二是派驻有经验的管理人员传授管理经验,提升分包商盈利能力;三是协助供应商和分包商解决困难,保障供应链正常运行;四是帮助供应商和分包商改进社会责任绩效等。项目自建以来与 378 家当地分包商开展工程分包合作,直接带动 1234 家当地物资、设备、材料供应商参与项目建设。

例如,公司与当地大型钢材生产商优质钢厂有限公司合作,派遣技术专家,与该公司组成联合技术团队,调整钢坯,提升钢筋生产工艺,帮助优质钢厂有限公司稳定生产满足标轨铁路项目要求的抗震钢筋。

责任沟通,做当地社区的守护者

项目部建立与沿线各级地方政府、社区和部族的沟通对话机制,识别项目决策、建设、运营对社区的影响,多次组织邀请项目沿线社区

For example, CRBC cooperated with a large local steel producer (High-Quality Steel Co., Ltd.), sending technical experts to form a joint team that worked on billets and improved the process of steel bar production to help High-Quality Steel Co., Ltd. stably produce seismic reinforcement bars up to SGR standards.

Safeguarding local community through CSR communication

The project team has established a mechanism for effective communication and dialogue with local governments, communities and tribes along the route to identify the impacts of the project during decision-making, construction and operation processes. Residents, teachers and students along the route were invited to the site for several times to enhance operation transparency. In addition, supported by the county-level governments, the project team launched water-source sharing, education assistance, medical & health care, emergency rescue and other pertinent programs to answer the expectations and appeals of the community identified through field investigations and visits, in a bid to safeguard the community and create a better future with the locals. All told, more than 220 social welfare activities have been organized for counties along the Mombasa-Nairobi SGR route, benefiting more than 13,000 Kenyans.

Project Value

With the Mombasa-Nairobi SGR, the travel time between Mombasa and Nairobi has been greatly shortened. Freight transportation, which used to depend heavily on the road net-

work, now relies mostly on railway services to achieve greater efficiency and reliability at only 60% of the original logistics costs. An improved cargo distribution and transportation system is taking shape in Mombasa. Besides, the railway network has the potential for future electrification to cope with the continuous rises in port throughput. Railway operations could also be a boost for local tourism. According to the statistics from local authorities, the hotel occupancy rate in Kenya has risen from 50% to 90% after the train was opened to traffic.

居民和学校师生参观在建工程,加强透明运营。在实地调查走访、深入了解当地居民期望与诉求的基础上,在当地郡政府的支持下,开展了水源分享、教育帮扶、医疗卫生、应急救援等多种类型的社区支持项目,与当地共同守护美好社区,共创美好未来。蒙内铁路项目全线各郡共组织社会公益活动超过 220 次,超过 13,000 名肯尼亚人从中获益。

项目价值

蒙内铁路建成后,大幅缩短蒙巴萨和内罗毕之间的运输时间,助力当地实现以公路为主铁路为辅的货运方式转变为铁路为主公路为辅,降低物流成本 40%,大幅提升货运效率和安全,缓解公路运输压力,完善蒙巴萨集疏运系统。铁路预留的电气化条件也可以应对日后港口吞吐量的持续上升。铁路运营还拉动了当地旅游业的发展,据当地相关部门统计,肯尼亚的酒店入住率从通车前的 50% 上涨到 90%。

“蒙内铁路的开通承载着肯尼亚和东非国家加强产品出口的希望,而现代化的内罗毕内陆集装箱港投入运营,将提高蒙内铁路未来的货运能力,加快贸易流通,降低物流成本,带动铁路沿线地区的经济发展,更为肯尼亚人民创造了就业机会。”

“The Mombasa-Nairobi SGR carries the hope of Kenya to strengthen exports with Eastern African countries. However, the modern inland container terminal in Nairobi will improve the freight transportation capacity of the Mombasa-Nairobi SGR, speed up trade and goods circulation, reduce logistics costs, spark economic growth of local communities and create additional jobs for Kenyans.”

—— 肯尼亚总统乌胡鲁·肯雅塔
— Uhuru Kenyatta, President of Kenya



2 卡洛特可持续水电, 点亮“中巴经济走廊” ——巴基斯坦卡洛特水电站项目

Sustainable Hydropower Services on CPEC
Karot Hydropower Project, Pakistan

项目简介 ABOUT THE PROJECT

巴基斯坦卡洛特水电项目位于巴基斯坦吉拉姆河流域旁遮普省和巴控克什米尔 (AJ&K) 地区的界河上, 装机容量 720MW, 是吉拉姆河水电规划 5 个梯级电站中的第 4 级, 也是巴基斯坦第五大水电站。项目总投资 17.4 亿美元, 由三峡国际能源投资集团有限公司采用 BOOT 方式投资建设。2015 年 4 月, 中国国家主席习近平访巴期间, 与巴基斯坦国家领导人共同见证卡洛特水电站项目动土仪式。

The Karot Hydropower Project is a 720MW run-of-river project located on the Jhelum River in both the Punjab region of Pakistan and Azad Jammu & Kashmir division (AJ&K). It is the fourth of five cascade hydropower stations planned on the Jhelum River, and the fifth largest hydropower station in Pakistan. The project, with a total investment of USD 1.74 billion, will be developed by China Three Gorges International Corporation (CTGI) on a Build-Own-Operate-Transfer (BOOT) basis. The commencement ceremony was held in April 2015 as witnessed by President Xi Jinping and Pakistan's national leaders, during Xi's visit to Pakistan.

项目进程/Key Milestones

签约时间/Date of contract-signing	2011.04
开工时间/Date of commencement	2016.12.01
完工时间/Date of completion	预计2021年完工 / Expected to be completed in 2021

可持续发展背景

巴基斯坦卡洛特水电项目由中国进出口银行、国家开发银行、世界银行旗下国际金融公司 (IFC) 和丝路基金、中国长江三峡集团有限公司共同出资, 多元资方给项目带来多方资源的同时, 也对项目提出了更高的要求。项目在环境保护、安全生产、移民安置、社区发展等方面, 既要遵循巴基斯坦当地法律法规, 还需要符合 IFC 和中国的相关要求。

解决方案

项目部综合分析巴基斯坦当地政府以及 IFC、银团、三峡集团等机构和企业相关要求, 构建了一套多利益相关方共同参与治理的可持续管理体系, 并以此为基础, 促进项目实现环境可持续和社会可持续。

治理可持续

项目部在与各利益相关方充分沟通协商的基础上, 以硬性的标准要求、严格的环评研究、详尽的建设执行计划, 形成了一套完备的可持续管理体系, 得到了银团和政府的认可, 为项目奠定了坚实的基础。

开展社会环境影响评价。结合 IFC《环境和社会可持续性绩效标准》、巴基斯坦当地法律法规以及银团、三峡集团等机构和企业相关要求, 项目部积极与 IFC、三峡集团、旁遮普省及 AJ&K 地区环保部门沟通, 与第三方顾问及当地政府协商, 形成了获得巴基斯坦吉拉姆河两岸环保部门审批的涉环评报

Sustainable Development - Background and Context

The project is financed by a consortium of China EXIM Bank and China Development Bank, Silk Road Fund and International Finance Corporation (IFC) of World Bank, and China Three Gorges Corporation (CTG). While multiple investors bring diverse resources, they also lead to higher requirements on the project. In addition to complying with local laws and regulations, the project must also measure up to IFC and China's standards on environmental protection, workplace safety, resettlement, and community development, etc.

Solutions

The project team analyzed the requirements of Pakistani government, IFC, bank consortium, CTG and other related organizations and enterprises, and established a sustainable governance system that involves multiple stakeholders to promote environmental sustainability and social sustainability.

Governance sustainability

The project team has fully communicated and negotiated with stakeholders, and established a sustainable governance system that includes mandatory requirements, rigorous environmental assessment studies and detailed plans. The system was highly recognized by the bank consortium and local government, laying a solid foundation for the project.

Environmental and social impact assessment. According to IFC's *Performance Standards on Environmental and Social Sustainability*, as well as the requirements of Pakistani government, bank consortium, CTG and other related organizations and enterprises, the project team has communicated with IFC, CTG, and the environmental authority of Punjab and AJ&K, and consulted with third-party agencies the local government, preparing an environmental assessment report approved by the environmental authorities from both banks of the Jilam River. The project team has also worked out institutional plans such as "safety management procedures" and "comprehensive contingency plan".

Environmental and social management planning. The project team has prepared five management plans, including social and environmental management plan (CMP) that applies to the entire project development process, community investment plan (CIP), resettlement action plan (RAP), stake-



告，制定了安全管理办法、综合应急预案等系列制度方案。

编制环境与社会管理计划。项目部编制了5个管理计划，包括建设期社会环境管理计划、社区投资计划、移民安置计划、相关方管理计划以及生物多样性计划。同时制定了更为详细的19个执行计划，涵盖人力资源、安全生产等各个方面。

利益相关方共同治理。项目部统筹协调，项目股东和业主方负责监督，以澳大利亚雪山公司为牵头的业主工程师负责进度相关执行，长江三峡技术经济发展有限公司和中国机械设备工程股份有限公司等承包商具体实施建设，多个利益相关方各司其职、协同联动、共同治理，推动项目顺利实施。

环境可持续

项目围绕“践行低碳和节能是第一能源”主题，成立了由业主、承包商、业主工程师等参建各方组成的环境管理专职部门，从废弃物处置、空气质量和饮用水监测、施

holder engagement plan (SEP) and biodiversity management plan (BMP). Under them, nineteen specific plans have been formulated to look into human resources, workplace safety and other details.

Joint governance by all stakeholders. All stakeholders take a well-coordinated and inter-connected approach to governance within their respective mandates to promote smooth progress of the project. The project team coordinates all activities; the shareholders and project owner take on the role of supervisors; the owner's engineers, led by Snowy Mountain Engineering Corporation, ensure that the project proceeds as scheduled; Yangtze Three Gorges Technology & Economy Development Co., Ltd. (TGDC) and China Machinery Engineering Corporation, among other contractors, implement the project.

Environmental sustainability

Holding the belief that "low-carbon and energy-saving practices are the primary source of energy", the project team set up a full-time environmental supervision department composed of project owners, contractors, owner engineers and other parties involved in the construction process to minimize any negative impacts of the project on local environment through proper waste disposal, air quality & drinking water monitoring, noise management, eco-environment protection, and biodiversity protection, etc.

Energy saving and emission reduction. The site uses advanced technology and equipment to manage wastewater and waste oil and reduce air pollution. A heavy-fuel-based

工噪声管理、生态环境保护、生物多样性保护等全方面最大程度地减少项目对当地环境产生的负面影响。

注重节能减排。项目部采取先进工艺和设备，处理废水、废油和降低空气污染。修建重油发电电厂以代替巴基斯坦主流的柴油发电机，2016-2019年减排二氧化碳170万吨；采用辐流式沉淀池沉淀加机械压滤脱水处理工艺，砂石拌和系统废水回收率达90%；定点放置生物医疗废物收集箱和防油泄露箱，合规性处理医疗废物和生产过程产生的重油废物；聘请第三方当地环境监测机构对现场噪声、空气、粉尘进行监测，并采用高压雾炮除尘。

加强生物多样性保护。编制了获得IFC批准的《生物多样性管理计划》，整体上规范指导杰拉姆河流域的生态保护；编制了《卡胡塔小溪恢复计划》、《植被恢复计划》，通过停止大型设备进入河流、停止采石、支付足额植被恢复费用等措施，恢复受项目影响的当地生态系统；编制了《动植物管理计划》，通过设置禁捕禁砍警示牌、把围堰里的鱼捕捞后重新投放下游等举措，确保项目建设期的动植物保护有效执行。

社会可持续

项目部对项目有可能产生的社会影响进行了调查评估，将移民安置、当地人才发展、社区建设等议题纳入可持续治理体系。

妥善安置移民，进行合理补偿。受项目影响，卡洛特水电站两岸的居民需要搬迁，根据IFC绩效标准和当地实际需求，项目部制定了移民安置计划，对项目受到影响的居民进行妥善安置和合理补偿。

▲根据当地政府规定对移民进行货币补偿的同时，聘请当地会计事务所开展详尽的货币

power plant has been built to edge out diesel-fueled power generation, which is a mainstream practice in Pakistan. All told, 1.7 million tons of carbon dioxide have been negated during the 2016-2019 timeframe. The site combines the use of radial sedimentation tank with mechanical dewatering technique to achieve 90% wastewater recovery from the sand-rock mixture process. Biomedical waste bins and oil-leakage-proof boxes are in place to ensure all biomedical and heavy-oil wastes are disposed of in accordance with pertinent rules. The site also engages a third-party environmental organization from the local community to conduct noise, air and dust monitoring, and uses high-pressure misting cannon for dust suppression.

Intensifying biodiversity conservation. The site has worked out the IFC-endorsed *Biodiversity Management Plan* to guide ecological protection efforts along the Jhelum River Basin; *Kahuta Creek Restoration Plan* and *Vegetation Restoration Plan* which aim to restore the affected local ecosystem by stopping large machineries from accessing the river, stopping quarrying operations, and making full payment for vegetation restoration; and *Flora and Fauna Management Plan* to enforce animal and plant protection during the period of the project by placing no-fishing and no-logging signs, releasing fish caught in the cofferdam back into the downstream river, etc.

Social sustainability

The project team has looked into the possible social influence of the project, putting such issues as resettlement, local talent training, and community development under a sustainable governance perspective.

Properly resettling migrants with a reasonable amount of compensatory payment. Since the affected residents on both banks of the Karot HPP need to be relocated, the project team has drawn up a resettlement plan up to IFC's performance standards and local needs, properly resettling the migrants with a reasonable amount of compensatory payment.

▲ While making monetary compensation to the affected migrants based on local government decisions, the site has also engaged a local accounting firm to offer detailed monetary knowledge training which helps migrant families make better use of the compensatory payment.

▲ The site has built new houses in the nearby area, and paid regular visits to the migrant families to understand their work and living conditions.

▲ Cemeteries have been properly relocated based on local customs as well as environmental and hygiene policies. The site has also relocated cultural relics and monuments following the "cultural heritage protection" principle stipulated in the IFC's Performance Standards on Environmental and Social Sustainability.

使用知识培训，帮助移民家庭更好地利用补偿金。

▲ 在附近提供移民安置地新建住房，定期回访了解移民家庭的生产生活情况。

▲ 遵循当地风俗礼节并注重环境卫生做好墓地搬迁工作，严格遵循 IFC 社会环境绩效标准中“文化遗产保护”原则做好文物古迹搬迁工作。

▲ 由于语言及文化差异可能导致沟通不顺畅，使移民产生疑虑和不解，项目组专门对移民政策进行详细解读。

促进当地人才发展。项目部从移民家庭中筛选品学兼优的学生，提供移民奖学金，采取“2+2”的模式在中国和巴基斯坦两国大学进行联合培养。现在第一批移民学生已经顺利完成了在巴基斯坦的两年学习，开始了在中国的两年深造。

制定社区投资计划。公司制定了在5年开发期内投资600万美元的社区投资计划，对当地受项目影响的教育、医疗、文体和道路的基础设施进行改善。目前，已经有几所学校和卫生医疗所建成，并且移交当地政府，后续还有一些新的项目正在建设和规划中。

项目价值

巴基斯坦卡洛特水电项目投运后，每年为巴基斯坦提供大约 32 亿度廉价清洁电能，为当地居民创造更多稳定就业机会，推动巴基斯坦经济社会发展。同时，该项目作为“一带一路”倡议实施以来的首个大型水电投资项目、中巴经济走廊首个水电项目、丝路基金成立后的首个投资项目，在推动“一带一路”倡议和“中巴经济走廊”战略、促进中巴能源电力领域紧密合作方面，发挥着重要作用。

▲ Considering ineffective communications and misunderstandings that might arise from language and cultural differences, the site has interpreted the resettlement policies in detail.

Promoting local talent development. The project team grants scholarships to students excellent both in conduct and learning from immigrant families, who will study at universities in China and Pakistan under a "2 + 2" joint education program. Now the first batch of immigrant students have accomplished the initial two-year learning in Pakistan and are in China for another two years of further studies.

Making community investment plans. The company has launched a \$6mn community investment plan to improve local educational, medical, cultural, sports, and road infrastructure affected by the project in five-year's time. Up to now, several schools and health clinics have been built and handed over to the local government; some other new projects are under development or planning.

Project Value

Once it gets functional, the Karot HPP will annually generate some 3.2 billion kilowatt-hours of clean electricity, provide tremendous job opportunities to the locals, and promote economic and social progress of the country. As the first large-scale hydropower project implemented under the Belt and Road Initiative, the very first hydropower project on the China-Pakistan Economic Corridor, and the first investment project financed by the Silk Road Fund, it is playing an important role in promoting the BRI, CPEC and close cooperation between China and Pakistan in the area of energy.



3 可持续发展为先，打造中加水电合作典范 ——加纳布维水电站项目

A Paragon of China-Ghana Partnership on Sustainable Hydropower Development

Bui Hydropower Station, Ghana

项目简介 ABOUT THE PROJECT

加纳布维水电站是由中国电建集团国际工程有限公司和中国水利水电第八工程局有限公司承建的 EPC 项目。项目位于加纳北部和科特迪瓦交界处，枢纽建筑物有 110 米高的碾压混凝土重力坝（主坝）、60 米高的黏土芯墙堆石坝（副坝）和 7 米高的均质土坝（副坝）各 1 座，总装机 404MW，年发电量可达 10 亿度。项目累计总投资超过 7.9 亿美元，建成后，布维水电站每年可生产大约 10 亿度的优质电源。截至 2019 年 12 月，已累计发电超过 73.18 亿度。该水电站已经成为中加友谊的永久象征，也是中加合作的重要经贸成果展示。

The Bui Hydropower Station, situated in the boundary between the north of Ghana and Cote Divoire, is an EPC project undertaken by POWERCHINA International Group Limited and Sinohydro Bureau 8 Co., Ltd. The complex consists of a 110m-high roller compacted concrete (RCC) main dam, a 60m-high clay-core wall rockfill saddle dam, and a 7m-high homogeneous earthfill saddle dam. With a total cost of USD 790 million and an installed capacity of 404MW, the HPP is expected to generate about 1 billion kWh annually. As of December 2019, over 7.318 billion kWh of electricity has been produced. The project has become a paragon of economic and trade cooperation between China and Ghana.

项目进程/Key Milestones

签约时间/Date of contract-signing	2007.04
开工时间/Date of commencement	2008.12.02
完工时间/Date of completion	2014.11.27

可持续发展背景

加纳北部属于偏远地区，周边物资匮乏。早在上世纪 20 年代，前苏联、法国和澳大利亚等国先后介入过布维电站规划，但均因无法适应当地条件铩羽而归。如何克服当地物资不足、设施落后的问题，成功实现项目在经济、社会和环境方面的可行性，是项目面临的巨大挑战。

解决方案

该项目在建设过程中注重全方面的可持续发展，从可持续治理、经济可持续、环境可持续和社会可持续方面同步加强管理，实现项目的高质量建设和运营。

经济可持续

2007 年，中国政府和进出口银行提供优惠贷款和买方信贷混合贷款融资支持，创造性地使用可可豆收入作为还款担保，让该项目真正落地。布维模式创新了中加经贸合作模式，以政府提供资金支持，创造性选择担保物，为非洲地区项目融资开拓了新的思路。

电站年发电量达 10 亿度，在维持加纳整体电网的稳定之时，向布基纳法索等西非国家输电，使得加纳从电力进口国一跃成为输出国。电站也带来了可观的附加价值：一是在电站上游建设 Jama 等数个天然渔场和交易场，越来越多的库区居民开始从事渔业发家致富，每年水产量可达 700 多吨；二是电站因其优美的自然景观已作为当地旅游胜

Sustainable Development - Background and Context

The remote northern part of Ghana is characterized by severe material deprivation, which daunted the former Soviet Union, France, and Australia when they attempted to engage in the planning process of Bui Hydropower Station in as early as the 1920s. How to establish economic, social and environmental feasibility of the project despite insufficient materials and backward facilities seemed quite a challenge for the project.

Solutions

The project has attached great importance to its sustainability in governance, economic, environmental and social dimensions to pursue excellence in development and operation.

Economic sustainability

In 2007, the Chinese government and The Export-Import Bank of China (CEXIM) financed the project through a mixed package of preferential loans and buyer credit, secured by the sale of cocoa beans. This financing structure, where the government provides funding backed by collaterals, marked an innovative attempt of China-Ghana economic and trade cooperation and provided an alternative ways to financially support projects in Africa. The hydropower station is designed with an annual energy output of 1 billion kWh which is able to meet the national power-load demand of Ghana and complement the power grids of Burkina Faso and other West African countries. Ghana has grown from a power importer to an exporter. Besides, several natural fisheries and trade markets have been built upstream of the power station, allowing more and more reservoir residents to make their fortune by fishing. The total output of aquatic products has exceeded 700 tons a year. Another benefit lies in the beautiful natural environment which has made Bui HPP a tourist attraction and driven economic growth.

Environmental sustainability

The project team designed an ecological dam drainage system that works in tune with local climate trends to guarantee certain water supplies in the downstream reach

地，拉动经济发展。

环境可持续

项目部根据当地气候情况，在大坝上设计相应的生态放水系统，以备在旱季雨水较少时，使下游河流仍能够有相当的水源维持。

项目部严格按照 ISO 标准和当地法律法规采取管控措施。为恢复工程周边环境，主动请教当地酋长和村民，选择当地植被来恢复土场，效果良好。

项目建成后极大改善了项目周边道路环境。电站相当于每年可替代标准煤约 31.8 万吨，减排二氧化碳 81.61 万吨，有利于区域大气污染防治和农业、林业生态保护，具有良好的环境效益，节能减排作用显著。

社会可持续

电站为当地带来大量就业岗位，中国电建累积直接雇佣的当地员工达到 8000 余人次，高峰期时项目部不含业主指定分包员工达到 2300 多人。在带动工地四周经济发展的同时，积极开展员工培训，为加纳培养了大量的技术工人。

打造劳资对话典范。电站员工队伍庞大，管理难度极高。电站项目部在严格遵守劳动法的前提下，以集体合同、对话协商、人为关怀有效化解矛盾，得到广大工人以及加纳建材行业工会委员会的高度认可。工会秘书长 Qunoo 先生曾说：“中国电建布维项目部与工会的对话合作机制在加纳乃至整个非洲堪称标杆。”国际劳工组织（ILO）代表经过现场调研访谈，称赞电站为“中资企业在非洲履行社会责任的典范”。

担当传播友谊使者。自开工以来的 10 年间，项目部为周边社区捐资修路、捐赠大

even in dry seasons.

The project team took control measures in strict accordance with ISO standards and local laws and regulations. It consulted local chiefs and villagers on the right vegetation to restore soil fertility and the surrounding environment, and achieved sound results.

The surrounding environment has also been improved greatly. The HPP can replace 318,000 tons of standard coal, which is equivalent to a reduction of 816,100 tons of CO₂ emissions. It benefits the environment in a huge way, in terms of regional air pollution control, agriculture and forestry ecological protection, energy saving and emission reduction.

Social sustainability

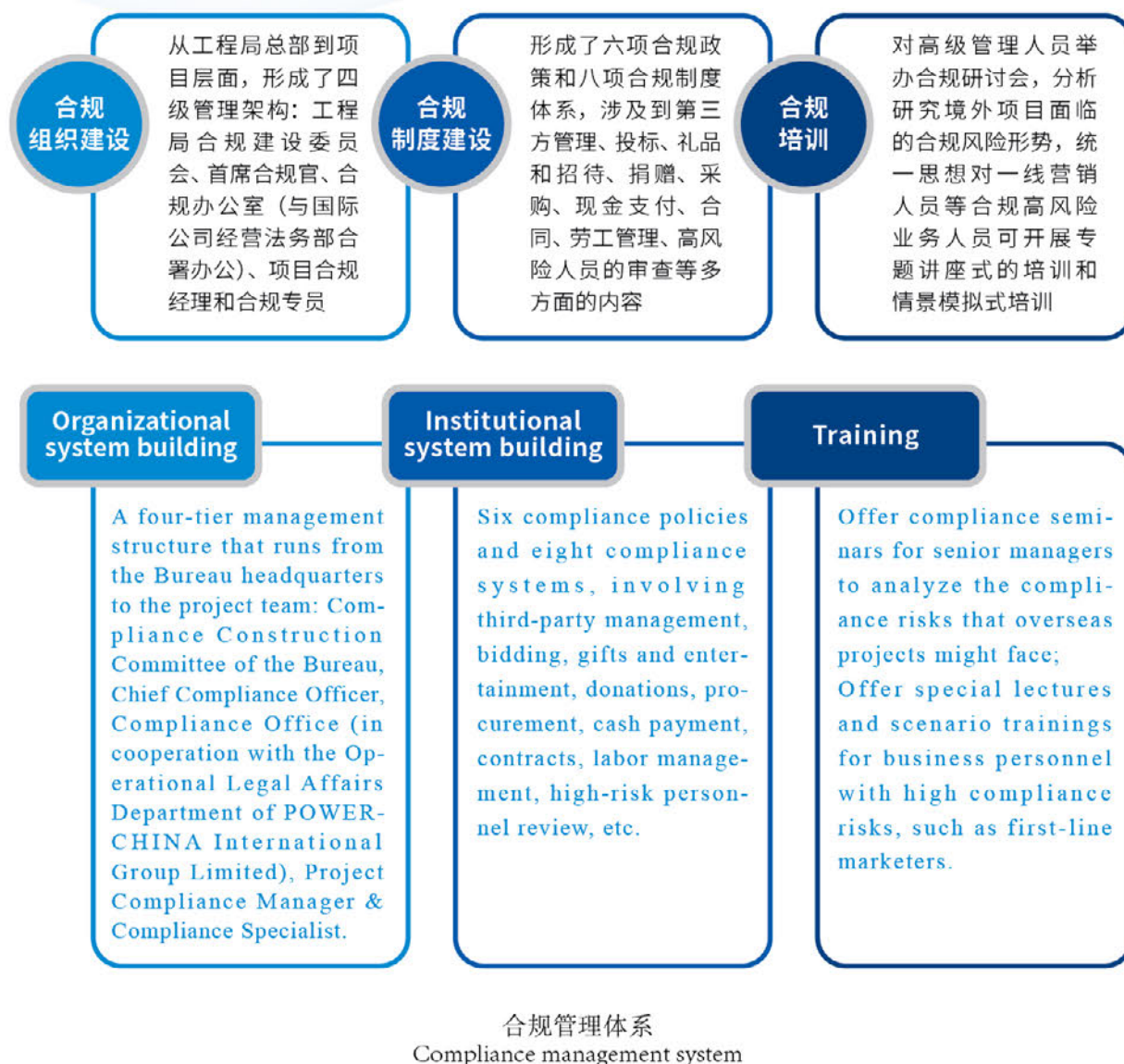
The project has created enormous jobs for the locals. POWERCHINA directly engaged more than 8,000 local employees; there were over 2,300 locals working at the site during peak construction season, excluding those employed by owner-designated subcontractors. While driving the economy of surrounding communities, the project team also provided training programs to help Ghana build a large pool of skilled workers.

Setting an example of labor-management communication. The HPP is heavily staffed, making HR management a tough challenge. The site strictly abides by the labor law, resolving conflicts through collective contracts, dialogues, negotiations, and human care & concern, which were applauded by all the workers and Ghana Building Materials Industry Trade Union. Mr. Qunoo, Secretary General of the Trade Union, said: “The dialogue and cooperation mechanism between POWERCHINA Bui HPP team and the Trade Union has set a benchmark in Ghana and even in Africa.” A representative of the International Labor Organization (ILO) visited the site and praised the HPP as “a model of Chinese company performing social responsibilities in Africa.”

Being a messenger. In the 10 years since the commencement of the project, the team has made more than 40 donations to surrounding communities in the forms of road development funds, rice, cassava, household appliances, sports equipment and school supplies, and offered medical services for 48,900 local employees and villagers. The POWERCHINA health professionals are crowned as the “Key Stand” who were highly appreciated and favorably received by the local government, chiefs and people.

Sustainable governance

The company has formulated the *POWERCHINA International Group Limited CSR Management Procedures* to



米、木薯、家用电器、体育器械以及一些学习用品40多次，为当地雇员和村民治病达48900余人次，项目部医疗人员被大家称为“定海神针”，得到了当地政府、酋长和群众的高度赞赏与欢迎。

establish the CSR review system, and issued China Electric Power Construction Co., Ltd. Comprehensive Emergency Response Plan for Emergencies Abroad and other early-warning plans to mandate a compliance management system that involves organizational system, institutional system, risk control, compliance training, compliance reporting and consultation, etc.

可持续治理

公司制定了《中国水电建设集团国际工程有限公司企业社会责任管理办法》，规定了社会责任考核体系，并印发《中国电力建设股份有限公司境外突发事件综合应急预案》等多种预警方案，从组织体系、制度体系、风险防控、合规培训、合规举报和咨询等多个方面建立了合规管理体系。

项目价值

项目为加纳提供了源源不断的电力，促进了北部省和布朗阿哈福省之间的经贸沟通和交流，也带动了当地旅游业、渔业等产业发展。2013年12月19日，来布维参加竣工仪式的马哈马总统和前任库福尔总统对布维工程给出了“布维水电站是中加两国人民伟大合作典范”和“中国水电建设了一座优质、漂亮的工程”的高度评价。

Project Value

The Bui Hydropower Station guarantees a steady stream of electricity in Ghana. It has strengthened the economic and trade ties between the Northern Region and Brong-Ahafo Region, and given impetus to local tourism and fishery industries. On December 19, 2013, then-President Mahama and former President Kufuor attended the completion ceremony of the Bui HPP, and praised it as “a magnificent high-quality work of POWERCHINA” and “a paragon of China-Ghana partnership”.



4 一桥飞架, 打通莫桑比克发展“经脉” ——莫桑比克马普托大桥及连接线项目

Maputo Bridge Breathes Vital Energy into Mozambique
Maputo Bridge and Link Roads Project, Mozambique

项目简介 ABOUT THE PROJECT

莫桑比克马普托大桥及连接线项目起于莫桑比克首都马普托市区, 由中国路桥工程有限责任公司以 EPC 方式承揽, 项目合同金额 7.858 亿美元。大桥设计为单跨双铰重力式锚碇悬索桥, 主跨 680m, 南北引桥长分别为 1.097 公里和 1.234 公里, 大桥全长 3.011 公里, 是非洲主跨跨径最大的悬索桥, 也是莫桑比克地标性建筑和南非基础设施标杆工程, 荣获南部非洲区域 FULTON 混凝土质量最高奖、大型项目组冠军, 美国 ENR 全球最佳项目桥隧组优秀项目奖。

The USD 785.8 million Maputo Bridge and Link Roads Project, undertaken by CRBC under EPC mode, is a trunk highway extending from Maputo, capital of Mozambique. The 3.011km bridge consists of a single-span double-hinged earth-anchored suspension structure which sports Africa's longest main span at 680 meters, a 1.097km south approach section, and a 1.234km north approach section. This is truly a landmark project that will set a new benchmark for infrastructure development in southern Africa. It has twice won the Fulton Awards, the highest distinction for concrete structures in the southern states of Africa (first for Highest Quality of Concrete, and then for Winner of Infrastructure > R100 Million Value). It has also won the "Award of Merit" of Engineering News-Record (ENR) in the category of "Global Best Projects (Bridge/Tunnel)".

项目进程/Key Milestones

签约时间/Date of contract-signing	2011.06.27
开工时间/Date of commencement	2014.06.06
完工时间/Date of completion	2018.11.10

可持续发展背景

莫桑比克位于非洲东南海岸, 拥有丰富的矿产、渔业及森林资源, 其首都马普托是一座美丽的滨海城市。由于独立后连年内战和自然灾害, 莫桑比克经济发展长期困难, 基础设施十分落后, 马普托湾两岸的居民, 因一水之隔需要绕行三四个小时, 或者不得不乘坐耗时耗力且有安全隐患的渡轮, 在马普托海湾上建立互联互通的桥梁成为莫桑比克政府及民众多年来的梦想。

解决方案

莫桑比克马普托大桥及连接线项目始终以打造“非洲第一悬索桥”作为项目目标, 不断在工程设计、施工技术、项目合作等领域寻求突破创新, 创造更多项目价值, 践行可持续发展战略。2018年11月10日, 在马普托建城131周年之际, 马普托大桥正式通车, 对改善当地交通条件、拉动区域经济发展产生了深远影响。

打造“非洲第一悬索桥”

莫桑比克马普托大桥是非洲首座悬索桥, 也是非洲主跨跨径最大的桥梁。为了保质保量完成“非洲第一悬索桥”建设, 项目部选择最优的工程设计, 不断创新施工技术和项目合作模式, 提升项目价值。

优化工程设计, 充分满足外部施工环境要求。大桥所在的马普托市是莫桑比克政治中心, 有市容市貌美观和谐要求; 大桥项目主引

Sustainable Development - Background and Context

Mozambique, a coastal country in southeastern Africa, is rich in mineral, fishing and forest resources. Maputo, the capital, is a dynamic seaside city. Years of civil war and natural disasters after independence have really proved to be a drag on the country's economy; the infrastructure is woefully inadequate. Citizens living on both sides of the Maputo Bay used to spend three or four hours on a detour to round the Bay, or ride on ferries which are labor-intensive and time-consuming with potential safety hazards. A bridge across the bay, therefore, had been a dream of Mozambican government and several generations of people there.

Solutions

Aiming to build the "No.1 suspension bridge in Africa", the project team has sought constant breakthroughs in project design, engineering and cooperation, etc., to create more values upon sustainable development. Maputo Bridge was officially opened to traffic on November 10, 2018 to coincide with the 131st anniversary of Maputo's elevation to city status. It has produced profound impacts on improving local traffic conditions and driving regional economy.

No.1 suspension bridge in Africa

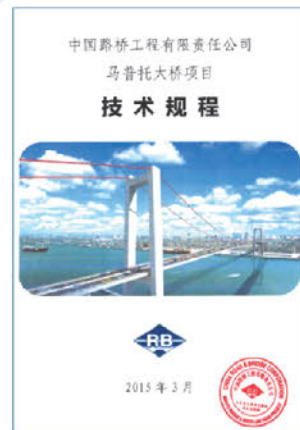
To ensure that Maputo Bridge, the first suspension bridge with the longest main span in Africa, can be finished to the agreed timetable and quality standards, the site has optimized the engineering design, and blazed new trails in engineering practices and the mode of partnership to enhance project value.

Optimizing the engineering design to meet the requirements of the surrounding environment. As the political center of Mozambique, Maputo has to maintain a positive image that reflects harmony and attractiveness. The main bridge has to provide a safe shipping clearance as it hovers across the shipping channel and busy port of Maputo Bay. However, located less than 4km away from Maputo International Airport, it is also subject to a height limit for aviation safety. The north approach section must not impede normal traffic movement when it stretches across the port operation area, major railway routes, as well as urban arterial roads and intersections. The south link road passes through an animal nature reserve, and shall produce minimal environmental footprints. To accommodate the above requirements, a single-span double-hinged earth-anchored suspension structure was chosen despite the high costs, complex load-bearing design

桥跨越马普托湾运输航线及繁忙的马普托港区，有航运净空要求；大桥距马普托国际机场不足4公里，有航空限高要求；大桥北引桥连续跨越港口作业区、马普托火车站重要轨道线路以及多个城市主干道和道路交叉口，有确保原有交通正常运行的要求；大桥南接线穿越当地动物自然保护区，有降低环境影响的要求。项目部最终确定采用单跨双铰重力式锚碇悬索桥，这一桥型充分满足跨径大、美观度高、桥下航运交通畅通、桥上航空限高、对保护区影响小等要求，而代价就是造价更高、承重结构更复杂、施工难度更大。

创新桥梁建造技术，研发当地材料，推动当地工程行业发展。如此大型的悬索桥梁在非洲地区建设尚属首次，项目部编制了《马普托大桥技术规程》，填补了当地工程行业的规范空白，为其工程技术升级换代提供了指引。同时，由于当地工业严重落后及地质构造环境特殊，当地可满足施工要求的粗骨料价高且难供应，不仅如此，整个非洲大陆常见的粗骨料吸水率也不能达到施工要求。为此，项目部投入大量人力物力，对当地材料进行研发，最终形成了一整套混凝土配制、生产及外观质量控制技术，获得了2017、2019年度南部非洲混凝土最高奖“富尔顿”奖，该项研究也适用于南部非洲后续桥梁项目。

创新国际合作模式，确保工程质量。项目部整合国际知名的质量监控、设计咨询资源，聘请德国GAUFF公司和津巴布韦CPG公司作为项目的质量监控和设计咨询方，充分发挥监理方的语言和欧标技术优势，搭建与业主方之间技术沟通的桥梁，形成中国规范设计、欧洲规范验算的合作模式。在南部非洲建筑施工标准多年沿用欧洲规范的背景下，这一合作模式让业主熟悉和信任中国规



《马普托大桥技术规程》
Maputo Bridge Technical Specifications

and engineering difficulties

Working on innovative engineering solutions while exploring the use of local materials to drive the local engineering industry. To build the largest ever suspension bridge in Africa, the project team has compiled the *Maputo Bridge Technical Specifications*, the first of its kind in Africa, to provide guidance for the upgrading of local engineering practices. However, given the disadvantaged industrial foundation and complicated geological formations, the coarse aggregates commonly found in the African continent are not able to meet the water absorption requirement of the project; the qualified ones are costly and rare. Therefore, the project team earmarked large amounts of funds, manpower and materials in its endeavor to develop local materials, and settled on a complete set of concrete preparation, production and QC procedures, which won the prestigious Fulton Awards for excellence in infrastructure concrete and can be applied to future bridge projects in southern Africa.

Ensuring project quality through innovative partnership. The project team engages world-renowned QC and design consultancy services, including GAUFF (Germany) and CPG (Zimbabwe). With local language proficiency and European-codes-based knowhow, they serve as a bridge of technical communication between CRBC and the project owner. In southern Africa where European codes have been prevailing for engineering works for many years, this mode of partnership that includes Chinese-codes-based design and European-codes-based acceptance check has enabled the project owner to get familiar with and confident in Chinese codes and ensured project quality. The project was highly recognized internationally and won the "Award of Merit" of Engineering News-Record (ENR) in the category of "Global Best Projects (Bridge/Tunnel)".

Improving local traffic conditions

To improve local traffic conditions is the original intention and basic value of Maputo Bridge. It has brought enormous changes to the everyday travel experience of local residents, and promot-

范，保证了项目工程质量。项目最终得到国际高度认可，荣获美国ENR全球最佳项目桥隧组优秀项目奖。

改善当地交通条件

改善当地交通条件既是大桥项目建设的初衷，也是大桥建成后的基础价值。马普托大桥建成通车后，不仅给当地居民的通行方式带来翻天覆地的变化，也促进了南部非洲区域互联互通。

给当地居民通行带来安全和便利。马普托大桥建成通车后，将原来两三个小时的渡海时间缩短到十分钟左右，人们不用乘坐费时危险的渡轮，也不用绕行三四个小时通勤，安全便捷的过桥大巴节省了居民的时间，保障了居民的安全，也给他们的工作和生活带来更多机会。

促进南部非洲区域互联互通。截止2019年10月，大桥通过车辆约为150万辆，其中大部分为来往于马普托与南非之间的客货运车辆。大桥通车后，从马普托经贝拉维什塔至南非客货运交通由4个小时缩减为1个半小时，显著提高了南部非洲公路网络化水平和连通性。

促进当地经济发展

带动当地就业。大桥施工期间，先后聘用当地劳务人员5000余名，为马普托地区创造就业岗位3788个，大桥运营与维护还将永久性解决1000多名当地员工的就业问题。项目期间培养了大量的实验员、测量员、焊工和驾驶员，很多当地工人也因为大桥的工作，改善了生活水平。大桥项目被当地媒体描述为“一个项目就像一座大学校”。

活跃当地基建市场。项目对物资材料和施工设备的需求量大，所需的水泥混凝土材



快捷安全的过桥大巴
Safe and convenient shuttle bus service

ed regional connectivity in southern Africa.

The development of Maputo Bridge is justified in the interest of safety and convenience to the local community. The time needed to cross the Bay, which used to be two or three hours, has been shortened to about ten minutes. The locals do not have to spend three or four hours on a detour to round the Bay, or ride on ferries with potential safety hazards. The shuttle buses run across the Bridge to save the travel time of locals with guaranteed safety, and open them up to more opportunities in work and life. Regional connectivity in southern Africa has come to a new height. As of October 2019, approximately 1.5 million vehicles have run across the Bridge, most of which were passenger and freight vehicles to and fro between Maputo and South Africa. The passenger and freight transportation from Maputo via Bela Vista to South Africa has been shortened from 4 hours to 1.5 hours. A highway network with much greater connectivity is taking shape in southern Africa.

Promoting local economy

Local employment has been improved. The site engaged more than 5,000 local labors for the construction activities, and has generated to date 3,788 jobs for the Maputo community. Besides, the operation and maintenance of the bridge will secure more than 1,000 permanent jobs. A large number of local workers have received trainings as laboratory assistants, surveyors, welders and drivers; many have seen an uplift in their living standards. The local media likened the Maputo project to a comprehensive school.

The local infrastructure market gained momentum. Building a



拥有一技之长的焊工
A skilled welder



边境口岸的旅游胜地——黄金角
A tourist attraction at the border crossing-the Golden Horn

料、辅助设备、车辆机械维修所需零件以及生活办公物资，均以当地购买为主，本地化采购率达62.3%。

带动当地旅游业发展。根据官方统计数据，2018年圣诞节期间，大桥项目南接线所到达的边境口岸，游客人数同比增长近三倍。2019年上半年黄金角地区收入同比去年增长一倍，游客数量总体增加37.4%。

带动南岸经济发展。马普托海湾南北两岸的发展因水域屏障而极不均衡，北岸的马普托市是莫桑比克的经济政治中心，而南岸的卡滕贝地区发展相对滞后，只有稀疏的水泥砖房和铁皮房。马普托大桥开通后，使得繁华的马普托市区和卡滕贝地区间的连接沟通更为便捷与通畅，中国路桥成为当地政府经济发展的深度参与者，为南岸卡滕贝新城规划提供蓝图，包括政府机构建设、土地开发、商业物流、现代工业等，促进当地经济和产业的可持续发展。目前，政府已经开始落实卡滕贝新城的开发。

bridge requires an enormous amount of materials and machineries, including cement concretes, auxiliary facilities, vehicle maintenance parts and work & life necessities, most (62.3%) of which were purchased locally.

The local tourism industry has soared. The official statistics revealed a nearly 300% y-o-y increase in the number of tourists at the border-crossing terminal the connects with the Maputo Bridge south link road during the 2018 Christmas season. The revenue generated in the Golden Horn area doubled in 2019H1 as compared to the same period of 2018, accompanied by a 37.4% increase in the number of tourists.

Economic development has been spurred on the south bank. The Maputo Bay separates the north and south banks both geographi-



马普托大桥南岸新城规划蓝图
Maputo Bridge south bank blueprint

项目价值

莫桑比克马普托大桥及连接线项目的实施让马普托湾天堑变通途成为现实，贯通莫桑比克南北部的交通连接，显著提高马普托南部地区的公路网络化水平和连通性，大大缩短莫桑比克与南非的通行距离，成为重要国际交通通道。同时，马普托大桥及连接线犹如莫桑比克的发展“经脉”，为南岸卡滕贝地区的发展提供良好契机，促进了莫桑比克工程建筑、客货运交通、生态旅游等多种行业的发展。

今日玉龙横卧，南北两岸比邻。总统纽西先生在通车致辞中表示，这座大桥是莫桑比克历任总统的夙愿，终于梦想成真。大桥建设克服了种种困难，是中莫两国团结的象征，是国家经济发展进步的标志。中国路桥为莫桑比克打造了足以载入史册的精品工程。

cally and economically. While the city of Maputo on the north carries great political and economic significance to Mozambique, Katembe on the other side lags significantly behind with only sparsely distributed brick houses and metal houses. The Maputo Bridge, after opening to traffic, has established convenient and unobstructed accessibility between the bustling downtown of Maputo and the region of Katembe. CRBC has involved profoundly in the local economy, and prepared blueprints for the new town of Katembe on the south bank in terms of government department building, land development, commercial logistics, modern industry, etc., to promote the sustainability of the local economy and industry. Now, the government has begun to implement the development plan of the Katembe new town.

Project Value

The Maputo Bridge flies to span the south and north of Mozambique, turning the deep chasm of the Bay into a thoroughfare. A highway network with much greater connectivity is taking shape in the southern Maputo to considerably shorten the travel time between Mozambique and South Africa. The Maputo Bridge and its link roads form an important channel that breathes vital energy into Mozambique, lending new impetus to Katembe on the south bank, and producing an expansionary effect on such industries as engineering & construction, passenger and freight transportation, and eco-tourism in the country.

President Nyusi of Mozambique said as he inaugurated the Maputo Bridge that this first ever bridge across the Bay of Maputo was a long-cherished dream of the previous presidents, and this dream has now come true. Despite the many difficulties, it is a milestone in the country's economic development. Built by CRBC, this project is good enough to go down in the history as a “national treasure”.



5 助力尼日利亚首都打造立体化交通体系 ——尼日利亚阿布贾城铁一期工程

Multimodal Transport System in Nigeria's Capital
Abuja Light Rail Project (Phase I), Nigeria

项目简介 ABOUT THE PROJECT

尼日利亚阿布贾城铁全长 45.2 公里，是一条标准轨双线铁路，最高运行速度 100km/h，连接了阿布贾国际机场、市中心、阿布贾城铁依都车站、西北卫星城库瓦等重要区域，助力尼日利亚首都阿布贾实现了“干线铁路+城市轻轨+城市航空+城市公交”立体、多维联通体系，使阿布贾成为通向尼日利亚全国、西非乃至世界的枢纽和窗口。项目以 EPC 方式承揽，之后转变为“投建营一体化”模式实施。

The 45.2km SGR network developed in Abuja under the first phase has two lines, where trains run at a maximum speed of 100 km/h through the city center, Nnamdi Azikiwe International Airport (ABV), Idu Station, Kubwa in the northwest, and other major areas. This project has contributed to the multi-dimensional connectivity of Abuja based on "trunk railway + urban light rail + urban aviation + urban bus", making Abuja a hub of Nigeria, West Africa and even the world. The project was contracted on an EPC basis, and delivered through the investment-construction-operation model.

项目进程/Key Milestones

签约时间/Date of contract-signing	2012.08.24
开工时间/Date of commencement	2013.01.07
完工时间/Date of completion	2017.12.15

可持续发展背景

尼日利亚基础设施比较薄弱，高度依赖公路，95%以上客运和货运都是靠公路。阿布贾是尼日利亚的首都，发展速度非常快，但是交通不便的“瓶颈”严重制约着其经济社会发展。如何解决社会各界对快捷方便的现代化交通需求与阿布贾产业规划不匹配的问题，更好地服务于社会发展，是项目亟待解决的问题。

解决方案

阿布贾城铁项目吸取了尼日利亚原首都拉各斯严重交通拥堵难题的教训，规划了六条轨道交通路网，将居民区、工业区、行政区、商业CBD、机场和卫星城紧密连接，构建首都地区的轨道交通路网，打造阿布贾综合交通体系。加强当地人才雇佣和培养，为当地社会发展提供强大的人才动力，促进首都区域经济协调发展。

无缝换乘，实现互联互通

中土集团借助同时实施阿布贾城铁、阿卡铁路和阿布贾新航站楼项目的契机，主动对三个项目的设计和施工统筹规划。阿布贾新国际机场换乘中心连接阿布贾城铁，既有航站楼、新航站楼的交通枢纽，又使公路、铁路、航空交通连接在一起。尼日利亚旅客由市中心各城铁车站乘车抵达机场车站，可通过同一层的平台换乘中心直接抵达机场售票候机大厅，实现无缝换乘。

Sustainable Development - Background and Context

Across Nigeria, poor infrastructure has directed 95% or more of passenger and freight traffic to roads. The capital Abuja, while expanding rapidly, sees an imperative to break the transport infrastructure bottleneck in social and economic development. The project, therefore, has to reconcile the mismatch between the needs for fast and convenient modern transportation and city's industrial blueprint, and to better serve the society.

Solutions

Having drawn lessons from the constant traffic gridlocks in Lagos, the old Nigerian capital, the project plans to create a comprehensive transportation system in Abuja by extending its light rail network to six lines, with connectivity to residential neighborhoods, industrial parks, administrative areas, CBDs, airports and satellite cities. The project also aims to strengthen local employment and training, establish a strong talent pool for the local society, and promote coordinated development of the regional economy.

Seamless transit and inter-connectivity

CCECC has worked out coordinated plans for the design and engineering of Abuja Light Rail, Abuja-Kaduna Railway, and ABV New Terminal Building, three projects that go in parallel. The ABV transit center is accessible through the Abuja Light Rail system. Nigerian passengers can arrive at the Light Rail airport station from any railway station in the city center, and can get to the airport ticket office or terminal buildings via the seamless transit center on the same floor.



阿布贾中心站
Abuja Metro Station

阿布贾城铁IDU站所在地规划为工业园，是阿布贾城铁与国铁-阿卡铁路-换乘中心，实现了国铁和轻轨的无缝连接，未来将实现北至卡诺、南连拉各斯港，从而实现货物、客流海、陆、空交互流动。

阿布贾市中心站设置综合换乘中心，与城市公交站对接，远期将与阿布贾城铁二期、国铁米纳线无缝换乘。阿布贾城铁其他重点站，均处于未来与阿布贾规划的城市道路交汇点，满足了未来城铁、城市公交的互联互通。

高效运营，解决当地交通拥堵问题

由于当地航班经常延误，阿布贾城铁及阿卡铁路准点、便捷、安全及优质的运营服务成功吸引了部分乘客改变原有出行方式。

尼日利亚旅客由市中心各城铁车站乘车仅需五分钟即可抵达机场车站，从市中心到机场的通行时间减少了约30分钟，出行费用也减少了一半。同时，城铁3号线始发站市中心站新增了市政公交站点，运营时刻表根据机场航班、阿卡铁路列车运营时间、民众出行时间特点等因素制定。

面对阿布贾城铁更加密集和繁忙的客流，所有12个车站还将相应增加市政公交站点，并根据城铁运营频率调整市政公交站点车辆频率，根据航班及大铁运营时间调整城铁运营时间，以便民众更加高效便捷的出行，缓解当地交通拥堵问题。

扩大项目影响力，带动当地就业和发展

阿布贾城铁项目创新合作模式，从最初的EPC模式转变到“投建营一体化”的模式，有助于项目更高效集约地开展，以降低项目成本，增加利润。

项目部将员工培训作为重要工作，把铁

The IDU station, as part of an industrial park, is where Abuja Light Rail and Abuja-Kaduna Railway converge for seamless transit. In the future, goods and passengers can be transported through land, water and air between Kano in the north and the Port of Lagos in the south.

Abuja Metro Station includes an integrated transit center accessible by bus service and, according to the long-term plan, will seamlessly connect with Abuja Light Rail Phase II and Abuja-Kaduna Railway Minna Line. Other major Light Rail stations will also be very close to the planned road intersections to facilitate the transportation inter-connectivity of Light Rail and bus services.

Effective operation as a cure for traffic congestion

Tired of frequent delays of domestic flights, some passengers have moved to the on-time, convenient, safe and high-quality services of Abuja Light Rail and Abuja-Kaduna Railway.

Nigerian passengers can get to the airport from city center within five minutes on the Abuja Light Rail network. Compared with conventional ways of travel, the time is reduced by about 30 minutes, and cost halved. In addition, new bus services have been added to Abuja Metro Station, the origin stop of Light Rail Line 3, and scheduled according to the airport flight timetable, Abuja-Kaduna Railway service time, and public traffic patterns, etc.

Given the high likelihood that passenger loads will grow denser and heavier on the Light Rail network, more bus services are to be added to all of the 12 Light Rail stations and timetabled to coincide with Light Rail runs. The Light Rail service time will be set based on the timetables of airport flights and Abuja-Kaduna Railway to ensure efficient public transportation and alleviate local traffic concerns.

Expanding project influence, driving local employment and growth

The project was contracted on an EPC basis, and delivered through the investment-construction-operation model to ensure efficient and intensive development at lower costs and higher profits.

The project team has prioritized employee training as a way to impart railway operation and maintenance knowledge to the locals, and nurture a large pool of railway construction and operation talents for the country of Nigeria. USD 1 million has been invested for this effort. While management-staff training is part of CCECC's overall training program, the project team offers general-staff training which includes theoretical lectures, on-the-job training and hands-on practices. Every employee has to receive not less than 12 days or sessions of training a year. Nearly 5,000 local people were offered employment directly with the project during peak construction season. Another 1,000 locals were added to the payroll after all the EMUs were in

路运营和维护技术传授给当地员工，为尼日利亚培养了大量的铁路建设人才和运营人才，员工培训投入达100万美元。管理层员工培训纳入公司整体培训计划，项目层面主要负责普通员工培训。培训既有理论授课，也有跟岗培训和实操培训，所有员工每年培训时间累计不少于12天或次。

项目施工高峰期直接雇佣当地雇员近5000人，运营动车组全部到位后，直接雇佣当地运营人员约1000人，带动周边间接劳动力数以万计。除了施工现场普通务工人员外，项目期间还雇佣了许多当地高级雇员，如项目公关部长、人力资源主管、法律顾问等，高级管理雇员在当地员工中占比约20%，不仅提高了项目对外办事效率和管理水平，也改善了当地人的生活水平。

项目价值

项目的建成和运营连通了阿布贾国际机场、西北卫星城库布瓦与市区中心，是联邦首都地区构建轨道一体化交通的开端。城铁开通后库布瓦卫星城到市中心的时间减少了约50分钟，到机场的时间减少了约30分钟。根据设计，城铁近期、中期和远期运输能力可分别达到每小时1.5万人、2万人和2.5万人，为当地提供了一种全新、准时、安全、便捷、经济的出行方式。

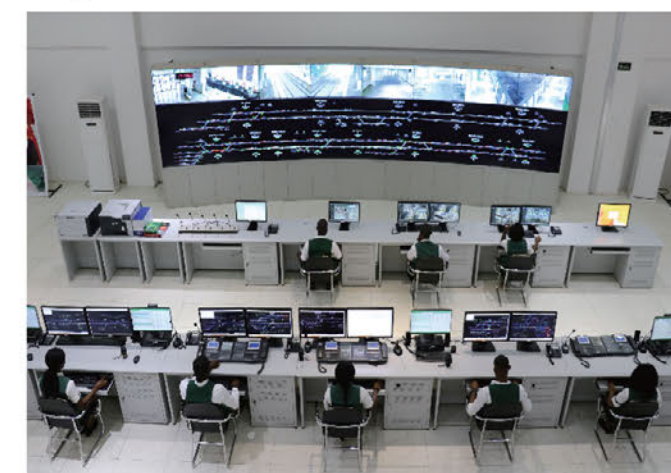
随着阿布贾城铁一期工程的实施，项目还推动了沿线土地增值、购买、开发，改善了投资环境，拉动了当地投资，带动了各区域经济发展，对促进尼日利亚首都区域协调和可持续发展具有重大的促进作用。

place. In addition, tens of thousands of labors were involved indirectly in the project. The site engaged not only ordinary workers, but also senior services, such as the Project PR Director, HR Director and Legal Counsel, which accounted for about 20% of local employees. This helped improve the external liaison and internal management efficiency of the project, and raise local living standards.

Project Value

The project connects the city center to Nnamdi Azikiwe International Airport (ABV) and the northwestern satellite town of Kubwa, marking the commencement of integrated rail transportation in and around the capital. With the Light Rail system, a trip between Kubwa and the city center could be nearly 50 minutes faster than before, and that between Kubwa and ABV could be about 30 minutes faster. The Light Rail network is designed to transport 15,000 passengers/hour, 20,000 passengers/hour, and 25,000 passengers/hour in the near-, mid- and long-term, respectively, as a new option of on-time, safe, convenient and cost-effective transportation for the locals.

The Phase I project has driven land value appreciation, land sale, and land development along the route to sharpen the competitiveness of the local investment environment, and spur regional economy. This carries quite a significance to the coordinated and sustainable economic development in and around the capital city of Nigeria.



在控制中心工作的当地员工
Local employees at the control center



6 打造生态友好的刚果(布)梦想之路 ——刚果(布)国家1号公路项目

The Eco-friendly Dream Road of Congo (Brazzaville)
Congo (Brazzaville) National Highway No. 1 Project

项目简介 ABOUT THE PROJECT

刚果(布)国家1号公路项目是中国政府与刚果(布)政府之间一揽子经济贸易合作框架协议项下最大的基础设施项目。该项目由中国建筑股份有限公司承包,项目合同金额28.9亿美元,全长536km,西起刚果(布)经济中心黑角,东至首都布拉柴维尔,穿越沿海平原、原始森林、河谷、高原等,是刚果(布)境内等级最高、通行体验最好的公路,被誉为刚果(布)的“梦想之路”。

Congo (Brazzaville) National Highway No. 1 Project is the largest infrastructure project under the “framework agreement of economic and trade cooperation packages” sealed between the governments of China and Congo (Brazzaville). Undertaken by CSCEC, this USD 2.89 billion project stretches 536km across coastal plains, virgin forests, river valleys, plateaus and other terrains from Pointe-Noire in the west to Brazzaville in the east. This the most accessible and highest-grade road in Congo (Brazzaville), the “dream road” of this country.

项目进程/Key Milestones

签约时间/Date of contract-signing	2008.02.13
开工时间/Date of commencement	2008.05.20
完工时间/Date of completion	2016.07.30

可持续发展背景

刚果(布)森林资源丰富,环境优美。国家1号公路穿越马永贝原始森林、热带草原并经过大量村庄和居民区,而马永贝是一片横跨60公里、纵深170多公里、生长着300余种树木的广袤原始森林,被联合国教科文组织认定为世界自然保护区。面对严苛的环境保护要求,如何更好地保护森林生态环境,建设高质量公路,是公司面临的巨大挑战。

解决方案

该项目建设秉承“不破坏是最大的保护”的环保理念和“绿色建造、环境和谐”的环境方针,始终坚持人与自然和谐、尊重自然、保护生态环境的原则,将项目对当地环境的影响降至最低,使公路建设最大限度的顺应自然、融入自然,使工程全线环境保护达到最优效果。

每1000平方米仅砍伐三棵树

中国建筑优化设计国家1号公路路线,在布满蛇虫的环境中丈量勘察,准确定位边界红线,为伐木队提供精准的砍伐标注,确保砍伐树木量降到最低,最大限度保护原始森林。根据1号路主体及附属工程所占面积测算,该项目平均每1000平方米砍伐3棵树。公路穿越原始森林90公里,共砍伐4879棵树。

在马永贝原始森林施工时,中国建筑克服雨季施工难度大、热带疾病频发、物资运输困难等不利条件,通过优化施工组织、制定科

Sustainable Development - Background and Context

Congo (Brazzaville) is blessed with many forests and mountains that give it a spectacular view. The National Highway No. 1 passes through Mayombe virgin forest, savanna as well as villages and residential areas. Mayombe which measures some 170 km by 60 km is a vast expanse of virgin forest with more than 300 kinds of plants; it is also a UNESCO-recognized nature reserve that enforces strict environmental policies. How to protect the ecological system of the forest and build high-quality roads, therefore, becomes a huge challenge facing the company.

Solutions

The project protected the local environment by not abusing it. From the very beginning, the project respected nature, blended into nature, and sought harmony with nature. With minimized impact on the local ecological system, the project is a true definition of “green building”.

Only three trees hacked away for every 1,000m²

CSCEC optimized the highway route design, and surveyed in an environment full of snakes and insects to identify accurate boundary lines and set logging marks for the logging team to ensure a minimal volume of timber felled and maximal protection of the primary forest. Calculated on the area taken by the main and ancillary works of National Highway No. 1, only three trees were hacked away for every 1,000m². The highway traverses 90km of the virgin forest; all told, 4,879 trees were felled.

Despite the engineering troubles in the rainy season, a high incidence of tropical diseases, difficult transportation of materials and other unfavorable conditions, CSCEC provided road access through the Mayombe mountains following a well-planned and organized engineering process. The project team was hailed by the President and the general Congolese as “people who split the mountains”.

Planting vetivers for multiple benefits

To fit the road nicely and eco-friendly with the surrounding and guarantee slope stability, the site conducted proper planning and chose vetivers, 3D-geomat lawn, humus-soil lawn and other

学施工方案等措施，顺利打通了马永贝原始森林，被刚果（布）总统和社会民众誉为“劈山的人”。

培育香根草，一举多得

为了保持与项目周边环境协调一致，改善周边生态环境，美化视觉，同时保证边坡稳定性，公路建设时合理规划，采用根系发达，对环境具有较强适应性的香根草、三维网植草、腐殖土植草等，作为水土保持和斜坡固定的植物。

项目部专门建立了香根草培育基地，对全线砂性土区域挖方边坡、涵洞进出口等地大量使用香根草防护，既保证了挖方区边坡和涵洞进出口的稳定性，绿化了公路、保护了环境，同时也降低了工程造价，一举多得。

截至目前，该项目已经批准的香根草防护、三维网植草防护等绿色防护面积约267万m²，占全部防护面积的98.8%，土壤污染治理实际投入占项目投资额的8%。

结合气候，因地制宜，绿色施工

项目在施工过程中除了采取常规的绿色施工措施，还因地制宜，探索符合当地实际的施工措施，最大限度地减少对自然环境的破坏，环保总投资达11200万元人民币。

项目部结合当地气候条件，制定了专门的施工组织方案，在方案中分别制定了旱季和雨季施工方案，土方开挖尽量避开雨季，并在雨季来临前完成回填和弃方处理，尽可能降低施工对环境的破坏。

同时，项目在雨水充沛的地区及时设置边坡截水沟等，以防边坡垮塌；在砂性土区域涵洞设置蒸发池，以控制泥沙沉淀；在砂性土路段施工时设置临时排水设施，最大限度地保护植被正常生长。



香根草培育基地及边坡防护效果
Vetiver cultivation base and slope protection

plans that have strong roots and strong adaptability to the environment to preserve soil water and stabilize the slopes. The project team also set up a vetiver cultivation base, and stabilized excavated slopes and culvert entrances in sandy soil areas through an extensive use of vetivers. These plants can also add green to the road, protect the environment, and lower the cost of the project.

Up to now, altogether 2.67 million m² are protected by green plants, including vetivers and 3D-geomat lawn, accounting for 98.8% of the entire protected areas. The cost of soil pollution control took up 8% of the total investment

Adopting green engineering practices that adapt to climate and local conditions

In addition to conventional green engineering practices, the project team also explored new solutions compatible with local conditions to minimize damages to the natural environment. The total investment in environmental protection reached RMB 112 million.

The project team worked out respective engineering plans based on the climatic conditions in the dry and rainy seasons. For example, earth excavation works shall not be performed in the rainy season; the back-filling process and the disposal of deserted excavated materials must be finished before the wet season to minimize environmental damages.

Meanwhile, in areas with abundant rainfall, interception ditches were constructed around the slopes to prevent slope failures; in sandy soil areas, evaporation ponds were installed in culverts to manage sedimentation. Also, temporary drainage facilities were added to sandy road sections under construction to maximally protect the vegetation growth.

Building sight-viewing platforms to admire the eco-tourism landscape

Given the varying landscapes and ecological features along the road, the project team adopted different designs for each road section. For example, sight-viewing platforms and transportation services were added to the Lukuni Bridge and Mindouli- Brazza-

修建景观平台，打造生态旅游风景

项目部根据不同生态区域分段设计的原则，充分考虑道路沿线景观和视觉特点，在横跨河谷的鲁库尼大桥、名都利-布拉柴段等附近设计了景观平台和配套交通工程，营造出壮观的动感生态旅游风景。

例如，在公路名都利-布拉柴段PK65左侧，存在当地极为少见的天然石林景观。为保护这一景观不被破坏，同时方便当地民众游览休息，项目部专门设计观景点，同时配备长凳及停车场等设施，方便民众停车游览及休息。

项目价值

刚果（布）国家1号公路项目满足了当地基本交通需求，将黑角至布拉柴维尔的车程从一个星期缩短至8个小时，车辆日通行量平均提高10倍以上，带动刚果（布）货运和客运运输业迅猛发展，推动当地经济发展。在施工过程中，为沿线居民修建人行道盖板、行车盖板等多处便民设施，方便居民出行。

ville section for tourists to admire the spectacular eco-tourism landscape.

To protect limestone formations on the left side of the Mindouli-Brazzaville section (PK65), which are rarely seen in the locality, the project team set up a sight-viewing booth with benches, parking lots and other facilities, so that local residents could take a rest or admire the view.

Project Value

The Congo (Brazzaville) National Highway No. 1 Project has answered the local needs for transportation, enabling the trip from Pointe-Noire to Brazzaville, which used to take one week, to be finished in eight hours. The average daily traffic increased by more than 10 times. The highway has boosted the freight and passenger transportation industry and offered impetus for the local economy. Some other facilities were also put in place, such as the cover plates on sidewalks and vehicle lanes, for the convenience of the locals.



鲁库尼大桥景观
View of the bridge

“只有建成了像国家1号公路这样的基础设施，人民群众才能更便利地开展活动……人民出行和物流运输都将会因为公路建设的顺利通车变得更加便利，该公路的建设和使用对于国家未来发展是非常关键的要素。”

——刚果（布）总统萨苏

“With infrastructure like National Highway No. 1, people can enjoy greater convenience...passengers and goods can move more freely and efficiently on the highway. The development and operation of this highway will play a critical role in the country's future.”

— Sassou, President of Congo (Brazzaville)



7 开发清洁风电, 增进巴基斯坦福祉 ——巴基斯坦萨察尔 (SACHAL) 风电总承包项目

Developing Clean Wind Power to Better the Lives in Pakistan
Sachal Wind Power Project, Pakistan

项目简介 ABOUT THE PROJECT

巴基斯坦萨察尔 (SACHAL) 风电总承包项目由中国电建集团国际工程有限公司及旗下中国电建集团华东勘测设计研究院有限公司以 EPC 模式承接, 项目合同金额 1.101 亿美元, 2017 年 5 月完工, 总装机规模 49.5MW, 共安装 33 台单机容量为 1.5MW 的风电机组。

Undertaken by POWERCHINA International Group Limited and POWERCHINA Huadong Engineering Corporation Limited on an EPC basis, the USD 110.1 million Sachal Wind Power Project consists of 33 units of 1.5-MW turbines to provide a total installed capacity of 49.5 MW. The project became operation in May 2017.

项目进程/Key Milestones

签约时间/Date of contract-signing	2012.04.28
开工时间/Date of commencement	2015.12.11
完工时间/Date of completion	2017.05.10

可持续发展背景

电力紧缺一直是制约巴基斯坦经济社会发展的重要因素之一, 自2007年爆发电力系统三角债之后, 巴基斯坦电力缺口逐年增大, 部分城市地区每天停电高达12小时, 农村地区高达18个小时。同时, 巴基斯坦在国内石油和天然气资源极度短缺、长期依靠高价进口的情况下, 燃油和燃气发电在电力结构中的份额占比仍达到60%, 发电能源结构亟待提升。

解决方案

近年来, 在中国“一带一路”倡议和“中巴经济走廊”等的推动下, 中巴能源电力领域合作愈加紧密。该项目正是在风能开发潜力巨大的巴基斯坦东部信德省达塔县实施的清洁能源项目, 不仅为当地提供清洁电力, 缓解当地电力短缺压力, 促进当地能源结构转型, 还以项目建设为契机, 带动当地社会发展。

带动当地社会发展

项目部始终秉持“开发一方、造福一方”的原则, 在建设、运营期间, 为当地提供清洁电力、增加就业机会、促进经济增长、带动社会发展。

截至2019年6月, 巴基斯坦萨察尔 (SACHAL) 风电总承包项目总发电量 5958.05万kWh, 创造效益约5987.84万元, 向当地政府纳税83.75万人民币。项目累计为当地居民提供就业岗位超过500人, 发放劳动

Sustainable Development - Background and Context

Power shortage has always been a hurdle for Pakistan to develop its economy and society. Since the outbreak of the 2007 revolving debt crisis in the power sector, Pakistan has been facing a gradual widening of the power gap. Lights go out for up to 12 hours a day in some cities, and even up to 18 hours in rural areas. However, despite the severe shortage of domestic oil and natural gas resources and the costly imports, around 60% of Pakistan's electricity is still generated with oil and natural gas; the energy structure for power generation has to be improved.

Solutions

With the launch of the "Belt and Road" Initiative and the "China-Pakistan Economic Corridor", China and Pakistan are cooperating even more closely in the energy and power sector in recent years. Located in Thatta District, Sindh Province where the potential for wind energy development abounds, the Sachal Wind Farm can provide clean electricity to the local community, relieve the pressure of electricity shortage, promote the transformation of the local energy structure, and drive the growth of the local society through project development.

Spurring the development of local society

Aiming to “benefit local people while developing local resources”, the project team has produced clean electricity, created job opportunities, and promoted economic and social development during construction and operation.

As of June 2019, the Sachal Project generated 59.581 million kWh of electricity, created about RMB 59.878 million of economic benefits, and paid RMB 837,500 to the local government through taxes. The project provided more than 500 jobs for local residents, paid more than RMB 7.415 million of salaries, and improved the skills and expertise of local employees through training programs.

The project team has prioritized local procurement, and subcontracted the supply of building materials such as cement and aggregates, as well as vehicle & power generator rental, sewage treatment and other services to local enterprises. All told, it has engaged 47 local suppliers for materials, equipment, goods and services, as well as 33 local subcontractors. The rate of local procurement reached 64.88%, and the value of subcontracts exceed-

薪酬超过741.48万人民币，并通过培训提升了当地员工的专业技术和技能。

项目部注重本地采购，结合当地供应情况，将水泥、砂石骨料等材料供应，车辆和发电机租赁及污水处理等分包给当地企业，与当地超过47家物资、设备与材料供应商、服务提供商进行业务合作，33家当地分包商开展工程分包合作，本地采购率达64.88%，累计创造当地分包合同额超过2935万人民币，拉动当地经济增长。

促进社区沟通和文化融合

项目部注重建立和谐的社区关系，尊重当地居民的风俗习惯，聘请当地人为社区关系专员，积极与当地政府合作、社区居民沟通交流，每逢当地节日主动赠送节日礼物，与周边社区建立了良好的关系。

在项目期间积极参加当地文化活动，在巴基斯坦当地最具热度的锦屏地区板球超级联赛中，积极组织队伍参加并荣获冠军，得到当地社区长老和居民的高度肯定。积极支持配合巴基斯坦项目群举办的“运动健康，中巴友谊”运动会和“健康2017”主题月活动，庆祝巴基斯坦独立70周年。这些活动加强了项目部与当地社区的沟通交流和文化融合，进一步增进了中巴友谊。

开展公益慈善活动

项目部积极履行社会责任，累计投入21.48万美元开展社区公益活动，并将其作为项目执行过程中的常态化工作，与当地居民和谐相处，为中巴友谊增添光彩。

完善社区基础设施建设。项目部主动帮助当地社区完善基础设施，在当地新建及改造公路20公里，建设永久房屋5000平米，建设医疗机构、清真寺等公共设施5个。



中巴板球联赛

Vetiver cultivation base and slope protection

ed RMB 29.35 million to drive local economic growth.

Promoting community communication and cultural integration

The project team respects local customs. It has hired some locals as community relations specialists, communicated actively with the local government and residents, and given out holiday gifts, having established a sound and harmonious relationship with the local community.

The project team has actively taken part in local cultural activities. It won the championship of Jhampir Super League, the most popular game of the locality, and was highly recognized by the community elders and residents. The project team also showed supports for the sports meeting and "Healthy 2017" monthly activities to celebrate the 70th anniversary of Pakistan's independence. These activities have strengthened the exchanges and cultural integration between the project team and the local community.

Launching activities for public welfare

The project team earnestly fulfills social responsibilities, having invested USD 214,800 into community outreach and public service activities which are included into the project's routine arrangements and lives together in harmony with local residents.

Improving community infrastructure. The project team helps local communities improve infrastructure, having built and upgraded 20 kilometers of roads, built 5,000 m² of permanent houses, and built 5 public facilities including medical institutions and mosques.

Improving people's livelihood. To help the local community address water scarcity, the project team has repaired water tanks and replenished drinking water on a regular basis. All told, 111 carts of water have been provided for local residents. To solve the shortage of medical supplies, the project team has engaged

改善民生条件。针对当地水资源匮乏的问题，项目部积极为当地修缮水池、定期提供饮用水，累计为当地居民提供111车水。针对当地医疗用品不足的问题，利用项目配置的医务室及聘请医务人员，定期对当地村民体检，并免费提供相应的药品，累计治疗病人318人次。此外，也根据当地需求，为当地学校捐赠送书桌、送书籍等物资。

项目价值

巴基斯坦萨察尔 (SACHAL) 风电总承包项目是中巴经济走廊能源合作项下的重点新能源项目，受到中巴两国政府高度关注。项目建成后，年均提供清洁电量1.6亿千瓦时，有效缓解巴基斯坦电力供需矛盾，同时对促进巴基斯坦能源结构转型、减少二氧化碳排放、应对气候变化发挥了积极作用。

medical staff to conduct regular health checks for the villagers at the medical facility of the project, and provided free medicines. Up to now, altogether 318 patients have been treated. The project team has also donated materials such as desks and books to local schools.

Project Value

Pakistan's Sachal EPC Project is a key new-energy project under the China-Pakistan Economic Corridor framework, and has received upmost attention of the Chinese and Pakistani governments. The project will provide an average annual output of 160 million kw·h of clean energy to effectively narrow the electricity gap in Pakistan, and play a positive role in transforming the country's energy structure, reducing carbon dioxide emissions, and addressing the climate change.



为社区修缮水池
Repaired water tanks



为当地人提供医疗服务
Medical service for the local



8 发展兼顾环保的斯里兰卡农业灌溉项目 ——斯里兰卡延河农业灌溉项目

Sri Lanka Yan Oya Reservoir Project: Development and Environment Protection
Yan Oya Reservoir Project, Sri Lanka

项目简介 ABOUT THE PROJECT

斯里兰卡延河农业灌溉项目由中工国际工程股份有限公司以 EPC 方式承揽，该项目位于斯里兰卡北中省阿努拉德普勒东北部地区，由 5 座拦河大坝、溢洪道及相关构筑物组成，大坝总长 5.9 公里，最大坝高 20 米，是斯里兰卡最大的农业综合水利水务项目。项目建成后，水库平均库容达 2 亿立方米，为当地近 8000 公顷的土地耕地创造旱季复种条件，提高 2047 万美金的粮食产量，造福当地 12000 户居民，能够有效满足斯里兰卡中北部地区的农业灌溉和生活用水需求。

Undertaken by China CAMC Engineering Co., Ltd. on an EPC basis, Yan Oya Reservoir Project is located in the northeastern District of Anuradhapura in the North Central Province, Sri Lanka. It includes five earth-fill dams with a total length of 5.9km and a height up to 20m, as well as spill ways, and other structures, and is the largest integrated agricultural water conservancy project in Sri Lanka. With an average storage capacity of 200 million cubic meters, the reservoir can provide 8,000 hectares of lands with sufficient irrigation water for multiple cropping in dry seasons. The grain output has been improved by USD 20.47 million. Apart from agricultural irrigation, the project can also ensure the availability of water for household use in central and northern Sri Lanka to benefit 12,000 local residents.

项目进程/Key Milestones

签约时间Date of contract-signing	2013.11
开工时间Date of commencement	2015.02.01
完工时间Date of completion	2018.12.21
开通运营时间Date of entry into operation	2018.12.22

可持续发展背景

斯里兰卡生态环境良好，美丽的印度洋及众多的山川、河流、湖泊、森林给动物带来了良好的生存空间。延河农业灌溉项目坐落于景色优美的热带雨林中，随处可见大象、孔雀、野鹿、斯里兰卡星龟等各种受保护的动物，斯里兰卡政府对项目施工的环保要求也非常高。

解决方案

项目部在项目设计阶段就贯彻资源节约型、环境友好型工程的初衷，建立完备的环境管理体系，采取多种资源循环节约措施，积极考虑生态系统保护问题，尽最大努力保护当地环境，使项目建设与当地生态环境保护同行并进。

将绿色环保理念践行到底

项目部遵守斯里兰卡政府环境保护部门的规定，在设计文件中确立绿色施工技术和施工理念，在施工组织和管理过程落实环境保护制度。

加强环境因素识别。项目部依据《中工国际质量、环境、职业健康安全管理体系文件》要求，对环境因素进行调查、识别、登记和评价，确定重要环境因素，并将有关信息进行公司内部审核备案。项目规划期间，进行环境影响评估并将报告提交斯里兰卡森林部、环境保护部、野生动物保护部门审

Sustainable Development - Background and Context

Sri Lanka has a good ecological environment. The beautiful Indian Ocean and numerous mountains, rivers, lakes, and forests are homes to animals. In the picturesque tropical rain forest where Yan Oya Reservoir sits, elephants, peacocks, wild deer, star tortoises and other protected animals are quite a common sight. The Sri Lankan government therefore demands strict environmental compliance and accountability of the construction works.

Solutions

The project team has always aspired to build a project that is environmentally responsible and resource efficient. To that end, it has established a complete set of environmental management procedures, incorporated ecological concerns into project planning, adopted multiple measures to address resource recycling and conservation, and made every endeavor to protect the local environment.

Putting environmental protection into practice

The project team has embedded green engineering principles into the design paper, and made environmental protection an integral part of the construction process to ensure environmental compliance required by the Sri Lankan government authority.

Strengthening the identification of environmental factors. The project team has investigated into, identified, recorded and evaluated environmental factors in accordance with the *Quality, Environment, and Occupational Health and Safety Management Systems of China CAMC Engineering Co., Ltd.* Once determined, the key environmental factors will be reported to the company for internal review and filing. As part of the project planning process, environmental impact assessment was conducted and submitted to the Ministry of Forestry, the Ministry of Environmental Protection and wildlife protection offices for review to minimize the impact of the project on the natural environment and wildlife.

Implementing the environmental protection regulations strictly . The project team has appointed management officials to supervise the implementation of environmental protection measures at its partners, and signed environmental protection

核,严格控制项目对自然环境和野生动物的影响。

认真落实环境保护规定。项目部安排专门管理人员监督审查合作伙伴的环保措施实施情况,与所有合作企业签署环境保护责任书,最大限度地降低施工对环境造成的负面影响。

将对野生动植物的影响降至最低

项目部根据业主和相关政府部门规定,听取斯里兰卡野生动物保护局的建议,在坝址选区时,回避延河地区野生大象的栖息地;帮助野生大象在距离原来栖息地不远的地区建立自然保护生态地。

▲在库区适当区域建立生态走廊,单独设置大象通道和动物逃生路径,方便其在库区沿线饮水和通行。

▲设立施工影响缓冲带、隔离带,减小施工中粉尘、噪声等对动物的影响。

▲为斯里兰卡中央环境机构提供人力、物力支持,帮助修建库区沿线物种生态监控系统,实时记录野生大象活动轨迹和生存状态,为野生大象的研究和保护提供宝贵数据。

项目部在水库蓄水前,联合斯里兰卡野生动物保护局帮助库区内野生动物集中迁徙,安排救生艇救助未及时迁徙的蛇类、猴类等野生动物,并将其送至野生动物保护区内。在蓄水期间,联系斯里兰卡野生动物保护局和森林保护局对珍稀物种专项保护。对受到影响的森林区域采取科学合理的保护措施,减少树木砍伐,移栽将要被淹没的树木,并在水库附近栽种新树木。

最大限度减少资源消耗

项目实施过程中需要消耗粘土400万方、河砂2万方。根据地质勘测报告和现场

commitment letters with all partners to minimize the negative impacts of construction works on the environment.

Minimizing impacts on wildlife

Based on the requirements of the project owner and relevant government departments, the project team has taken advices from Sri Lanka's Department of Wildlife Conservation, separating the construction site away from the habitat of wild elephants in the Yan Oya, and setting up a nature and wildlife reserve not far away from their original habitat.

▲Establishing ecological corridors properly within the reservoir area, with separated elephant passages and animal escape routes to ensure their safety while drinking and moving along the reservoir.

▲Setting up buffer belts and isolation zones to reduce the impact of dust and noise on animals during construction.

▲Providing manpower and material supports to Sri Lankan's central environmental authority, building an ecological monitoring system over animal and plant species along the reservoir, recording the movement and living conditions of wild elephants in real time, and providing valuable data for the research and protection of wild elephants.

Before the reservoir began to impound water, the project team joined force with Sri Lanka's Department of Wildlife Conservation to relocate the wild animals, and used lifeboats to rescue snakes, monkeys and other animals that failed to migrate in the first time and sent them to the wildlife conservation park. During the impoundment period, the project team contacted the Sri Lanka's Department of Wildlife Conservation and Department of Forest Conservation for special protection over rare and endangered species. Besides, proper measures have been taken to protect the affected forest area by reducing tree felling, transplanting trees that will be submerged, and planting new trees around the reservoir.

Minimizing resource consumption

The project was estimated to consume 4 million cubic meters of clay and 20,000 cubic meters of river sand. Based on the information of the geological survey and site survey, to reduce negative impacts on the local natural environment, the project used the earth and sandstones of the reservoir area where possible, and adopted new technologies and new processes to reduce the consumption of construction materials and to avoid wasteful use of natural resources both inside and outside the reservoir area.

The project team communicated several times with partners to increase the proportion of fly ash, steel formwork and other renewable, durable and adaptable materials. Among them, fly ash accounted for 15% of the total cement use, and steel formwork accounted for 95%.

实勘,为了减少对当地自然环境的负面影响,项目在建设时尽可能利用库区土方和砂石资源,并采取多种新技术、新工艺帮助施工环节减少施工材料的使用,避免了库区内自然资源的浪费和库区外自然资源的消耗。

在项目执行过程中,项目部多次与合作伙伴沟通,加大粉煤灰、钢模板等可再生、耐用和适应性强的材料比重,其中,粉煤灰占水泥总用量的15%,钢模板占模板总用量的95%。

项目价值

项目建成之后带动农业、渔业和旅游业的蓬勃发展,为斯里兰卡扶贫减贫事业做出了卓越贡献。灌溉工程同当地多个天然湖泊景点相串联,形成了斯里兰卡北中省特色的绿色旅游文化区。水库建成之后为当地政府发展库区水面太阳能等绿色发电项目以及水处理厂项目提供了便利。农业灌区复种指数可达到1.46,为当地土地创造旱季复种条件,提高耕地利用率。此外,项目提升水资源管理和利用,修复现有灌溉系统,改善农业生产现状,减少自然灾害,也有助于斯里兰卡发展其他粮食作物及渔业。

Project Value

The project has brought out the dynamics in local agriculture, fishery and tourism, and made substantial contributions to the poverty alleviation effort of Sri Lanka. The irrigation dam and local natural lakes string together a green picture, a characteristic tourism and cultural spot in North Central Province, Sri Lanka. The reservoir has facilitated the local government's effort to develop water treatment and green power projects such as water-surface solar system in the reservoir area. The multiple cropping index can reach up to 1.46 in the agricultural irrigation area, establishing favorable conditions for multiple cropping in dry seasons to improve cropland productivity. In addition, the project has enhanced the efficiency of water resource management and utilization, improved the existing irrigation system and agricultural production conditions, reduced the frequency and severity of natural disasters, and enabled Sri Lanka to develop other food crops and fisheries.



库区水生动物资源调查保护
Investigation and protection of aquatic animals in the reservoir area



9 绿色先行, 打造人类史上最大的挖入式港口 ——卡塔尔多哈新港及内防波堤项目

Environment First: The Largest Excavated-in Harbor of All Time
Doha New Port Basin and Inner Breakwater Construction Project, Qatar (NPP)

项目简介 ABOUT THE PROJECT

卡塔尔多哈新港及内防波堤项目是卡塔尔基础设施建设总体规划的重点工程,也是举办 2022 年卡塔尔世界杯的关键性项目之一。该项目作为可容纳 18 米吃水、近 400 万平米的港池及调头圆区域的现代化港口,预计实现 600 万标箱/年,170 万吨件杂货/年,100 万吨谷物/年,50 万辆汽车/年的运量吞吐能力。这是中卡两国政府开辟经济合作领域具有里程碑意义的特级项目,是人类建港史上迄今为止最大的挖入式港口工程。

NPP is an important part of Qatar's infrastructure master plan. It is also one of the key projects of FIFA World Cup Qatar 2022. As a modern port with an 18m draft and a roughly 4 million m² area (the turning basin factored in), NPP is expecting an annual throughput of 6 million TEUs, 1.7 million tons of general cargo, 1 million tons of grain, and 500,000 vehicles. NPP is not only a milestone for China-Qatar economic cooperation, but also the largest excavated-in harbor of all time.

项目进程/Key Milestones

签约时间/Date of contract-signing	2010.12
开工时间/Date of commencement	2011.01.24
完工时间/Date of completion	2015.06.28

可持续发展背景

卡塔尔具备完整、系统的环境保护法,当地环保部制定了严格的项目施工环保许可条件和监督检查要求,对环境监测、控制和预防、固/液体废弃物的处理、废弃物的循环使用以及历史遗迹的保护等都有严格的要求。作为港口项目,海洋生物多样性保护、防止海洋污染等环境议题也至关重要。

解决方案

项目期间搭建环境管理体系,加强环境管理,创新多种节能减排新技术保护海洋环境不受污染,采用科学的措施加强海洋生态保护,为卡塔尔建设绿色环保可持续的基础设施项目。

采用国际标准, 科学搭建环境管理体系

该项目施工建设中采用 BS (Britain Standard) 标准 (英国标准) 以及当地 QCS (Qatar Construction Standard) 标准 (卡塔尔工业标准), 重大分项施工均进行申请并获得卡塔尔环保部颁发的作业许可证。

项目部不断研究当地政策要求, 结合项目实际, 形成了多元化的、具有中东工程界特点的环保管理风格。编制项目施工环保管理方案 (CEMP) 并获得当地环保部批复, 联合当地环保管理经验丰富的国际环保咨询公司 (GHD) 共同编制项目施工环保管理大纲, 完善环保应急响应机制, 还特设了环保应急处理小组。

Sustainable Development - Background and Context

Qatar has a holistic, systemic legal framework for environmental protection. The Qatari Ministry of Environment has formulated rigorous green rules, covering monitoring and control of environmental hazards; solid/liquid waste disposal and recycling; and preservation of historic sites. As far as port projects go, marine biodiversity conservation and pollution prevention are also among the key concerns.

Solutions

Establish an environmental management system, develop new technologies for energy conservation and emission reduction, take scientific marine conservation measures, and build a sustainable infrastructure project.

Scientific environmental management system based on international standards

The project observes Britain Standards (BS) and Qatar Construction Standards (QCS). Permit from the Qatari Ministry of Environment has been acquired for each major sub-project. The project is run by a diversified team in line with local policies and realities. Its Construction Environmental Management Plan (CEMP) has been approved by the Qatari Ministry of Environment. The project team has developed the Outline of Environmental Management together with GHD, an international environmental consultancy with extensive local experience. The team has also streamlined its environmental emergency response mechanism, and dedicated a task force to such response. The project's international environmental management unit is led by an Environmental Manager with a globally-recognized industry credential and 10+ years of experience. The unit is also staffed with three Chinese environmental engineers and five foreign engineers with rich industry experience. The unit organizes an internal environmental audit once every three months, and another such audit with external engineering consultants once every six months, laying a solid foundation for sustainable infrastructure construction.

Innovative green technologies

The project team has developed and fully implemented new technologies and measures for energy conservation and emission



国际化环保管理团队
International Environmental Management Team

项目部组建了国际化环保管理团队，为管理团队配备具有国际环保认证资质且具备10年相关工作经验的环保经理，配备3名中国环保专业工程师以及5名外籍环保经验丰富的工程师。及时开展环保审计与管理评审，每三个月开展一次环保内审检查，每半年开展一次联合咨工的环保外审检查，为建设可持续的基础设施建设奠定坚实的基础。

创新节能减排技术

项目建设过程中把降低对周边环境污染、减少能源消耗的环保理念融入施工工艺及组织实施全过程，探索创新了节能减排新技术和新方法。项目部主动咨询当地专业的环保公司，从英、美等国进口多项当前国际先进的监测仪器，将对地下水、周边海水水质、土壤等化学元素含量的检测送往专业实验室，严格监测对海洋环境的影响。

例如，项目共需要预制砼方块约3.5万块，按照传统淡水养护方法将消耗大量的淡水资源。为节约当地淡水资源，项目部经市场调研、理论论证、现场试验等，最终证明并说服业主方采用高温条件下的砼专用养护液取代传统淡水养护的工艺以节约淡水资源。

reduction. It has followed the advice of local environmental consultancies, imported the world's leading monitoring instruments from the UK and the US, and commissioned professional laboratories to test the chemical element contents of underground water, sea water, and soil in places where its operations are based.

For instance, the project needs 35,000 precast concrete blocks. Traditional concrete curing methods would consume a large amount of freshwater. After market survey, proof-of-concept and on-the-spot demonstration, the project team has finally persuaded the proprietor to adopt a freshwater-saving technique, i.e. applying curing compounds at high temperature in lieu of traditional methods.

Zero damage to the estuary and ecological communities nearby

To enable dry construction in the harbor basin, the project needs to continuously discharge water with sand particles into the sea. The total discharge will amount to 250 million m³. Without proper control, such a discharge will change the face of the estuary and damage ecological communities nearby. Before construction began, the project team conducted a

注：混凝土养护液是高分子材料，喷洒在混凝土表面会形成一层致密的薄膜，使混凝土表面与空气隔绝，减少水分从混凝土表面的蒸发损失，从而利用混凝土自身的水分最大限度地完成水化作用。

Note: Concrete curing compounds are made of polymers. Sprinkled over the surface of concrete, they form an impervious film which keeps the air out, reducing moisture evaporation and retaining water in the concrete to maximize hydration.

对入海口及周边生态群落未产生任何破坏

为了保证港池内持续具备干施工条件，项目需要累计不间断向外海排出近2.5亿立方米的总水量。如果不对此控制，水中的总含沙量将会改变入海口及周边生态原貌并破坏周边自然生态群落。

因此，项目部开展了前期降水实验，分析港池开挖周界水位变动情况，实施混凝土止水墙12.3公里，以降低外海对港池内的渗水速度，从而减小施工周期中的总排水量。

同时，根据现场施工计划所需降水要求，场内配备近400口降水井进行可调节式作业，排水明渠沿港池周界及沉淀池至入海口累计长约13公里，内部均为混凝土表层加固，以降低水中悬浮沙颗粒含量。

经项目部对现场降排水工作的持续观测发现，直至项目结束，未对入海口及周边海底珊瑚、海藻、红树林等生态群落产生任何破坏。

项目价值

多哈新港项目在环保工作及创新实践中进一步验证了科学的国际项目环保管理模式不仅可以实现可持续发展目标，也可以达到节能减排、降本增效的实际经济效益，有效地保护海洋生态环境。工程的建成对发展卡塔尔经济、提升当地交通运输能力以及提高卡塔尔与周边各国的贸易竞争力具有重要意义。该项目改善了当地民生，提升了居民生活“幸福感”，也使得之前卡塔尔进口受阻或制约的许多民生产品释放贸易空间，增加了物流流转效率，预计在未来20-30年内可以满足卡塔尔社会经济发展所需的港口吞吐需求，提升卡塔尔与世界各国的“互联互通”步伐。

dewatering experiment, and analyzed water level variation at the basin excavation boundaries. A 12.3km concrete wall has been built to protect the basin from sea water seepage and in turn reduce water discharge during the construction. The construction site is also installed with some 400 dewatering wells as required for adjustable operations. Surface channels extend approx. 13km along the boundaries and from the sedimentation tank to the estuary. The inside of the channels is bolstered with concrete to reduce suspended sand particles in water. Through constant on-site observation of dewatering and discharge, the project team is convinced that it has never done any damage to the estuary and ecological communities nearby (e.g. coral reefs, seaweeds, mangroves).

Project Value

NPP is another proof that scientific environmental management can not only be cost-saving and profit-increasing for an international project, but also conducive to marine conservation and the fulfillment of Sustainable Development Goals (SDGs). Once completed, NPP will give a big boost to the transport capacity, economy, and trade competitiveness of Qatar and beyond. So far, the project has improved local livelihood, increased the happiness of people in daily life, and facilitated the import and circulation of vital products. In the next 20-30 years, NPP is expected to meet Qatar's demand for port throughput, bringing the country closer to the rest of the world.



10 建在玻利维亚“天空之镜”的现代化工厂 ——玻利维亚乌尤尼35万吨钾盐工厂项目

Modern Factory on the “Mirror of the Sky”
Uyuni 350KTPA Potash Plant, Bolivia

项目简介 ABOUT THE PROJECT

玻利维亚乌尤尼 35 万吨钾盐工厂项目是在世界第一大盐湖建立的第一个利用盐湖资源生产产品的现代化、量产化工厂。项目由中工国际工程股份有限公司以 EPC 方式承揽，项目合同金额 1.83 亿美元，2018 年 5 月完工，项目运营期限 30 年，工厂每年氯化钾产量 35 万吨。

Built on the world's largest salt flat, the modern factory is the first to use Salar de Uyuni's indigenous resources for mass production. CAMC is the EPC contractor and operator. The USD 183 million project will produce 350KTPA potash each year during the 30-year operation starting from May 2018.

项目进程/Key Milestones

签约时间/Date of contract-signing	2015.07.13
开工时间/Date of commencement	2015.09.29
完工时间/Date of completion	2018.05.15

可持续发展背景

玻利维亚尽管拥有丰富的盐矿，但由于环保条件严苛，技术滞后，此前并没有现代化的钾盐工业。乌尤尼35万吨钾盐工厂项目是玻利维亚第一个现代化钾盐工厂。项目位于玻利维亚西部高原上的乌尤尼盐沼，海拔3656米，是世界最大的盐层覆盖荒原和著名的旅游风景区，素有“天空之镜”的美称。在玻利维亚宪法、第1333号环境保护法等现行法律法规的严苛要求下，中国企业尽管拥有成熟的加工工艺和建设速度，要在国家环境保护区和旅游风景区这样的敏感区域内开矿建厂仍然面临着艰巨的挑战。



盐湖厚厚的盐壳
Thick Salt Crust

Sustainable Development - Background and Context

Until the Uyuni 350KTPA Potash Plant, Bolivia had not had a modern potash industry up to the strict environmental and technical standards, despite the sheer quantity of salt deposits. Located within the Altiplano - a high-elevation plateau - of western Bolivia, Salar de Uyuni at 3,656m, long hailed as the “mirror of the sky”, is the world's largest salt-covered wilderness and a popular tourist destination. Mining in such an environmentally sensitive area would be legally challenging, even to a Chinese company known for speed and technical prowess. It would have to meet the rigorous requirements of existing laws and regulations, including the Constitution of Bolivia, and the Environmental Law No. 1333.

Solutions

The project team takes “zero pollution” as a must for construction and operations. The team strictly observes Bolivia's environmental laws, regulations and guidelines, and aligns itself with high design and engineering standards. It promotes the well-being of locals through ingenious foundation treatment and mining, rigorous waste management, efficient disposal of industrial and domestic sewage, and maximum preservation of the Salar's natural environment and landscape.

Scientific mining without leaving a blot on the landscape

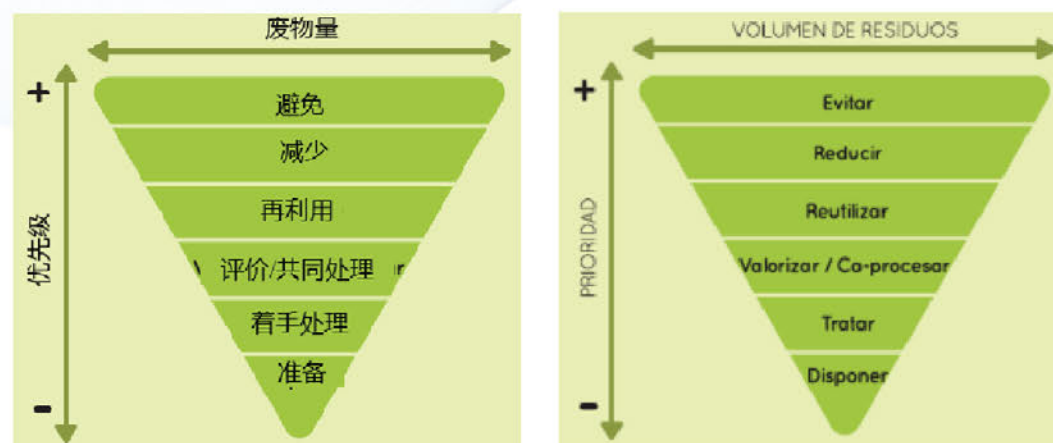
Foundation treatment is no easy task at the Salar, since the 4.3-meter bearing stratum (composed of salt and rock) lies beneath a 0.25-meter salt crust and a 0.55-meter sludge, both to be removed. The construction of concrete foundation cannot start until nearly 400,000m³ of graded gravel is filled up to 0.7 meter

解决方案

项目部把“零污染”作为建设期和运营期的硬性目标，严格遵守玻利维亚环境保护法律法规和当地政府环境保护相关要求，高标准设计施工，通过巧妙的地基处理和施工取材、严格的废弃物管控、出色的生产生活污水治理，最大程度保护天然盐田的环境和美景，为当地人民创造更多福祉。

科学取材，维护盐湖自然景观

盐湖内的地基处理是一个大工程，4.3米厚盐岩承载力层大约在湖面以下0.8米深度，需要将表面约25厘米的盐壳和55厘米左右的淤泥全部挖出，使用级配石料进行换填并垫高至湖面0.7米以上，才能开始混凝土基础施工，这一过程需要土石方量近40万立方。



倒金字塔废弃物控制原则
The Inverted Pyramid for Waste Management



垃圾分类
Waste Sorting

为了处理挖出的盐壳淤泥，项目部开展专项配比试验，将其用来修筑盐田堤坝和湖内道路，取得良好的效果，一举两得。此外，考虑到环绕盐湖四周的山丘本身就是天空之镜自然景观的重要组成部分，项目部从更远的山丘在不采用爆破的情况下，从山的表面取料，最大限度保护山的形状，而代价是大大增加了取料难度和运输成本。

采用倒金字塔原则，严控废弃物排放

项目部采用倒金字塔的废弃物管控原则，严格实行污染源头控制和全过程跟踪控制。将生活固体垃圾分为6大类，施工垃圾

above surface.

After experimenting mixtures of salt crust and sludge, the project team successfully used the waste to build a dam and pave internal roads. Seeing that the surrounding hills constitute an integral part of the “mirror”, the team employed the method of surface mining, which was more costly and difficult than blasting, so as to maintain the shape of the hills to the greatest extent possible.

The Inverted Pyramid for waste management

The project team has adopted the inverted pyramid principle of waste management. It not only watches out for pollution in the process of construction and operation, but also traces pollution to its source. The team has divided municipal solid waste into six categories and construction waste into five categories. It helps workers develop waste sorting awareness and habits, in an effort to nip pollution in the bud. For the sake of zero emission, the team keeps the generation, sorting, export, and treatment of con-

分为5大类，并对进场人员开展垃圾分类培训，培养进场人员的垃圾分类习惯和观念，从源头上避免或减少污染物。对污染物产生、分类、外运和处理进行严格的全过程跟踪控制，实现工厂建设和生产零排放。

废水变清池，人与自然和谐共处

生产生活污水处理也是该项目重点关注的问题。作为一条纯物理浮选工艺的生产线，工艺用水完全循环使用，尾盐重新回归盐湖，不会给当地带来任何污染。对于生活污水，采取净化后排至蒸发池自然蒸发的双保险方式进行处置，干净、清澈的蒸发池吸引了湖区大量水鸟栖息。

项目价值

玻利维亚乌尤尼钾盐项目在设计、施工、调试运行以及投产整个项目生命周期内周详计划、严密部署，实现了“绿色环保排放、零污染”的庄严承诺，工厂和盐湖景区环境和谐融合，获得业主以及监理单位的一致好评。

钾盐工厂生产的钾肥将有力提升当地农产品的质量和抗病虫害能力，为玻利维亚农业生产提供有力保障。同时，该厂的投产标志着玻利维亚可蒸发资源利用进入工业化阶段，为当地盐湖工业开发拉开了序幕。

taminants under full control.

From sewage lagoon to bird habitat

Emphasis is also placed on the disposal of industrial and domestic sewage. Based on 100% physical separation techniques, the production line ensures complete recycling of process water and the return of salt tailings to the Salar. Domestic sewage is purified and discharged into a pond for natural evaporation. The limpid evaporation pool has attracted birds from all parts of the Salar.

Project Value

The project makes sure everything goes to plan - from design and construction to commissioning and operations. It has delivered on its promise of zero pollution, and received unanimous accolade from the proprietor and construction supervisors for its harmonious coexistence with the scenic area. The potash fertilizer it produces will greatly enhance the quality of local agro products and build up a resistance to diseases and insects. As the plant became operational, Bolivia's volatile resources were put into industrial use for the first time.

“当看到在项目投产仪式上，玻利维亚人民载歌载舞、举国欢庆的时候，我们觉得所有的努力和付出都是值得的！”

——郝宝良 中工国际玻钾项目项目经理

“It is a big day for Bolivia. Seeing our local friends singing and dancing at the completion ceremony, I suddenly feel all our devotions and efforts are worthwhile.”

— Hao Baoliang, Manager of Uyuni 350KTPA Potash Plant



在蒸发池边栖息的水鸟
Birds Resting by the Evaporation Pond



11 高标准、严要求的孟加拉联合循环燃机电站 ——孟加拉古拉绍365MW联合循环燃机电站项目

Power Plant up to the Highest Standards
Ghorasal 365 MW Combined Cycle Power Plant, Bangladesh

项目简介 ABOUT THE PROJECT

孟加拉古拉绍365MW联合循环燃机电站项目是孟加拉国单机容量最大的燃机项目之一，项目净出力365MW，由中国技术进出口（集团）有限公司与中国机械进出口（集团）有限公司作为联合体承包。该项目建成后为孟加拉国18万户居民送去清洁电力，使孟加拉国电力容量提高了4%，为其缓解电力危机发挥了重要作用，在当地燃机项目中起到了良好的示范性效用。

The Ghorasal 365 MW Combined Cycle Power Plant is one of Bangladesh's largest projects of its kind. It is contracted by the consortium of CNTIC and China National Machinery Import & Export Corporation. After its completion, the project will provide clean power for 180,000 local households and increase Bangladesh's power capacity by 4%. It will, therefore, play an important exemplary role in reducing the country's power crisis.

项目进程/Key Milestones

签约时间/Date of contract-signing	2013.05.29
开工时间/Date of commencement	2015.08.16
完工时间/Date of completion	2018.05.15

可持续发展背景

孟加拉天然气资源丰富，就地进行能源开发，变气为电，化资源优势为经济优势，符合当地的能源政策。如何加强环境管理，在联合循环燃机电站项目中将对当地环境的影响降到最低，是项目面临的重要课题。

解决方案

项目在建设中采用了有利于孟加拉国可持续发展的做法，加强全流程环境管理，注重降噪减排，加强野生动物保护，致力于打造高质量、高标准、环境友好的燃机电站项目，为当地提供高效清洁的电力供应。

全方位、全流程环境管理

古拉绍电站项目全面开展环境保护工作，建立了施工环境管理体系，把环境管理体系作为项目管理体系的一部分，采用组织机构创新的管理模式，现场定期监督调查，及时更新环境管理制度，加强监管措施。

项目部加强对环境因素的识别和评价，定期、不定期的对项目建设进行全周期环境因素识别和评价，通过调查、分析和研究，明确环境影响因素并及时提出解决方案。电站在设计上遵循了中国、孟加拉国等多项先进标准，制定了关于环境污染事故应急预案等多项内部环境管理规定和作业流程，确保在环境保护上不出意外。加强环保管理队伍建设和环保宣传教育，整体提升环境管理水

Sustainable Development - Background and Context

Bangladesh is rich in natural gas resources. Turning gas into electricity will, therefore, give Bangladesh's economy a boost. How to minimize the environmental impact of power generation is a major consideration of the project.

Solutions

The project is built in such a way as is conducive to the sustainable development of Bangladesh. Its whole-process environmental management covers emission and noise reduction and wildlife conservation. Adhering to high environmental and quality standards, the project aims to provide a clean and efficient power supply for the local community.

Omnidirectional, whole-process environmental management

The project is green-minded in every way. An innovative system for construction environmental management has been established as part of the project management system. Regular on-site monitoring and survey is complemented by timely upgrading of environmental management rules.

The project team has stepped up efforts to identify, and regularly or irregularly assess, the environmental factors throughout the construction process. Solutions are promptly developed based on survey, analysis and research. In line with advanced design standards of China and Bangladesh, the team has laid down contingency plans for pollution accidents, among other internal by-laws and processes for environmental management. The team building and literacy campaigns have enhanced the green awareness and managerial expertise of all employees. In short, environmental efforts have permeated every rung of the construction and operational ladder.

Emission and noise reduction

Identification and assessment of environmental factors suggests that the power plant is genuinely a "clean" energy project. Its environmental impact will remain minimal, as long as it is able to deal with the little noise and solid waste it produces.

Most of the noise comes from turbo generators and gas turbines.



环境保护措施
Environmental Protection Measures

平和所有员工的环保意识，把环保工作纳入到项目部的日常运行和项目建设中。

降噪减排，最大限度减少对环境的负面影响

通过对环境因素的识别和评价，我们发现燃机电站是清洁能源项目，对环境整体影响较小，仅有少量的噪声、固体废物等因素影响环境。

项目建设所产生的噪声主要来源于汽轮发电机、燃气轮机等，项目建设过程中通过采取噪声小的施工工艺，隔声、减震等噪声控制措施，隔声屏障，设备减震处理，厂房隔音等减少噪声污染，保证厂界达到相关标准值的要求，不影响项目所在地声音环境质量。

The project has employed low-noise techniques, sound barriers and shock absorbers to meet the boundary noise limits.

Fully committed to wildlife conservation

Eyeing the coordinated development of economy, society and environment, the project has taken full account of its possible ecological impact, and set out precautions accordingly. During power plant construction, the project team actively considers possible impacts on mammals, reptiles and amphibians, which are less capable of migration and more dependent on the environment. The project ensures its impact on wildlife populations is limited during the construction, and will be quickly reversed thereafter. These measures have been taken to follow through with wildlife conservation:

- ◆ Regular patrols, to make sure that vehicles crisscrossing the power plant will not threaten the safety of mammals, reptiles and amphibians.
- ◆ Prohibition on chasing, spooking, injuring and killing animals (any violator will be held legally liable).
- ◆ Timely rescue for injured or trapped animals.
- ◆ Minimize the impact of human activity, construction noise,

将野生动物保护贯彻到底

项目充分考虑施工过程中可能涉及对生态系统造成的影响，提前预防规划，确保经济、社会、环境协调发展。

电站建设中主动考虑对哺乳类、爬行类和两栖类动物可能产生的影响，制定相应的解决方案和保护措施。哺乳类、爬行类和两栖类动物迁徙能力较弱，对环境依赖性较强，但是整个项目对种群影响有限，随着项目建设完成，动物种类数量很快得以恢复。项目部将动物保护贯彻到底，主要采取了以下措施：

- ◆ 安排人员定期行巡视，防止进出厂区的车辆对哺乳类、爬行类和两栖类动物的安全构成威胁
- ◆ 严禁追赶、惊吓野生动物，禁止伤残、猎杀野生动物，违者追究法律责任
- ◆ 发现受困、受伤的野生动物及时采取保护措施
- ◆ 尽量减少人员活动、施工噪音、灯光等对动物生活环境造成影响
- ◆ 废弃物、垃圾等及时清理，防止对野生动物造成危害
- ◆ 开挖土方时，绝不允许超挖超放，尽量减少对野生动植物的破坏

项目价值

孟加拉古拉绍联合循环燃机电站项目全部采用天然气，废气排放较少，运行污染很小，具有良好的环保效益。电站的建设实现了发电与环保并重，经济与社会全面协调。燃机电站建成后，满足了孟加拉地区的电力负荷需求，提高了电网的稳定性。项目在建设过程中加强对当地钢筋、水泥、混凝土、砂石料等建筑材料的本地化采购，大量招募当地员工，为当地创造就业机会，提高了当地员工的家庭收入和幸福指数。

and lighting on the animal living environment.

- ◆ Timely disposal of wastes to prevent harm to wildlife.
- ◆ Prohibition on over-excavation and over-dumping of excavated soil and rock.

Project Value

The project exemplifies coordination of economic, social and environmental benefits. It uses 100% natural gas for power generation, which produces less exhaust and prevents operational pollution. It is able to meet local demands and improve the stability of the national electricity grid. It has ramped up localized procurement of building materials like rebar, cement, concrete, sand and gravel. Also, it has given a big boost to local employment, income and happiness levels.



12 培养合格供应商, 与当地合作共赢 ——多哥埃雅德玛国际机场扩建及现代化改造项目

Nurturing Qualified Suppliers and Seeking Win-win Cooperation
Expansion and Modernization of Gnassingbe Eyadema International Airport, Togo

项目简介 ABOUT THE PROJECT

多哥埃雅德玛国际机场扩建及现代化改造项目由中国民航机场建设集团公司和威海国际经济技术合作股份有限公司共同承建, 项目总投资 1.5 亿美元, 是多哥首都洛美标志性大型公共建筑。多哥洛美机场跑道长 3000 米, 航站楼面积 22750 m², 机场配备 22 个登机桥伸缩端, 能够停靠波音 747 等大型飞机, 每年可接待旅客达 160 万人次, 有效促进了当地旅游业和运输业等的发展。

The expansion and modernization of Gnassingbe Eyadema International Airport is a USD 150 million project jointly undertaken by CACC and WIETC. A large public facility and a landmark of Lome, the capital of Togo, the revamped airport features a 3,000-meter runway, a 22,750m² terminal and 22 boarding bridges. Able to handle large aircraft like Boeing 747 and 1.6 million passengers per year, the airport gives local tourism and transport a shot in the arm.

项目进程/Key Milestones

签约时间/Date of contract-signing	2010.12.02
开工时间/Date of commencement	2012.08.16
完工时间/Date of completion	2015.06.01

可持续发展背景

供应链管理是承包工程行业规避运营风险, 建立竞争优势的重要环节。多哥埃雅德玛国际机场扩建及现代化改造项目大力推行本地化采购, 与当地供应商积极开展合作, 却依然面临着时间紧、任务重、技术难度大、供应商技术管理不足等问题。

解决方案

多哥埃雅德玛国际机场扩建及现代化改造项目建设中始终秉承“公平公正公开”原则, 优化供应商管理程序、规范供应商行为、提升供应链合作伙伴管理和技术水平, 形成了风险共担、合作共赢的命运共同体。

优化供应链管理程序

项目部编制《多哥洛美机场项目当地物资采购管理制度》, 将合格的供应商纳入合格供方名录; 建立集采平台, 实行阳光采购; 采购审批流程通过ERP系统实现, 确保每个审批环节的公正、透明、可追溯; 项目期间对供应商和分包商实行采购、监管、抽查、评价的全过程控制管理。

制定社会责任倡议书, 规范供应商行为

公司要求供应商签署《威海国际合作公司社会责任及SDGs倡议书》, 在供应商考察评价表中列明社会责任要求, 并参照《对外承包工程行业社会责任指引》等指南, 将社会

Sustainable Development - Background and Context

Seeing supply chain management (SCM) as a key to mitigating operational risks and building competitive edge, the project team vigorously engaged in localized procurement and joined hands with local suppliers. Still, the team was facing a tight schedule, a heavy workload, and technical challenges, and suppliers' deficiencies in technology management were not making things any easier.

Solutions

On the principle of “fairness, justice and openness”, the project team streamlined the supplier management process, regulated supplier behavior, enhanced the managerial and technical expertise of supply chain partners, and gave shape to a community where every stakeholder has skin in the game.

Streamlined SCM process

The project team formulated the *Lome International Airport Local Procurement Management Rules* along with a qualified suppliers list. It established a centralized platform for “sunshine procurement”, and an ERP system to ensure justice, transparency and traceability at every link of the procurement approval process. It managed suppliers and subcontractors through monitoring, sampling and assessment - both during and after the procurement.

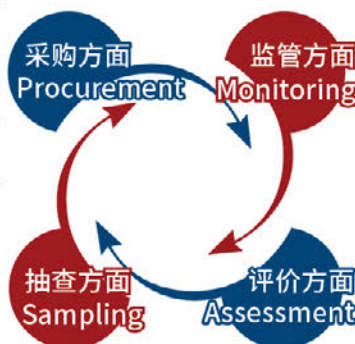
CSR Initiative for suppliers

Suppliers were regulated by the *WIETC Initiative on CSR and SDGs*. CSR standards were specified in the Supplier Assessment Form. According to the *Guide on Social Responsibility for Chinese International Contractors*, CSR was included in supplier performance assessment, and taken as a premise of future cooperation with the suppliers.

Top priority was given to subcontractors and equipment/material suppliers certified to ISO 14000. Instructions on environmental protection were issued to partners, who were required to confirm their environmental and CSR commitment. Subcontractors were enrolled in an environmental and safety literacy program.

- ◆ 调研当地市场,精挑细选供应商
- ◆ 对中国的供应商,分包商实行严格开箱验收,对于问题产品反馈给承包商并按照情节严重程度采取不同措施
- ◆ 对专业分包商进入多哥之前采取人员面试和交底工作

- ◆ Look into the local market and carefully choose the suppliers.
- ◆ Chinese suppliers and subcontractors are subject to open-package inspection. Contractors will be notified of defective products, and measures will be taken depending on the seriousness of the case.
- ◆ Specialized subcontractors are interviewed and briefed before entering Togo.



全过程控制管理
Whole Process Control

- ◆ 监事会对所有采购,分包活动进行随机抽查,并出具相关报告
- ◆ Snap check and reporting on procurement and subcontracting by the Board of Supervisors snap.

- ◆ 对分包商的工程质量和安全开展统一监督和管理,比如聘请专家或者第三方机构参与保障工程质量

- ◆ Subcontractors are subject to quality and safety check (e.g. by external experts or a third-party institution).

- ◆ 每年年终或合作结束时,总部根据各方面反馈,对供应商、分包商的绩效进行评定,决定今后是否继续合作,优胜劣汰

- ◆ At year-end or when a partnership contract expires, suppliers and subcontractors are graded based on performance and word-of-mouth. Only the high-graders will be considered for future cooperation.

责任作为供应商业绩评价的内容和今后是否继续合作的前提之一。

典型举措有: 优先选择通过ISO 14000认证的分包商及材料设备供应商进行合作; 发放合作方环保告知书, 要求其提供环境宣告表与社会责任宣告书; 对分包商进行环境安全教育等。

提升供应链合作伙伴管理和技术水平

公司制定《相关方环境、安全宣告表》, 规范分包商和供应商在三废管理方面的行为。例如, 公司为了加强当地采购和分包, 扶持当地中小型供应商发展, 主要在当地采购水泥。然而当地供应商在环保方面面临较大风险, 公司对其进行技术、管理指导, 提高其能力和绩效, 进而采购其产品, 同时也规避了整个项目的风险。

以BOITAS公司为例, BOITAS是一家做劳务分包的当地企业, 主要提供混凝土施工、墙地砖镶贴, 装修施工等服务, 但是在实际操作



《威海国际合作公司
社会责任及 SDGs 倡
议书》
WIEITC Initiative
on CSR and SDGs

Enhancing the management and technical capabilities of supply chain partners

The Instructions for Stakeholders on Environment and Safety informed subcontractors and suppliers of the right way to manage the “three wastes”. Take cement, a locally purchased material, for example. As environmental risks loomed large in front of cement suppliers, the project team offered management and technical guidance before buying their products. That in turn reduced the project's risk exposure.

A local labor subcontractor, BOITAS provided concrete construction, wall and floor tile installation, among other decoration

中存在许多问题, 公司帮助其改善管理方式, 保障项目进度, 得到业主方和监理的赞扬。

洛美机场高压柜采用SM6环网柜, 这是一种适用于配电室或箱式变电站安装, 电缆从正面接线的装备。考虑到高压管理问题和当地高压施工技术相对较为成熟, 项目部采用当地电业公司施工、派出人员进行技术指导的模式, 这一创新的施工模式提高了当地分包商技术水平和工作效率。

项目价值

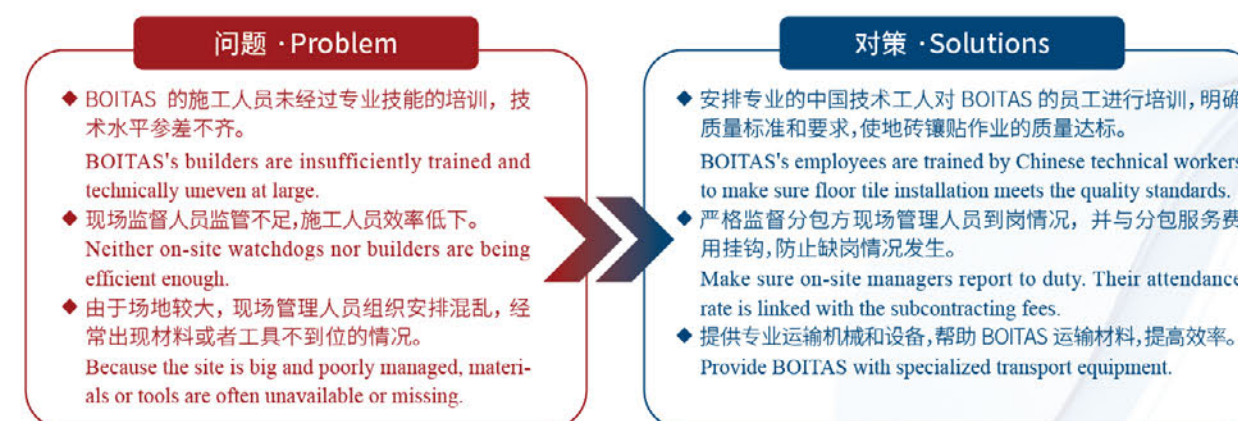
项目的建成为当地创造了大量就业机会, 使机场年货运量从1万吨提高到3.5万吨, 促进了当地交通物流的发展, 打开了与外部交流沟通的渠道。这座凝聚着国人智慧与汗水的航站楼, 如同一道彩虹, 搭建起承载多哥人梦想的腾飞平台, 成为目前西非现代化程度最高的机场航站楼之一。中国民航机场建设集团有限公司派驻现场的项目负责人周颖、威海国际经济技术合作股份有限公司副总裁郝玉成被多哥总统福雷授予多哥国家对外国人的最高荣誉——“莫诺军官荣誉勋章”。

and furnishing services for the project. The company, however, hit quite a few snags from the very beginning. Things did not get any better until BOITAS improved its management model with the project team's help. Finally, to the acclaim of the proprietor and construction supervisors, the company caught up with the schedule.

The airport uses SM6-type high voltage ring main units which are suitable for power distribution rooms and box-type substations. A technologically advanced local company was entrusted with high voltage engineering under the guidance of specialists from the project team. Such a new mode of cooperation kicked local capabilities and efficiency up a notch.

Project Value

The project created lots of local jobs. The airport's annual cargo throughput jumped from 10,000 to 35,000 tons. Local transport got a facelift as Togo drew closer to the outside world. The new terminal - and by far one of the most modernized terminals in West Africa - crystallizes the Chinese wisdom, the Togolese dream, and the efforts of both sides. CACC Resident Project Manager Zhou Ying and WIETC Vice President Hao Yucheng were granted the “Grand Officer of the Order of Mono Award”, Togo's highest honor for foreigners, by Togolese President Faure Gnassingbé.



与 BOITAS 合作过程
Process of Cooperation with BOITAS



13 乌干达高速公路带动当地合作伙伴共同履责

——乌干达KE机场高速公路项目

Joint CSR Fulfillment with Local Partners
Kampala-Entebbe Expressway, Uganda

项目简介 ABOUT THE PROJECT

乌干达 KE 机场高速公路是乌干达第一条收费高速公路，由中交一公局集团承建，连接首都坎帕拉和恩德培国际机场，总造价 4.76 亿美元。主线全长 36.85 公里，连接线全长 12.64 公里。从 2009 年 9 月开始，项目全过程的勘察设计咨询服务用了近 10 年时间。2018 年 6 月该公路竣工通车，填补了乌干达没有高等级公路的空白，带动了乌干达公路工程管理服务机构及上下游配套设施的完善，促进了当地建材行业的快速发展。

Kampala-Entebbe Expressway is Uganda's first ever toll road. Undertaken by CFHEC, the USD 476 million expressway, with a 36.85km main line and a 12.64km connecting link, extends from Kampala, the capital city, to Entebbe International Airport. Reconnaissance, design and construction started in September 2009 and took almost ten years. When the expressway finally became operational in June 2018, it had not only filled a high-grade gap in Uganda's road system, but also boosted the country's building industry, road project management services, and supporting infrastructure.

项目进程/Key Milestones

签约时间/Date of contract-signing	2012
开工时间/Date of commencement	2012.11.19
完工时间/Date of completion	2019.07.17

可持续发展背景

乌干达KE机场高速路划分路段多，路基宽度灵活多变，对设计和材料要求较高。乌干达本地市场发展不够充分，原材料质量达不到采购要求，本地采购面临困难。同时，当地符合要求的合格分包商较少，难以满足项目需要，给项目执行带来潜在的安全风险、社会风险。如何解决本地采购、分包等方面的问题，选择和培养本地合作伙伴，是项目面临的挑战。

Sustainable Development - Background and Context

The expressway was divided into many sections. The width of road base varied wildly. Local raw materials often failed to pass muster. Eligible subcontractors were too few. All these problems posed safety and social risks. How to select and nurture local partners was, therefore, a major challenge confronting the project team.

Solutions

CFHEC rolled out a detailed supplier management process with clear CSR standards, aiming to help suppliers enhance their technical capabilities and create a win-win situation.

解决方案

公司制定了详细的供应商管理流程，帮助供应商提升其工艺水平，对供应商履行社会责任提出明确要求，实现与当地供应商的互利共赢。

制定供应商管理流程

公司面对供应商积极采取响应措施，建立一套完整的协作队伍准入、管理和退出的办法。

鼓励负责任的供应商

项目部鼓励负责任的供应商，要求供应商主动履行社会责任，严守法律法规、保障员工基本权益、做好疾病预防工作、保护生态环境。

提升供应商工艺技术水平

项目建设期间，共建设沥青拌合站1



供应商管理流程
Supplier Management Process

个，混凝土拌合站3个，水泥稳定碎石拌合站1个，这些设备将在项目建成后继续使用。高水平设备数量的增加，打破了当地市场该类设备极度匮乏和少量设备垄断的地位，通过市场的自我调节和淘汰机制降低了施工和材料价格。项目建设所需的水泥和钢筋等均从当地采购，在项目对材料的严格要求下，当地生产商工艺不断革新，供应材料质量提高。

以水泥为例，乌干达KE项目桥梁桩基建设所需的水泥不仅需要高强度，还需要对沼泽酸性水有极强的耐腐蚀性。项目建设之初，当地市场无任何水泥厂商满足上述条件，在项目的高要求和生产配比的建议支持下，当地Hima公司率先进行了生产工艺研究和改革，生产出合格水泥，拔高当地水泥市场材料生产质量的新标准，树立了行业榜样。

项目价值

项目建设带动了当地公路行业配套设施的完善，加速了水泥、机械设备、钢筋等相关领域的发展；作为一条连接Kampala市和Entebbe镇的重要干线收费道路，项目建成后有助于将分散的经济活动集中到坎帕拉的中央商务区，改善交通环境，减少交通拥堵，为商业区周边的发展提供机遇，为当地民众提供了更好的运输设施，为零售业与公共服务提供了集中场所，缓解了当地就业压力，是乌干达真正的“民生工程”。该项目的建成还推进了基础设施建设的互联互通，实现了技术标准体系的对接，有助于推进国际骨干通道建设。

Developing the supplier management process

CFHEC established a complete set of measures for the entry, management and exit of partners.

Building CSR awareness among suppliers

Suppliers are required to proactively assume social responsibilities and strictly observe laws and regulations. Specifically, they should safeguard employees' basic rights and interests, and commit themselves to disease prevention and environmental protection.

Enhancing the technical capabilities of suppliers

The project left behind one asphalt mixing station, three concrete mixing stations, and one cement stabilized gravel mixing station. These hi-tech facilities were soon put to other use. They have smashed monopolies, hastened obsolescence, reshaped the local market, and in turn pared down engineering and material costs. Suppliers constantly upgraded their techniques to meet the project's rigorous requirements for locally purchased materials. Cement, for one, was expected to be not only heavy-duty, but also exceptionally acid-tolerant. At first, none of the local plants could cut the mustard. Hima was the first to break the logjam. Technical research and innovation on the project team's advice enabled the company to deliver and excel.

Project Value

Kampala-Entebbe Expressway is truly a "well-being project". It not only reduced congestion and improved the traffic environment, but also hastened the development of supporting sectors like cement, machinery and rebar. Thanks to greater accessibility, retailers and public services are more concentrated in the Kampala CBD. Even the surrounding areas are buzzing with activity, since jobs are readily available. From a macro perspective, the project is conducive to infrastructure connectivity, the alignment of technical standards, and the construction of international trunk passageways.

严守法规 / Compliance

- ◆ 严格要求协作队伍和供应商遵守中国及乌干达劳动法、环境保护法、税法，工程项目环境评估流程等相关管理条例
- ◆ 定期检查，整改不合格者
- ◆ Partners and suppliers are required to strictly observe the labor laws, environmental laws, tax laws, and engineering project EIA processes of China and Uganda.
- ◆ Regular check and rectification.

保障权益 / Rights and interests

- ◆ 要求协作队伍和供应商保障员工生活、卫生医疗等权益
- ◆ 按月度上交环境治安维稳责任承诺书等相关记录
- ◆ Partners and suppliers are required to safeguard employees' basic rights and interests, including the access to sanitary living conditions and medical care.
- ◆ They are also required to submit on a monthly basis the Letter of Commitment to Protecting the Environment and Maintaining Social Order, along with relevant records.

预防疾病 / Disease prevention

- ◆ 加强当地文化宗教，法律法规，疾病预防宣传
- ◆ 签订预防宣讲合同，定期为项目全体职工宣传疾病专业知识
- ◆ 发放药品等基本防护工具
- ◆ Ramp up publicity of local culture and religion, laws and regulations, and disease prevention.
- ◆ Hold regular lectures in disease prevention for all employees.
- ◆ Distribute drugs and basic protective equipment.

生态保护 / Environmental protection

- ◆ 与优秀的材料供应商建立长期的合作关系
- ◆ 优选绿色环保材料使用，对购买的材料和产品检验其质量合格证书绿色环保证书
- ◆ Strike long-term partnerships with outstanding material suppliers.
- ◆ Select green materials, and examine the quality certifications and green credentials of materials and products.

供应商管理
Supplier Management



14 根植当地, 聚光为能, 贡献摩洛哥社会发展 ——摩洛哥努奥二期200MW槽式光热电站工程项目

From Solar Power to Social Development
Noor II 200MW IPP Concentrating Solar Power Plant, Morocco

项目简介 ABOUT THE PROJECT

摩洛哥努奥二期 200MW 槽式光热电站工程由山东电力建设第三工程有限公司承建,是首个由中国企业在海外 EPC 总承包的大型光热电站,是世界光热电站的里程碑工程。该电站单台装机容量 200MW,利用太阳能将水加热成水蒸气推动汽轮机发电,每年减少二氧化碳排放量约 30 万吨,被誉为聚光为能、引领未来的“丝路奇迹”。

Undertaken by SEPCOIII, the project is the first large solar power plant overseas with a Chinese company as the EPC contractor. It is also a milestone in global solar industries. With an installed capacity of 200MW, the project uses solar energy to vaporize water and keep steam turbines humming. To generate the same amount of electricity, a thermal power plant would have to emit 300,000 tons of CO₂ each year. The project is hailed as a “miracle on the Silk Road” for its forward-looking endeavor.

项目进程/Key Milestones

签约时间/Date of contract-signing	2015.05
开工时间/Date of commencement	2015.07.27
完工时间/Date of completion	2018.04.24

可持续发展背景

摩洛哥社会失业率较高,大量劳动力闲置,高新技术企业缺乏,工业加工能力薄弱。同时,摩洛哥属于伊斯兰国家,整个国家的文化、思维习惯以及做事方式与中国存在较大差异。如何与当地员工、企业加强相互理解和信任,为当地就业和工业化发展做出贡献、实现合作共赢,是企业亟需解决的难题。

解决方案

摩洛哥努奥二期200MW槽式光热电站工程项目部研究制定了社会责任行动目标和计划,涵盖雇佣本地员工、加强技能培养、管理团队本土化、助力相关产业升级、文化融合等重点行动,旨在从当地需求出发,通过项目建设更好地融入当地,贡献当地,实现与当地社会的“共商共建共享”。

帮助“洋徒弟”提升技能

项目期间制定了培训管理程序,规范工作流程,明确工作标准,保证培训全过程管理的有效性。结合摩洛哥特点,制定了个性化的员工培养方案,涵盖专业工程理论、技术操作、运行维护、安全管理、质量管控、商务管理、人力资源管理等工程建设的各个方面。

在项目期间通过中国籍导师带徒模式,帮助“洋徒弟”提升工作技能和工作水平。该项目培训投入资金达112万美元,累计组织各类培训800多次,培训人数超过9000人次,培训覆盖率100%。

Sustainable Development - Background and Context

Morocco is beset by a largely idle labor force, a dearth of hi-tech companies, and a weak processing sector. Its Muslim population is also a far cry from the Chinese people in culture, thinking habits, and the way of doing things. How to enhance mutual understanding and trust with local businesses and employees? How to boost local employment and industrialization through win-win cooperation? These are the questions each Chinese enterprise needs to ask itself before doing business in Morocco.

Solutions

The project team has laid down a CSR action plan with specific goals, covering local hiring, management team building, skills training, industrial upgrading, and acculturation. In line with local demands, the project aims to engage with and contribute to the community on its doorstep

Training for Moroccan apprentices

The project team has regulated the work process and clarified the work standards during its structured training management. In light of Morocco's characteristics, the team has set out personalized employee training plans, encompassing engineering theories, technical operations, operational maintenance, safety management, quality control, business management, HR management, etc

According to the plans, Chinese coaches have provided skills training for Moroccan apprentices. The training costs have amounted to USD 1.12 million. All local employees have been involved. The number of training sessions has topped 800, and that of participations 9,000 and training coverage is 100%.

The project team has also offered a series of professional and specialized training programs to more than 300 technology managers from the proprietor and local engineering companies, setting the stage for future implementation of Morocco's industrialization strategy.

Technology + factories = industrial development

Standing on the cutting edge of global technology, solar thermal power stations have placed high requirements on equipment and materials. Based on “technology + factories”, a new mode of win-win cooperation, the project team has trained local subcon-

通过一系列的专业化培训和日常工作养成教育，该项目直接为业主单位和其他当地工程公司培养了技术管理人员300余人，为当地储备了一批技能型和管理型人才，也为摩洛哥未来工业化发展战略做出贡献。

“技术+工厂”合作新模式，打通产业发展脉络

光热电站技术属于世界前沿科技，对设备和材料的要求标准较高。项目部采取“技术+工厂”的技术合作新模式，利用与当地分包商的合作，对分包商相关人员开展管理知识、生产技能等培训，实现与当地分包商的合作共赢。

以钢结构为例，项目部从国内调入一批能力过硬的技能专家，进驻当地工厂，手把手教授当地技术人员和工人新的生产工艺和理论知识，帮助当地工厂完成材料加工。通过此种方式，受帮扶的钢结构厂在保证产品质量的前提下，生产效率提高了30%，基本满足项目钢结构生产进度要求。

项目部开创“技术+工厂”的合作模式，实现部分设备和材料的当地化生产目

标，满足了项目施工需求，同时为当地培养了一批生产高端设备材料的技能型人才，加快了摩洛哥工业化步伐和产业转型升级。

Take steel structure as an example, a number of Chinese experts have come all the way to local factories. They have imparted the latest theoretical and practical knowledge to technical workers. As a result, local processing capabilities have met the team's expectations. The productivity in structural steel, for one, has seen a 30% rise without compromise to quality.

“Technology + factories” has enabled localized production of certain equipment and materials. It has also fostered local talents in high-end manufacturing, and in turn put Morocco on the fast track to industrial transformation and upgrading.

Cultural bricks for the “Sino-Moroccan bridge”

There is a big difference between Chinese and Moroccan cultures. The project team has organized a number of activities to better integrate into the local community and bridge cultural differences.

The project team has sent gifts to local employees during Islamic holidays, and to the adjacent welfare home on the eve of Eid al-Adha (literally, “Feast of the Sacrifice”). It has invited local employees to traditional Chinese holiday celebrations, in an effort to deepen mutual understanding. It has also launched volunteer campaigns to spread the Chinese language and culture. These widely-acclaimed activities have added bricks to the “Sino-Moroccan bridge”.

Project Value

The project will provide 1 million local households with clean power. It will take a substantial load off Morocco's electricity supply, wean the country off its reliance on power import, and

offer a sustainable path to energy development. The project has created job opportunities for the 600 residents of Ghassat and neighboring areas. With it come the high-end manufacturing industry, sophisticated engineering technology, and advanced management ideas. The project has greased the wheels of industrialization, revved up consumption and investment, hastened the birth of supporting sectors, and eased Morocco's overdependence on agriculture and tourism. Given its outstanding achievements in promoting local development, the project has been granted two national awards (respectively for social contribution, and economic and employment promotion).

加强文化交流，架起中摩友谊桥梁

中国与摩洛哥文化差异较大，为了更好地融入当地，项目部加强和当地的交流沟通，推出一系列文化融合和人文关怀举措，让中国文化和摩洛哥文化更好地交流融合，赢得当地员工和社区的认可。

项目部在穆斯林节日时，为当地员工送上节日慰问品，让当地员工感受到公司关怀；在宰牲节到来前，为当地福利院赠送宰牲节慰问品；在庆祝中国传统节日时，邀请当地员工参加，感受中国文化，加深相互理解；开展志愿者活动，传播汉语文化，促进中摩文化交流等。通过一系列的文化交流沟通举措和活动，促进中摩文化交流，架起中摩友谊桥梁。

项目价值

摩洛哥努奥二期200MW槽式光热电站建成投产，极大地缓解了摩洛哥电力紧缺局面，整个电站投产发电后可为摩洛哥100万家庭带来清洁电力，为其摆脱电力进口的困境奠定了基础，也为摩洛哥能源发展提供了一条绿色可持续途径。

该项目解决了所在村镇Ghassat社区及周边600名村民的就业问题，改变了摩洛哥以旅游业和农业为主的经济结构，推动了当地工业化进展，刺激了当地的投资和消费。在项目建设过程中，为当地带来了先进的产品制造、施工技术和管理理念，促进了当地工业化发展，拓展了当地电站配套设施等新产业。基于对当地发展的突出贡献，项目获得摩洛哥“社会贡献奖”和“经济与就业促进奖”。



镜场导热油小管道保温工艺
Heat preservation technology of mirror field heat transfer pipe line



15 “筑坝育人”，塑造喀麦隆水电站典范 ——喀麦隆曼维莱水电站项目

Power Generation and Talent Fostering: A Model Project
Memve'ele Hydropower Station, Cameroon

项目简介 ABOUT THE PROJECT

喀麦隆曼维莱水电站项目由中国电建集团国际工程有限公司及旗下中国水利水电第十六工程有限公司承建，是喀麦隆在建的最大水电站项目，连续三年获得喀麦隆南部大区政府颁发的优秀企业奖。项目合同金额 6.37 亿美元，2017 年 12 月完工，水库总库容 1.3 亿 m³，有效库容 0.08 亿 m³，电站总装机容量 211MW，平均年发电量 11.87 亿 kW·h，装机年利用小时 5626h。

Undertaken by POWERCHINA and its subsidiary Sinohydro Bureau 16 Co., Ltd., the Memve'ele Hydropower Station is Cameroon's largest project of its kind. For three consecutive years, it received the Outstanding Enterprise Award from the South Region. Completed in December 2017, the USD 637 million project has a reservoir capacity of 130 million m³, an effective reservoir capacity of 8 million m³, an installed capacity of 211MW, an average annual production of 1.187 tW·h, and 5,626 utilization hours of installed capacity per year.

项目进程/Key Milestones

签约时间/Date of contract-signing	2009.09.25
开工时间/Date of commencement	2012.12.28
完工时间/Date of completion	2017.12.31



拦河坝
The Dam

可持续发展背景

曼维莱水电站位于喀麦隆南部安坝省紧邻赤道几内亚的恩特姆河上，除了缓解当地电力紧张、增加邻国电力出口外，还为当地创造了大量的就业岗位，是喀麦隆境内重要的民生工程。然而，由于当地员工技术经验和能力不足，难以满足工作岗位需求，当地人才培养成为项目实施的重点。

解决方案

喀麦隆曼维莱水电站项目秉承“筑坝育人”的理念，招聘大量喀籍员工，专门成立喀方员工管理办公室，通过“以中带喀，以喀管喀”的模式，为喀麦隆培养专业人才。

“以中带喀”，培养当地人才

项目部通过“以中带喀”的方式，大量录用并精心培养当地员工，成为喀麦隆总统府推进30万个就业岗位的试点单位。

项目实施过程中，对于喀方员工可能胜任的岗位优先聘用当地员工，为当地创造更多就业岗位。项目累计带动3128位当地员工就

Sustainable Development - Background and Context

The project is located by Ntem River in Ambam Town, South Region, along the Cameroon-Equatorial Guinea border. It helps ease power shortage and increase electricity export to neighboring countries. As a “well-being project”, it has also created lots of jobs. At first, however, the local labor force was not technically experienced or capable enough to do the jobs. The project team, therefore, spares no effort in fostering local talents.

Solutions

The project team places equal emphasis on power generation and talent fostering. It has set up an office to manage the large number of Cameroonian employees.

Fostering local talents

Local employees have learned a lot from their Chinese coaches. The project takes up a large share of the 300,000 new jobs the Office of President of Cameroon is expecting.

As many Cameroonians have been hired as conditions permit. In fact, 3,128 locals have worked for the project, accounting for 75% of the total workforce. At the peak of construction, over 1,400 Cameroonians were simultaneously on the payroll.

Employee training: Logistics and power/rebar engineering are undertaken by all-Cameroonian crews. To staff in-demand jobs (e.g. excavator operator, drilling engineer, blaster, scaffolder) with locals, the project team pairs Cameroonian apprentices with Chinese coaches, helping the former learn more about the internal by-laws, safe operations and professional skills. In 2013, the project had its first female Cameroonian excavator operator. She gave a number of mainstream media interviews, and her stories were shared far and wide.

Leadership training: Cameroonian engineering managers and university graduates at the project's functional departments are groomed for leadership roles in corporate affairs, HSE, and operations. Local executives have so far accounted for 2% of the total. In October 2014, the project team hired a dozen local university graduates. They filled key positions involving technology, measurement, quality assessment, testing, and security. After careful training, many of them became operational maintenance coaches for the proprietor. The team

业，本地员工占比75%，在施工高峰期，1400余名喀方员工参与工程建设。

培养普通员工。项目所有的后勤服务、电工、钢筋工等技术要求相对较低的工种全部雇佣喀籍员工。对于挖机、钻机、爆破工、架子工等喀麦隆紧缺岗位，精心组织岗位规范培训，并通过与中方员工结对子的方式，宣贯规章、传授安全操作和工种技能。2013年，项目培训出当地首位女挖机手，喀麦隆主流媒体多次进行采访与报道。

培养管理人才。项目期间在机关职能部门聘用喀籍工程管理人员和喀籍大学毕业生，经岗位管理和技能培训后，担任事务高管、HSE高管、作业工长等职务，管理层中当地员工累计占比达2%。2014年10月，项目部在当地高校招聘十几名大学生，并把他们安排在技术、测量、质检、实验、安全等重要岗位，经过精心培养，他们中多名员工成为业主运行维护培训人员的中坚力量。对于优秀喀方员工和高管，公司给予培训、表彰，并选送到中国进行研修。

“以喀管喀”，加强员工沟通

由于语言文化、宗教信仰、生活习惯等方面的差异，中方人员与业主、监理工程师、喀籍员工的交流和融合相对比较困难。项目部除了积极倡导中方员工学习法语、了解当地文化习俗增进中喀文化交流和融合外，还通过选拔和培养的方式，将有一定管理经验、工作表现优秀的喀方员工，选拔到喀方员工管理办公室，负责喀方员工的沟通与管理，例如宣贯项目规章制度，办理喀方员工劳动关系事务和处理劳动纠纷等。这一“以喀管喀”举措，有效促进了喀方员工管理和中喀文化交流融合。喀方员工办公室负责人李白（中文名字），在促进就业方面贡献突出，2015年度获班门达西

recognizes Cameroonian executives and employees for their outstanding performance. Some of them are even sent to China for further studies.

Improving employee communication

Due to differences in language, culture, religious belief and living habits, Chinese teammates cannot blend in as easily with Cameroonian employees, partners and supervisors as with their countrymen. The team, therefore, calls on its Chinese members to learn French, an official language of Cameroon, and know more about local culture and customs. Meanwhile, it designates experienced and outstanding Cameroonian employees to manage their compatriots, including communicating the internal bylaws, going through the paperwork for new hires, and handling labor disputes. Such approaches serve to keep local employees in high spirits and bridge the cultural gap. In 2015, one of the Cameroonian managers, who goes by the name Li Bai in tribute to the Chinese poet, was granted a medal of honor for his outstanding contributions to local employment.

Safeguarding employees' basic rights and interests

The project team constantly streamlines the management rules, ameliorates the working and living environment, and improves employee care and recognition. It safeguards employees' basic rights and interests, helping them stay happy, healthy and safe in the workplace.

Streamlining the management rules: The project team frequently holds the Cameroonian employee management meetings. According to national laws and regulations, the team has issued internal by-laws on labor protection, medical care, and workplace injury management.

Building a self-contained company town: In addition to distributing labor protection supplies, the project team allows Cameroonian employees access to a complete set of supporting infrastructure, including clinics, restaurants, shops, and even a football pitch.

Improving employee care and motivation: The project team gives local employees a fair shake. It respects and cares about them, and strives to increase their senses of belonging, honor and identity. It brings together Cameroonian employee representatives twice a month to hear and address their concerns. It celebrates local public holidays by giving employees cash allowances and organizing football matches. According to its *Measures for Rewarding Outstanding Cameroonian Employees*, the team recognizes local exemplars on a monthly or yearly basis.

Project Value

The project provides stable industrial and domestic power supply for Yaoundé, a capital city with a population of about 4

million. Thanks to its employee training model, summed up as “Cameroonian apprentices under Chinese coaches” and “Cameroonian employees under Cameroonian managers”, the project has fostered a large number of management and technical talents. Furthermore, it has boosted jobs and living standards, and spurred the economic development of Cameroon and beyond.

加强管理，保障员工基本权益

项目建设过程中，不断完善管理制度，优化生产生活环境，加强员工关怀激励，保障员工基本权益和职业健康安全，增进员工幸福感。

完善管理制度。项目部多次召开喀方员工管理会议，依据喀麦隆法律法规，先后出台了涉及劳动保护、就医、工伤管理等多项制度，全面规范当地员工管理，保障当地员工基本权益和职业健康安全。

提供健康安全的工作条件。项目部除了统一发放劳保用品外，对喀方员工营地进行了全面规划，道路、水路、电路等辅助设施完备，餐馆、医疗所、购物商店以及足球场等公共配套设施齐全，为员工提供了安全舒适的工作条件。

加强员工关怀激励。在工作和生活上，项目部对喀籍员工一视同仁，给予关心和尊重，提升当地员工的荣誉感、认同感和归属感。项目部每半月召开一次喀方员工代表会议，集中听取并解决喀方员工代表所反映的问题；每逢当地法定节假日，给喀方员工发放过节费，举办足球赛等文化活动；根据出台的《优秀喀方员工奖励办法》，定期开展“每月之星”“年度之星”评选活动，奖励激励当地优秀员工。

项目价值

喀麦隆曼维莱水电站项目不仅解决了沿线城市和首都雅温得约400万人口生活及工业用电不稳定的问题，其“以中带喀，以喀管喀”的员工培养模式，为当地培养了一大批技术和管理人才，带动当地就业，有力促进了喀麦隆和周边地区的经济发展，改善当地民众生活。

million. Thanks to its employee training model, summed up as “Cameroonian apprentices under Chinese coaches” and “Cameroonian employees under Cameroonian managers”, the project has fostered a large number of management and technical talents. Furthermore, it has boosted jobs and living standards, and spurred the economic development of Cameroon and beyond.

“由中国公司建设的曼维莱水电站是一座高质量、现代化的水电站，它的建成发电将大大提高喀麦隆整体发电能力，作为业主的喀麦隆水资源和能源部对于中国公司的工程质量十分满意，堪称‘完美’。”

——罗杰 喀水能部曼维莱水电站项目现场代表

“Memve'ele is a high-quality modern hydropower station built by China. It will greatly increase the power generation capacity of our country. As the proprietor, the Cameroonian Ministry of Energy and Water Resources is very satisfied with the quality that our Chinese partners delivered. Everything is just perfect.”

— Roger, Field Representative of the Cameroonian Ministry of Energy and Water Resources at Memve'ele Hydropower Station



16 激发员工价值，打造中老友谊之坝 ——老挝会兰庞雅水电站项目

Employees Add Value to “Sino-Lao Copartnership Dam”
Houay Lamphan Gnai Hydropower Station, Laos

项目简介 ABOUT THE PROJECT

老挝会兰庞雅水电站项目由中国葛洲坝集团股份有限公司以 EPC 方式承揽，项目合同金额 1.99 亿美元，装机容量 8.8 万千瓦，年发电量 4.8 亿度，水库最高蓄水位 820 米，最大库容 1.41 亿立方米。项目于 2010 年 11 月 8 日开工，2015 年 9 月完工，比合同工期提前 66 天完工，荣获老挝国家电力特殊贡献奖。

Houay Lamphan Gnai Hydropower Station is a USD 199 million project with an installed capacity of 88MW and an annual production of 480 gW·h. Its full reservoir level is 820 meters, and its maximum reservoir capacity 141 million m³. With CGGC as the EPC contractor, its construction started on Nov. 8th, 2010 and ended in September 2015 (66 days in advance). It is a winner of the Laos National Power Special Contribution Award.

项目进程/Key Milestones

签约时间/Date of contract-signing	2009.08.12
开工时间/Date of commencement	2010.11.08
完工时间/Date of completion	2015.09.03

可持续发展背景

老挝政府大力支持水利开发，计划将电力出口作为本国经济发展和创汇的重要支撑。老挝会兰庞雅水电站项目位于老挝南部湄公河支流HLG河上，项目实施过程中，面临当地专业人才缺乏、语言沟通障碍、劳动习惯和文化习俗与中国存在较大差异等诸多挑战。



水电站进水口工程
The Intake

解决方案

项目把大量就业机会留给当地居民，有效推进员工属地化，建立完善的当地员工培养体系，加大当地员工激励，加强员工之间的语言文化交流，发挥当地员工价值。

加强本地雇佣，培养专业人才

加强本地雇佣，带动当地就业。项目所需员工主要来自老挝当地、越南、柬埔寨和中国，雇佣中国以外的管理人员约30%，普通员工约80%，高峰期作业人员达1500余人。其中，雇佣老挝当地员工1000余人，在员工总数中占比达50%，在管理层员工中占比达5%。

重视当地员工培养，提升老方员工就业能力。针对老挝籍员工，建立全面的培训培养体系，邀请公司和项目部先进代表、技术技能专家以及外部合作机构专家，开展入场安全教育培训、作业能力提升培训、技术工艺措施交底培训及管理能力提升培训，发挥中方员工“传、帮、带”的管理和指导作用，提升员工的综合素质、业务能力和实操水平。项目部累计举办各类培训班50余次，外籍员工培训覆盖

Sustainable Development - Background and Context

The Lao government is particularly keen on water resources development. It positions electricity export as a main economic driver. The project is located by Houay Lamphan Gnai, a tributary of the Mekong in southern Laos. Its Chinese teammates have to take into account the lack of specialized local talents, language barriers, and differences in work habits, culture and customs.

Solutions

The project team has vigorously engaged in local hiring and established a full-fledged local employee training system. It has ramped up motivation and unleashed the value of local employees, and enhanced cultural and language exchanges between Chinese and Laotians.

Stepping up local hiring and specialized talent training

Boosting local employment: Most of the team members come from Laos, Vietnam, Cambodia and China. Non-Chinese members account for some 30% of the managers and roughly 80% of the employees. In particular, the 1,000-odd Laotians account for 5% of the managers and 50% of the employees. Over 1,500 people work together in peak season.

Training local employees: The project team has established a holistic training system for Lao employees. Model employees, technical experts and external specialists are invited to train locals in workplace safety, operational techniques and managerial expertise. Chinese members play a prominent role in helping Laotians improve their generic competencies and pro-

率100%，通过培训，累计50余人次取得所在国家认可的焊工证书、电工证书等特种作业认证，120余人次熟练掌握2种及以上工程机械操作技能，并取得相应的设备操作证书。

加强员工技能考核，储备专业人才。项目部对老方员工技能、效能等综合能力进行评价考核，区分等级并登记，为相同班组或后续项目创建人才数据库，储备专业人才。2017年老挝会兰庞雅下游水电站工程项目中，再次启用本项目人才数据库中储备的约20名班组长及部分作业人员，再次为当地人才提供就业和发展机会。

加大当地员工激励，保障员工基本权益

保障员工薪资，激发当地员工工作热情。项目部对员工实行10000基普/月的月龄工资，严格落实热带项目的降温费发放，核算老方员工正常时间、加班时间和节假日时间等工时工资，有效减少了劳务流动，激发了员工工作热情。同时，项目部加强对分包商用工的监督，通过工资保证金和向分包商代发付工资等形式，保障员工工资发放，实现同工同酬和零拖欠工资。

选拔优秀人才，助力当地员工发展。项目部注重对老方员工的考核评比，选拔优秀老方员工担任工班长和小组长，逐步将普通老方员工培养为技术性和管理型人才，最终形成老方工班长管理和培养老方工人的管理模式，激发当地员工潜力，实现当地员工价值。

保障员工权益和职业健康安全。项目部建立和实施职业健康安全管理体系统，始终坚持“消除一切隐患风险，确保全员健康安全”的方针，规范项目的职业健康安全状况和人员职业健康安全行为，为每位员工购买社会保险，定期组织员工健康体检及职业病防治体检，每年组织体系内审，持续提升项目职



大坝下游流面
Downstream Face of the Dam

fessional skills. The team has organized over 50 training sessions for all of its foreign members. Upwards of 50 trainees have received nationally recognized certificates in welding, power engineering and other special operations; more than 120 are proficient in operating two or more machines and have received the corresponding certificates.

Enhancing employee assessment and pooling specialized talents: The project team grades Lao employees based on skills and performance assessment. With an eye on subsequent projects, it has built a talent pool. In 2017, about 20 unit leaders and operators in the pool participated in building the Lower Houay Lamphan Gnai Hydropower Station.

Ramping up motivation of local employees and safeguarding their basic rights and interests

Motivating local employees with competitive compensation packages: The project team offers high temperature subsidies and overtime pay to Lao employees on top of a seniority-based salary (a base salary + a monthly increase of LAK 10,000). That has reduced employee churn and increased enthusiasm at work. In addition, the team has kept a closer eye on whether subcontractors have treated laborers fairly. Sometimes it pays wages on behalf of the subcontractors or gives a wage payment deposit to ensure pay equality and prevent wage arrears.

Promoting outstanding local talents: The project team has taken pains to assess Lao employees and appointed high achievers as unit leaders, hoping to gradually develop locals into management and technical talents and eventually let Laotians lead and train Laotians. That is the way it seeks to tap the potential of employees and add value to them.

Safeguarding employees' rights and interests: The project team has established and implemented the occupational health and safety management system. Committed to “keeping risks at bay and taking care of everyone”, it has created behavioral and

业健康安全绩效。

促进多元文化交流，和谐员工关系

加强员工语言学习和文化交流，和谐员工关系，增进员工幸福感。项目部基于老挝、越南、柬埔寨和中国等多元文化背景，开设老语课加强员工老语学习，每月底对员工进行老语学习考试，对考试成绩合格的每月给予100元奖励，快速提高了全体员工的老语水平，拉近员工之间的关系。项目部还建立掷球球场、羽毛球场等场地，购置文体用品，积极组织文体活动和老挝传统文化活动，丰富员工业余生活，提升员工归属感和幸福感。

项目价值

老挝会兰庞雅水电站已投产运营，年发电量4.8亿度，年电费收入0.36亿美元，对老挝国家经济年增长贡献率达0.23%，有力缓解了老挝南部地区用电紧张问题，减少枯水期从邻国电力进口，增加丰水期对邻国电力出口，为老挝经济社会发展注入强劲动力。项目积极履行企业社会责任，关注当地社区发展需求，充分利用自身资源，开展捐资助学、修路打井、修建医务室、抗洪救灾等公益活动，多项事件记入老挝塔登县县志，进一步巩固了中老两国人民友谊。

operational standards, covered each employee with social insurance, organized regular physical examinations and performed annual internal audits. As a result, it has been doing a better job in helping employees stay healthy and safe in the workplace.

Promoting diversified cultural exchanges and building a harmonious workplace

The project team has laid stress on language learning and cultural exchanges. Given the diversified cultural backgrounds of its members, the team offers Lao courses and tests students at month-end. To those who pass the test, it pays an RMB 100 bonus each. These courses have improved employees' Lao proficiency and brought them closer to one another. Also, the team has built badminton and Bocce courts, bought stationery and sports goods, and proactively organized games and traditional Lao cultural activities, so as to enhance employees' senses of belonging and happiness at and after work.

Project Value

The hydropower station has an annual production of 480 gW·h and an annual revenue of USD 36 million. It contributes to 0.23% of Laos' economic growth annually. It eases the power strain in southern Laos, reducing electricity import during the dry season while increasing export during the wet season. The project team proactively assumes social responsibilities. Leveraging its own resources, the team has engaged in welfare campaigns like donating for education, building roads, sinking wells, establishing clinics, fighting floods and providing disaster relief. Many of its good deeds have been recorded in the Thateng County Annals.



17 包容雇佣多种族员工, 建设非洲跨境供水项目 ——埃塞-吉布提跨境供水项目

Multiracial Recruitment and Inclusiveness: A Cross-border Project
Djibouti-Ethiopia Transnational Water Supply Project

项目简介 ABOUT THE PROJECT

埃塞-吉布提跨境供水项目是迄今为止非洲最大的单体供水项目,是由埃塞俄比亚、吉布提及中国三国政府共同合作推进的东非区域内互联互通项目。项目包括建设数十口水源井和蓄水池,从埃塞水源德雷达瓦取水,采用自流方式,沿途铺设长达 380 公里供水管道,终点至吉布提港口。项目由中地海外集团承建,总额 3.39 亿美元,供水规模 10 万立方米,满足了 75 万人的用水需求,有效地降低了因饮用水供应不足而造成的较高疾病发病率,改善了当地人民生活条件。

The project is by far the continent's largest water supply project. It is also an East African connectivity effort backed by the governments of Djibouti, Ethiopia and China. The project includes building dozens of wells and reservoirs, and laying a 380km free flow pipeline from Dire Dawa (the water source) in Ethiopia to the Port of Djibouti. Undertaken by CGCOC, the USD 339 million project has met the demand of 750,000 people, with a daily water supply capacity of 100,000m³. It has improved the living standards of locals and reduced the incidence of diseases incurred by insufficient drinking-water supply.

项目进程/Key Milestones

签约时间/Date of contract-signing	2013.04.11
开工时间/Date of commencement	2015.03.30
完工时间/Date of completion	2017.06.30

可持续发展背景

埃塞-吉布提跨境供水项目所处地区劳动力不足,项目一方面需要尊重当地用工的地方保护主义,平衡内外部劳动力比例,另一方面需要保证项目的连续性,因此面临巨大的挑战。项目沿线经过埃塞俄比亚索马里州,途径索马里人伊萨族、阿法尔族裔和阿拉伯族裔等不同民族,涉及不同信仰和文化,如何有效管理多元化员工团队,是项目顺利建设的关键。

解决方案

埃塞-吉布提跨境供水项目秉承“以人为本”原则,根据当地法律法规,充分参考当地政治环境、治安状况、地理条件、气候因素和人文特征等,形成符合当地实际情况、受到当地认可的管理制度体系,切实保障员工的基本权益。

制定计划,提高当地员工比例

项目部制定《人员引进计划》,科学规划内外部员工工种、人数、用工期限等指标,并针对其中的细节问题,拜访了索马里州Shinele大区政府的主要领导,向其说明项目面临的用工难题及解决方案,获得大区政府的谅解和支持。面对当地用工的地方保护主义问题,项目部本着支持当地用工的原则,联同镇一级政府进入索马利族裔的各个村落开展工作,积极与当地政府、当地族裔长老沟通,在各方支持下达成共识,建立了镇政府推荐当地用工和外

Sustainable Development - Background and Context

The pipeline runs through the Somali Regional State, an Ethiopian region peopled by the Somali Issas, Afars, Arabs, etc. To get the legal blessing, the project has to maintain a certain percentage of local employees, no matter how scarce they are in the region. It is equally challenging to manage a team with different cultural and religious backgrounds.

Solutions

The project team adhered to the "people-oriented" principle, has taken full account of local laws and regulations, politics and geography, climate and culture. It has developed a series of locally accepted management rules to ensure employees' basic rights and interests.

Increasing the proportion of local employees

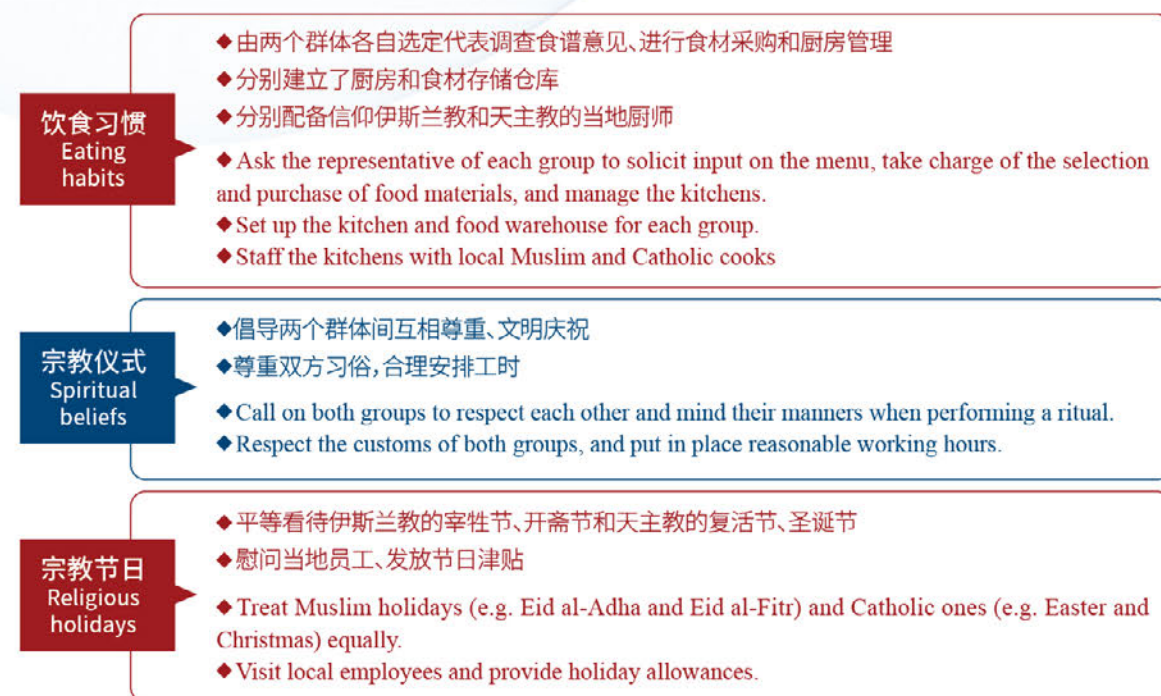
The project team stipulated in its *Talent Introduction Plan* the in-demand specialties, proportion of Chinese and local employees, and duration of employment. The plan is well-structured. The local labor market is anything but. The team, therefore, raised its dilemma with the governors of Shinele Zone in the Somali Regional State. Meanwhile, it sought recourse from town/village heads and tribal chiefs. A consensus was soon reached by the supportive stakeholders: local workers would be recommended on a town-by-town basis, while registered Chinese employees would be gradually admitted to the construction site.

Respecting local customs and building a harmonious workplace

Local employees are mostly Catholics and Muslims. The project team fully respects their different eating habits, spiritual beliefs and religious holidays. It also calls on both groups to respect each other, support each other, and blend in with each other.

Supporting employee growth

The project team has looked deep into the laws and regulations of Djibouti and Ethiopia. It has provided guidance and training for employees, and hired as many locals as practical. A total of 1,500 local names have successively made it to the payroll, which means a substantial increase in employment rate. Also, the team has safeguarded employ-



部员工有计划登记进场的合作机制,有效解决了用工难的问题。

尊重员工习俗,鼓励员工和谐相处

项目涉及天主教和伊斯兰教等不同信仰的员工,面对两类不同宗教信仰人群的不同文化差异,公司给予充分尊重和包容,在饮

ees' rights and interests, optimized occupational health management, and offered diversified career paths.

Project Value

The project has pulled the local community out of the water crisis. Aside from domestic water supply to neighboring towns and villages, the project has turned the Doraleh Container Terminal and Djibouti International Free Trade Zone into clients. The project has also provided a strong impetus for local logistics, service and transport industries. Indeed, its



员工管理



Employee Management

食习惯、宗教仪式、宗教节日等方面采取不同方案,倡导两个群体间互相尊重与互助,实现不同文化的跨越式融合。

contributions to the Djiboutian and Ethiopian economy and society are of historic proportions.

保障员工权益,助力员工成长

公司深入学习埃塞和吉布提两国法律法规,开展培训和咨询,实行属地化管理,雇佣当地员工人次达 1500 名,有力促进了当地就业发展。项目期间充分保障员工权益,完善职业健康管理,提供多元化发展渠道,助力员工成长。

项目价值

埃塞-吉布提跨境供水项目的建成有效解决了当地缺水断水的困境,除了供应项目沿线城镇居民的日常生活用水,项目还陆续为吉布提集装箱港口和吉布提自贸区等大客户提供水源,对当地的运输业、物流业及服务业都起到了较大的带动作用,极大地促进了吉布提港口经济的发展,改善当地居民的生活条件和经济水平,对于埃塞和吉布提两国具有历史意义。

“让吉布提 80% 的人口获得干净的水资源是无价的,政府的责任是提供清洁水。水在未来会是战争的一个潜在因素,但对我们来说,也是促成与埃塞一体化的原因。由中国资助的埃塞至吉布提跨境供水工程未来将影响社会和人民。”

——吉布提经济、财政与工业部长达瓦莱

“Providing clean water for 80% of Djiboutians - that is not about money, that is what our government should do. Water could be a cause of war. Water could also be the driver of Djibouti-Ethiopia integration. Funded by China, the Djibouti-Ethiopia Transnational Water Supply Project will change our societies and our peoples' lives.”

— Ilyas Moussa Dawaleh, Djiboutian Minister of Finance, Economy & Industry



18 提升本地运营能力, 打造中老水电合作典范 ——老挝南湃水电站项目

Improved Localized Operations: A Model for Sino-Lao Cooperation
Nam Phay Hydropower Project, Laos

项目简介 ABOUT THE PROJECT

南湃水电站位于老挝赛松本省龙剑县, 距万象 233.5 公里。其坝址位于湄公河的 1 级支流南俄河(Nam Ngum)支流南湃河(Nam Phay)上游峡谷中, 由北方国际合作股份有限公司以 BOOT 方式承建。该电站装机容量 86MW, 平均年发电量 4.19 亿千瓦时, 年利用小时数 4878h, 项目完工后投运正常, 已累计发电 9.68 亿度, 有效满足了老挝政府培育以水电为主的电力支柱产业的需要。

The Nam Phay Hydropower Project is located in Longchaeng District of Xaisomboun Province, about 233.5km away from Vientiane. The dam lies in a valley in the upper reaches of Nam Phay, a tributary of Nam Ngum, which is itself a major tributary of the Mekong. Undertaken by NORINCO International, the project has an installed capacity of 86MW, an annual production of 419 gW·h, and 4,878 annual utilization hours. The project has been completed and put into normal operation. So far, it has generated power of 968 gW·h. It fits into the Lao government's electricity industry puzzle in which hydropower serves as a pillar.

项目进程/Key Milestones

签约时间/Date of contract-signing	2014.02.28
开工时间/Date of commencement	2014.10.11
完工时间/Date of completion	2017.08.08
开通运营时间/Date of entry into operation	2017.11.01

可持续发展背景

在过去, 老挝电力供应能力不足且稳定性较差, 特别是在旱季生产高峰期, 经常出现断电和电压骤变等事故。南湃水电站建成运营后有望助力提升电力供应质量。然而, 老挝当地的劳动力技术水平受限, 水电站建成后的可持续运营面临挑战。

解决方案

老挝南湃水电站项目创新管理模式, 雇佣当地员工, 构建出一套具有南湃特色的属地化管理模式, 将理论学习与实际相结合, 提升当地员工的技术水平, 保障了电站的安全稳定运行。

采用投建营一体化模式, 保障项目顺利衔接

南湃水电站是北方国际合作股份有限公司在海外推进全产业链一体化战略实施的投资项目, 该项目是集项目投资、规划设计、建设以及运营维护于一体的“投建营一体化”合作模式。该模式能让项目的建设和运营更好衔接, 后期运营维护更专业, 降低了潜在的运营风险。

水电站投运前, 项目部聘用老挝当地大学生, 以开班授课和现场参观的方式系统培训理论知识; 水电站投运后的运行维护工主要由老籍员工承担, 并对其进行培训, 培训时将理论学习与现场投运设备结

Sustainable Development - Background and Context

Power supply in Laos was inadequate and unstable. As the peak season coincides with the dry season, outage and transient voltages were commonplace. Although the project promises to make a difference, the low-skilled local labor market throws a cloud over sustainable operations.

Solutions

The project team has developed a new management model with local characteristics. For the sake of safe and stable operations, it equips local employees with theoretical knowledge and improves their technical skills through practices.

Investment-Construction-Operations integration

The project exemplifies NORINCO International's push for industry chain integration overseas. It has adopted the BOOT (build-own-operate-transfer) model, which enables smooth transition from construction to operations, facilitates subsequent maintenance and mitigates operational risks.

Before the operations began, the project team organized lectures and company visits for local university students. Since operational maintenance is largely undertaken by Laotians, the team has provided them with theoretical and practical training, covering standardized equipment operations, on-site inspection, book-keeping, troubleshooting, and shift handover. Local employees are expected to keep the equipment in good repair and deliver quality and quantity.

Employee management with local characteristics

According to its training plans for local employees, the project team organizes special training on its own, and examines the training effects through tests.

Employee training covers power plant systems, workplace safety, operating standards, and management rules. To ensure efficient theoretical and practical training, each Chinese coach is paired with a Lao apprentice. A pyramid organizational structure has taken shape, which consists of Project Manager, Chief Trainer, Chinese unit leaders, and Lao employees. For every Chinese, there are 2.5 Laotians on the team, and the percentage of the latter continues in the uptrend. Such a hiring and training strate-

合，包括规范设备操作、巡检、台账记录、故障处置、交接班等，确保做到设备“勤保养、查隐患、消缺陷”，保质保量完成各项工作任务。

构建具有南湃特色的属地化管理模式

项目部制定当地员工培训计划，坚持“人才自主培养”的原则，采取“以考促培和专题培训相结合”的办法，构建出一套具有南湃特色的属地化管理模式。

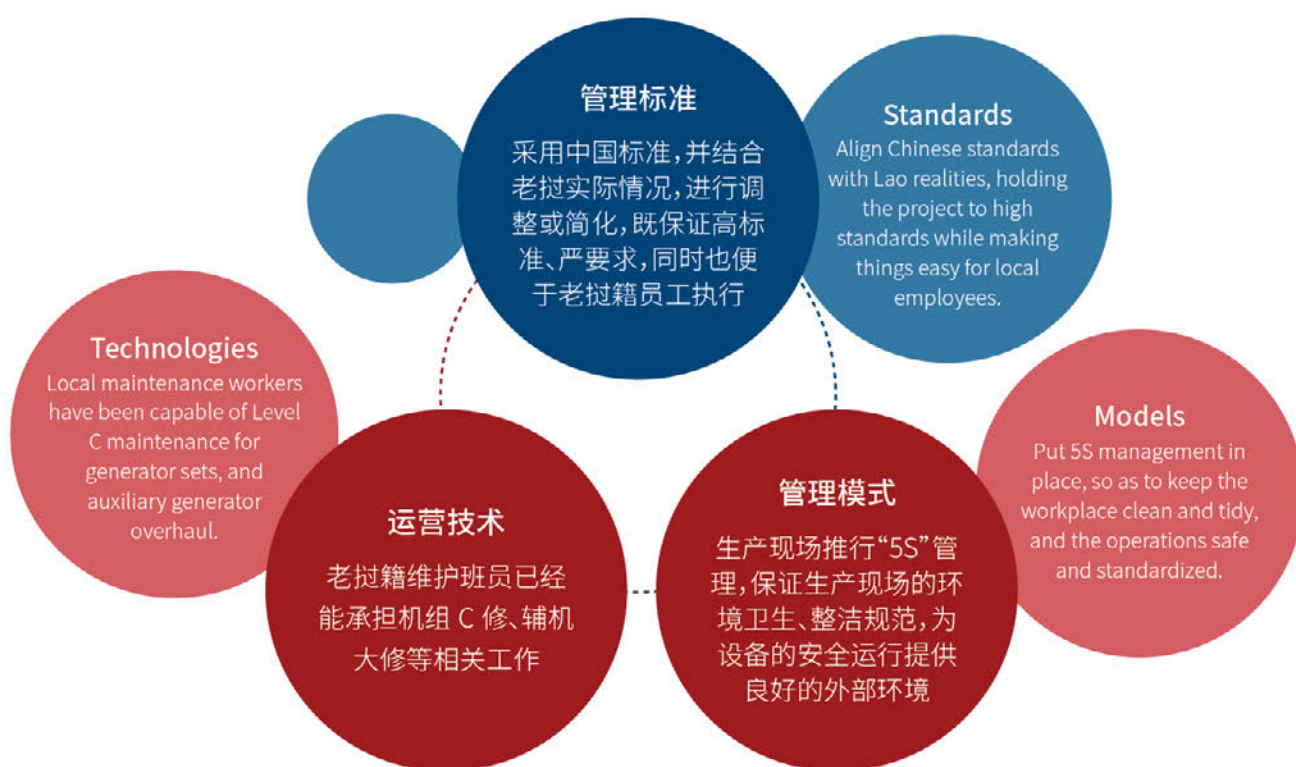
员工培训涵盖电站各系统讲解、安全教

育，是 both economical and endogenous.

Not just a source of job opportunities, the project is also a window to Chinese models, standards and technologies. It goes down well with locals and embodies the spirit of win-win cooperation.

Project Value

The BOOT Project adopt the integrated operation mode of investment, construction and operation, and has integrated SDGs into construction, maintenance, and subsequent management. Hailed by the Lao government as a “well-being project”, it spares no effort in hiring and training local talents, and provides a steady supply of clean power during the dry season. It is a byword for “China speed” and “China quality”, a paradigm of Sino-Lao hydropower cooperation, a big contributor to the Lao economy.



育、运行规程、管理制度等各个方面。为使培训更高效，通过中老员工“一对一师徒”的方式，由中方导师手把手传、帮、带、授，提高老挝籍员工专业知识和实操能力，实行“站长—总培训师—中方值长—老挝籍员工”的立体化班组管理模式。项目期间中国籍员工与老挝籍员工的比率为1:2.5，员工本土化比率上升，既提高了运营能力，降低运营成本，又为当地创造了就业机会，获得当地民众的支持和认同。

项目期间向当地传输了中国的水电站运营技术、管理标准和管理模式，实现了双方的合作共赢。

项目价值

老挝南湃水电站项目采用投建营一体化的运营方式，重视项目从建设、维护到后期管理过程，践行属地化管理，实现项目可持续发展。老挝政府称赞南湃水电站为重大民生工程，施工质量高、建设进度快，可在老挝旱季电量匮乏时为老挝提供优质、稳定的电量，是中老水电项目合作的典范，为老挝的经济发展做出了重要贡献。



中方员工指导并与老籍员工共同检修机组
Laotians Are Repairing a Generator Set under the Guidance of a Chinese Employee



19 精心做好社区沟通, 可持续开发尼泊尔水电 ——尼泊尔上马相迪A水电站项目

Community Engagement and Sustainable Hydropower
Upper Marsyangdi A Hydropower Station, Nepal

项目简介 ABOUT THE PROJECT

上马相迪 A 水电站项目是中国电建集团在海外推进全产业链一体化战略实施的 BOT 项目, 总投资额约 1.66 亿美元。上马相迪 A 水电站坐落于尼泊尔西部的马相迪河, 是一座径流式水电站, 总装机容量 2×2.5 万千瓦, 约占尼泊尔全国装机容量的 5.72%, 投产后每年将提供约 3.17 亿千瓦时的电量, 包括建设期在内的特许期共 35 年。该水电站 2019 年度累计发电量达 3.2 亿千瓦时, 自首台机组投产以来已累计发电 10.6 亿千瓦时, 安全生产 1177 天。

The project is a run-of-the-river power plant located by Marsyangdi River in western Nepal. It exemplifies POWERCHINA's push for industry chain integration overseas. The USD 166 million project has an installed capacity of 2×25 MW, accounting for approx. 5.72% of Nepal's total, and an annual production of 317 gW·h. So far, it has been running smoothly for 1,177 days and generated power of 1.06 tW·h. Its production reached 320 gW·h in 2019 alone. The franchise term is 35 years, including the construction period.

项目进程/Key Milestones

签约时间/Date of contract-signing	2013.01.08
开工时间/Date of commencement	2016.12.31
完工时间/Date of completion	2017.01.01

可持续发展背景

尼泊尔水电资源丰富, 但全国装机容量只有 80 多万千瓦, 电力短缺严重, 加德满都被划分为 7 个区域每天轮流停电。当地社会环境复杂, 项目建设容易受到政府更迭、公共治理薄弱等方面的社会因素影响, 存在潜在的社会风险, 影响项目进度与后期运营。因此, 系统开展社区规划与管理, 成为克服困难、顺利实施与交付项目的重点。

解决方案

尼泊尔上马相迪 A 水电站项目建设运营中, 根据尼泊尔国情和项目所在地社情民情的实际情况, 创新思路及管理方式, 以项目部为主导, 依靠当地属地资源, 充分发挥地方优势, 制定了社区发展计划。

注重当地各方的沟通, 系统促进社区发展

项目部开展实地考察, 深入了解当地政府与百姓需求, 积极开展沟通与交流; 尊重当地政府、各种社会团体、党派和百姓的意见, 制定社区计划, 协调处理村民与项目的矛盾; 实施社会责任项目规划、实施、验收、移交属地化等实际行动, 获得当地政府、组织和群众的支持。通过媒体宣传、参加尼泊尔政府及各种团体组织的交流会、展览会等方式树立公司品牌, 获得了中外方一致好评。

搭建社会责任履行一体化平台

Sustainable Development - Background and Context

Despite its abundant hydropower resources, Nepal registered an installed capacity of only 800MW. Severe power shortage forced Kathmandu into "rolling blackouts". The capital city was divided into seven zones, and each experienced a staggered outage period a day. Running a project in the country is tricky. It will easily fall victim to a government reshuffle or social unrest. Therefore, systematic community engagement is key to risk control and project success.

Solutions

In line with local and national realities, the project team has leveraged the attractive resources available to prepare the communi-

内部邀请 GEOCE 环境咨询公司 GEOCE Consultants

- ◆ 进驻项目现场
- ◆ 参与社会责任实施管理
- ◆ 建立符合尼泊尔法律法规的环境管理及社会责任履行模式
- ◆ Move onto the site.
- ◆ Manage CSR.
- ◆ Establish an environmental management and CSR fulfillment model in line with Nepalese laws and regulations.

外部成立地方协调委员会 Local Coordination Committee

- ◆ 由项目周边村镇推荐的地方各界重要人士、党派和团体组织代表 60 多人组成
- ◆ 帮助协调理顺社会关系、出面解决罢工阻工、协助项目征地
- ◆ 帮助项目公司细化解构社会责任工程
- ◆ 60+ members, including local personalities recommended by neighboring towns and villages, and representatives of political parties and social groups.
- ◆ Engage with local communities, handle strikes and work stoppages, and facilitate land requisition.
- ◆ Break down the project's social responsibilities.

内外建立社会责任工作管理体系
Internal and External CSR Management Systems

为确保项目实施过程程序化、规范化、科学化，项目部建立社会责任工作管理体系，在各方的配合下，发挥出GEOCE环境咨询公司的法律专业作用和地方协调委员会的协调纽带作用，既保证社会责任项目履行符合当地政府和村民的需要，又保证社会责任履行的整个过程受控。

开展重点领域社会责任实践

项目部积极履行社会责任，以“微薄之力”尽“善心之举”。项目期间扎实推行本土化战略，关注民生、造福当地百姓。开展多项促进民生和社会经济发展的项目，资助当地学校、村庄、道路、路灯、医院、供水设施、寺庙等公共设施建设，改善了地方基础设施，促进了上马相迪当地旅游、经济的发展。

截至2019年，公司累计共实施社会责任项目164项，社会责任完成合同金额460.94万元，社会捐助捐赠金额为44.92万元。

2015年4月尼泊尔8.1级地震造成大量房屋倒塌，项目部积极参与电站抢险救灾，保证电站安全运行，同时投入人力和救援设施帮助当地抗灾自救，帮助当地群众恢复家园。2018年尼泊尔遭受持续暴雨袭击，形成多出泥石流、造成山体滑坡，公司自发组织捐赠活动，帮助购买用于恢复建筑物的房建材料，并给予受灾家属慰问金。上马相迪A水电站不仅为尼泊尔经济增长注入了血液，也为优化能源消费结构，实现能源消费的清洁化、多元化奠定了基础。项目建成保障了当地电力的稳定供应，带动附近村民建设旅馆、饭店、商店，促进当地工业、商业、旅游业的蓬勃发展，尼泊尔步入发展快车道。尼泊尔国会议员嘉明德拉为公司颁发了社会责任项目完工与感谢证书，并称赞道：“中

ty development plan

Community engagement and development

Through community engagement and field survey, the project team has fully understood the needs of the local government and residents. In the course of community planning, it has respected the opinions of all stakeholders and addressed villagers' concerns. CSR infuses the planning, implementation, acceptance and handover of the project. As a regular at exchange meetings and exhibitions organized by the national government and civil society, POWERCHINA has built its image in Nepal and won many hearts at home and abroad.

Integrated platform for CSR fulfillment

Committed to 3S (scientific, standardized and systematic), the project team has established a CSR management system, and partnered with GEOCE Consultants, an environmental consultancy, and the Local Coordination Committee. In so doing, the team ensures the project is socially responsible, aligned with local needs, and open to internal and external scrutiny.



娜雅迪河交通桥移交图
Handover of Ngadi Bailey Bridge

CSR practices in key fields

The project team strives to contribute its little bit to society. It pushes ahead with localization and pays attention to people's livelihood. It finances the construction of schools, villages, roads, street lamps, hospitals, water supply facilities, temples, and other public infrastructure, bringing benefits to the economy and tourism of Upper Marsyangdi.

As of 2019, the project team had donated RMB 449,200 and engaged in 164 CSR programs with a contract value of RMB 4.6094 million.

In April 2015, a magnitude 8.1 earthquake struck Nepal, turning buildings into rubble piles. The project team was quick off the mark. It troubleshot the hydropower station to ensure smooth operations. Meanwhile, it joined the local relief efforts and helped people rebuild their homes. In 2018, continuous heavy rain caused landslides and mudslides in the country. The team voluntarily donated building materials to the affected areas, and

国电建投公司在尼泊尔的水电投资建设项目中树立了良好的榜样及学习的典范，我们号召其他电站项目向上马相迪学习、向中国电建学习。”

consolation money to the bereaved families.

Project Value

The project has not only added vigor to the Nepalese economy, but also bolstered the push for more and cleaner energy. Steady power supply encourages villagers to set up hotels, restaurants and shops, putting local industry, commerce and tourism on the fast track. Jamindra Man Ghale, a Member of Parliament of Nepal, awarded a Certificate of Appreciation upon the completion of the socially responsible project. “POWERCHINA Resources Ltd. has set a good example in Nepal for hydropower station investment and construction. We hope other similar projects can take a page from its copybook,” said he.



捐赠学习用品
Donation of School Supplies



尼泊尔国会议员嘉明德拉颁发感谢证书
Certificate of Appreciation Awarded by MP Jamindra Man Ghale