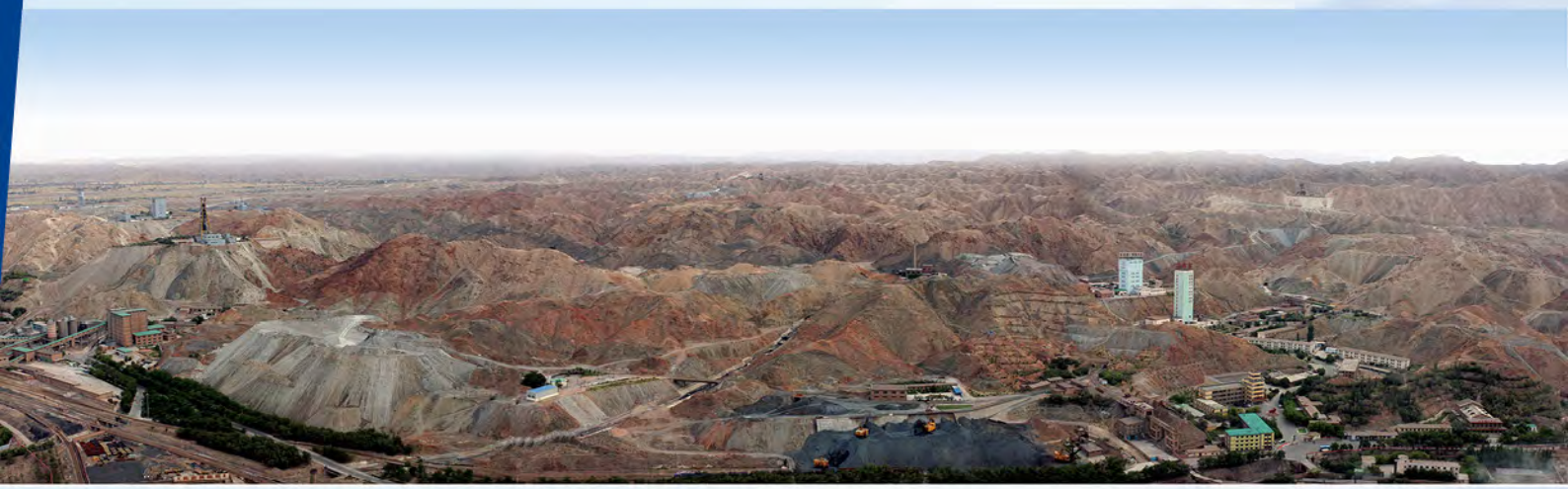
矿山工程
MINE ENGINEERING

点资源之石 成事业之金

TURN A STONE OF RESOURCE
INTO A GEM OF UNDERTAKING



企业简介
Brief Introduction

中国有色工程有限公司暨中国恩菲工程技术有限公司（简称“有色院（中国恩菲）”），前身是中国有色工程设计研究总院（即原北京有色冶金设计研究总院），成立于 1953 年，是中华人民共和国成立后，为恢复和发展我国有色金属工业而设立的第一家专业设计机构，现为世界五百强企业中国五矿、中冶集团骨干子企业，是在行业内具有突出影响力，在国际上知名的品牌企业。

经过六十多年的发展，有色院（中国恩菲）已经成为人才集聚、专业齐全，具有领先的技术创新能力、成熟的项目管理能力、突出的工程集成创新能力，进行资源整合、产业孵化的高科技平台，可以提供从投（融）资、咨询、规划、设计到建设、装备、运营等项目全生命周期服务。

有色院（中国恩菲）以人才和技术为本，立足有色矿冶工程，依靠科技创新驱动，高端咨询引领，发展科学研究、工程服务与产业投资三大业务领域，深耕非煤矿山、有色冶金、水务资源、能源环境、新高材料、市政文旅、城市矿产、智能装备、房产经营九个业务单元，形成核心能力突出、竞争优势明显、国际化运作、特色鲜明的多元业务集群，致力于成为最值得信赖的国际化工程综合服务商及能源环境发展商。

ENFI, formerly known as China Nonferrous Engineering and Research Institute, established in 1953,is the first engineering institute since the founding of the People's Republic of China dedicated to the recovery and development of China' s non-ferrous metals industry. ENFI is now a backbone subsidiary of MINMETALS and MCC, both in the Fortune 500 companies list.The company has an influential existence in the industry in China, and is widely known around the globe.

After more than sixty years of growth, ENFI has boasted a large number of experts in a wide range of disciplines, and strong R&D capability and rich experience in project management and integration. With a large client base and widespread partnerships, ENFI has remarkable strength in pooling resources and incubating projects, able to provide services covering every step in the project life cycle, from investment (financing), consultancy, planning, design, to construction, equipping and operation.

ENFI, with orientation of talent and technology and standpoint on the nonferrous mining and smelting projects, leads the high-end consulting industry and is dedicated to development of three business fields including scientific research, engineering service and industrial investment, especially the nine business units covering non-coal mine, nonferrous metal, water resource, energy and environment, hi-tech material, municipal culture and tourism, urban mining, intelligent equipment and real estate, relying on scientific and technological innovation. All these further form the multiple service cluster with outstanding core competency, obvious competitive advantage, internationalized operation and distinctive features.ENFI is striving to be the most trust worthy international company committed to integrated service for international projects and energy & environmental development.

中国矿山工程领域的知名品牌
Famous Brand in Mine Engineering Field of China

人才优势
Human Resource Advantages

中国恩菲现有中国工程院院士 1 名，全国劳动模范 2 名，AusIMM 院士 3 名，全国工程勘察设计大师 3 名，全国有色金属行业工程设计大师 13 名，国家百千万人才工程入选者 3 名，享受政府津贴专家 89 名，各类国家注册执业人员 496 名，高级职称以上人员 578 名。

60 多年来，中国恩菲承担国内外金属矿山、非金属矿山 400 多座，获得国家级、省部级科技进步奖及优秀工程设计奖等近 300 项，取得专利数百项。

ENFI has one academician of China Engineering Academy, two National Model Workers, three AusIMM Fellows, three National Design Masters, thirteen Design Masters in Non-ferrous Metal Industry, three Candidates for the National New Century Talents Project, 89 experts receiving government allowances, 496 national registered engineers in a variety of specialties and 578 senior engineers.

Over sixty years, more than 400 consulting and design and EPC projects of metal and nonmetal mines both in China and abroad undertaken by ENFI have won about 300 national and provincial scientific improvement awards and excellent project design awards and been granted with several hundreds of patents.

矿山工程领域
Mining Engineering Field

中国工程院院士　于润沧
Academician of China Engineering Academy
Yu Runcang

全国工程勘察设计大师　陈登文
National Design Master
Chen Dengwen

全国工程勘察设计大师　于长顺
National Design Master
Yu Changshun

全国有色行业设计大师　刘育明
National Design Master of Nonferrous Industry
Liu Yuming

全国有色行业设计大师　邓朝安
National Design Master of Nonferrous Industry
Deng Chaoan

中国矿山工程技术的主要源创地
Main Innovation Source of Mine Engineering of China

科技创新平台
Research and Development

院士专家工作站
Academician Workstation

博士后科研工作站
Postdoctoral Programme

充填研究试验室
Filing Research Laboratory

中国有色金属深井开采及膏体充填工程技术研究中心
National Engineering & Technology Research Center of Deep Mining & Paste Backfill

国家安全生产监督管理总局金属非金属矿山尾矿库安全技术中心
Metal/Non-Metal Mine Tailing Pond Safety Technology Center of State Administration of Work Safety

国家安全生产监督管理总局金属非金属地下矿山安全工程技术研发中心
Metal/Non-Metal Underground Mine Safety Engineering Technology Research Center of State Administration of Work Safety

国家金属尾矿综合利用先进适用技术依托单位
National Key Organization in Advanced and Applicable Technology for Comprehensive Utilization of Metal Tailings

中国有色金属工业协会标准规范处
Standards and Regulation Office of China Nonferrous Metal Industry Association

国家“超大规模超深井金属矿山开采安全关键技术研究”技术总牵头单位
National Lead Unit in “Research Program on Key Technology for Safety Mining of Large-Scale and Super-Deep Metal Mines”

六十年技术积累 Accumulated Technologies Over 60 Years

专长技术
Technical Expertise

中国恩菲有丰富的矿山工程经验，形成了独特的矿山专长技术体系，
在矿山技术及其应用上曾创造了多项全国第一。

ENFI, rich in mine engineering experience, has established a unique mine technical expertise system and has been ranked first in many area in terms of mining technology and application.

深井开采综合技术
Deep-mining technology

地下矿山高强度采矿技术
High-efficient mining in underground mine

高浓度及膏体充填技术
High-density and paste filling

自然崩落法采矿技术
Block caving

钾石盐矿采选工艺技术
Potash mining and mineral processing technology

露天与地下联合开采技术
Open-pit mining combined with underground mining

大型露天矿综合开采技术
Large-sized open-pit mining technology

井下无人驾驶有轨运输技术
Underground unmanned track transportation technology

矿山数字化信息管理系统
Mine digitalized information management system

半自磨球磨磨矿工艺技术
Grinding technology by SAG + Ball Mill

超细碎节能碎磨工艺技术
Ultra-fine crushing comminution process

多金属选矿技术
Polymetallic mineral processing

炭浆法提金技术
Gold extraction by carbon-in-pulp process

选矿自动化技术
Automation for mineral processing technology

长距离管道输送技术
Long-distance slurry pipeline delivery technology

大规模尾矿干堆技术
Large-scale tailings dry stacking technology

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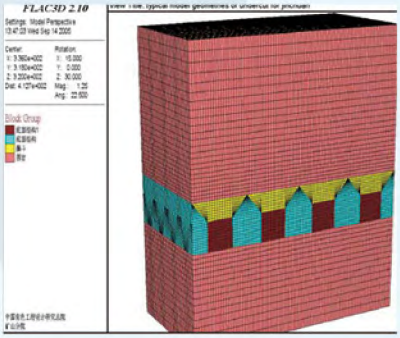
一流的办公条件 First Rate Office Facilities

先进的设计工具
Advanced Design Tools



地质统计 / 建模参数计算软件 —— Snowden Supervisor

Geostatistics/modeling parameters estimation software

地质、采矿软件 —— Datamine

Software for geology and mining

地下矿山设计和采掘计划软件 —— Studio 5D Planer

Underground mine design and scheduling system

边坡稳定性分析软件 —— SLOPE/W

Slope stability analysis software

地下水量及水质模拟计算软件 —— Feflow

Ground water quantity and quality simulation & estimation software

露天开采境界优化程序 —— NPV program package

Open-pit limit optimization program

自然崩落法块度预测软件 —— BCF

Software to predict block cave fragmentation

自然崩落法管理、优化和放矿软件 —— PC-BC

Software of management, optimization and ore drawing for block caving

稳定性计算软件 —— FLAC 3D

Stability analysis software

地下开采通风模拟计算软件 —— Ventsim

Ventilation simulation & estimation software for underground mining

有限元分析软件——ANSYS

Finite element analysis software

地下矿山三维通风软件——UMA-3D network

Underground mine 3D ventilation software

选矿流程计算软件——METSIM

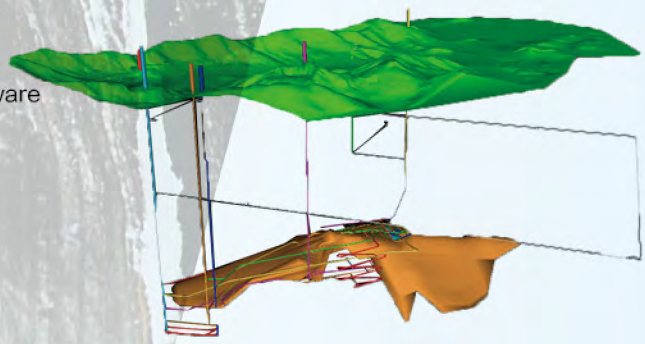
mineral processing circuit calculation software

磨机选型软件——JKSimMet

Mill selection software

三维工厂设计软件——Bentley 系列

Bentley series 3D plant design software



数百座矿山的工程经验 Engineering Experience of Hundreds of Mines

海外工程代表业绩
Representative Achievements of Overseas Projects

恩菲业务点
ENFI Business Distribution

巴布亚新几内亚瑞木镍钴矿
Ramu Ni-Co laterite mine in Papua New Guinea
缅甸达贡山镍矿
Tagaung Taung nickel laterite mine in Myanmar
巴基斯坦山达克铜矿
Saindak copper mine in Pakistan
巴基斯坦杜达铅锌矿
Duddar lead-zinc mine in Pakistan
越南生权铜矿
Sin Quen copper mine in Vietnam
赞比亚谦比西铜矿
Chambishi copper mine in Zambia
蒙古国奥云陶勒盖铜金矿
Oyu Tolgoi copper mine in Mongolia
厄瓜多尔米拉多铜矿
Mirador copper mine in Ecuador
刚果民主共和国 SICOMINES 铜钴矿
Sicomine copper-cobalt mine in DRC

阿富汗艾娜克铜矿
Aynak copper mine in Afghanistan
利比里亚邦铁矿
Bong iron ore mine in Liberia
墨西哥巴霍拉齐铜矿
Bahuerachi copper mine in Mexico
蒙古国前巴音钼矿
Uvur Bayan molybdenum mine in Mongolia
加拿大赛尔温铅锌矿
Selwyn lead-zinc mine in Canada
津巴布韦霍普韦尔铂钯矿
Hopewell Pt-Pa mine in Zimbabwe
老挝东泰钾盐矿
Dongtai potash project in Laos
……

数百座矿山的工程经验 Engineering Experience of Hundreds of Mines

国内工程代表业绩
Representative Achievement of Domestic Projects

德兴铜矿 Dexing copper mine
冬瓜山铜矿 Dongguashan copper mine
铜矿峪铜矿 Tongkuangyu copper mine
安庆铜矿 Anqing copper mine
富家坞铜矿 Fujiawu copper mine
多宝山铜矿 Duobaoshan copper mine
玉龙铜矿 Yulong copper mine
普朗铜矿 Pulang copper mine
永平铜矿 Yongping copper mine
武山铜矿 Wushan copper mine
阿舍勒铜矿 Ashele copper mine
铜绿山铜矿 Tonglushan copper mine
白乃庙铜矿 Bainaimiao copper mine
萨热克铜矿 Sareke copper mine
邹平铜矿 Zouping copper mine
金川镍矿 Jinchuan nickel mine
喀拉通克铜镍矿 Kelatongke copper-nickel mine
周庵铜镍矿 Zhou'an copper-nickel mine
栖霞山铅锌矿 Qixiashan lead-zinc mine
会泽铅锌矿 Huize lead-zinc mine
银山铅锌矿 Yinshan lead-zinc mine
金堆城钼矿 Jinduicheng molybdenum mine
车户沟铜钼矿
Chehugou copper-molybdenum mine
东沟钼矿 Donggou molybdenum mine
岔路口钼铅锌多金属矿
Chalukou molybdenum-lead-zinc and polymetallic mine
大湾锌钼矿 Dawan zinc-molybdenum mine
沙坪沟钼矿 Shapinggou molybdenum mine
黄岗梁铁锡多金属矿
Huanggangliang Fe-Sn polymetallic mine
思山岭铁矿 Sishanling iron-ore mine
济宁铁矿 Jining iron-ore mine
程潮铁矿 Chengchao iron-ore mine
金山店铁矿 Jinshandian iron-ore mine
白象山铁矿 Baixiangshan iron-ore mine
会宝岭铁矿 Huibaoling iron-ore mine
陈台沟铁矿 Chentaigou iron-ore mine
西鞍山铁矿 Xi'anshan iron-ore mine
大冶铁矿 Daye iron-ore mine
谷家台铁矿 Gujiatai iron-ore mine
凤凰山铁矿 Fenghuangshan iron-ore mine
马兰庄铁矿 Malanzhuang iron-ore mine
蔡家营锌金矿 Caijiaying zinc-gold mine
三山岛金矿 Sanshandao gold mine
尹格庄金矿 Yingezhuang gold mine
戈塘金矿 Getang gold mine
瑞海金矿 Ruihai gold mine
天河铝土矿 Tianhe bauxite mine
老虎洞磷矿 Laohudong phosphor mine
毛牛坪稀土矿 Maoniuping rare earth mine
微山稀土矿 Weishan rare earth mine
香炉山钨矿全尾砂充填系统
Total tailings filling system for Xianglushan Tungsten mine
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地下采矿 Underground Mining

中国第一座自然崩落法矿山
The First Mine in China Adopting Block Caving

中条山铜矿峪铜矿 Zhongtiaoshan Tongkuangyu copper mine

年产矿石 600 万 t With annual ore output of 6 million t

在国内第一次采用低成本的自然崩落法

The first mine in China adopting the cost-saving block caving method

采用 BCF 软件进行崩落块度预测

Applying BCF software to predict cave fragmentation

采用 PC-BC 软件进行放矿管理优化

Applying PC-BC software ore drawing management and optimization

采用 Ventsim 软件进行井下通风模拟计算

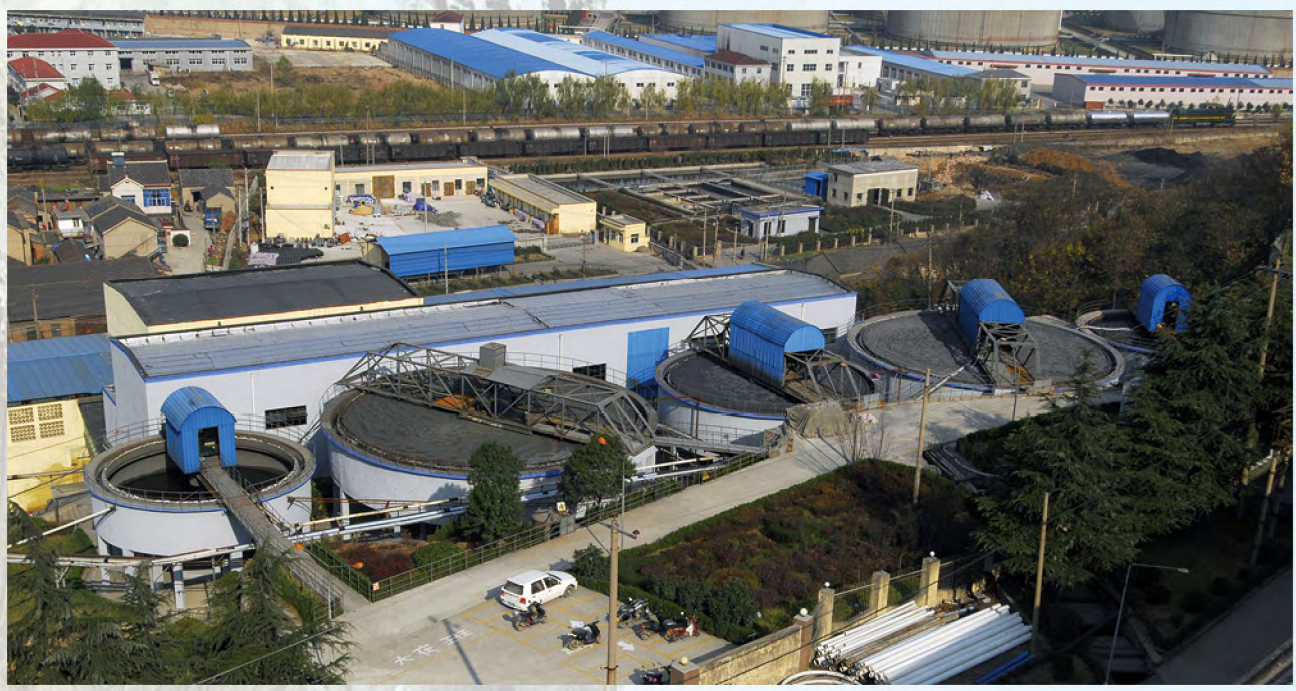
Applying Ventsim software for underground ventilation simulation & estimation

地下采矿 Underground Mining

中国第一座无废开采的矿山
The First Wasteless Mine in China

南京栖霞铅锌银矿 无尾矿库、废石场，无废水外排，应用了上向水平分层充填采矿、尾砂充填、选矿废水处理与循环利用等多项新技术，实现了矿山的无废开采。

The Qixia lead-zinc-silver mine in Nanjing has neither tailings pond, waste dump nor drainage of waste water. Several new technologies are applied to realize wasteless mining, such as cut-and-fill, tailings backfilling as well as treatment and recycling of mineral processing wastewater.



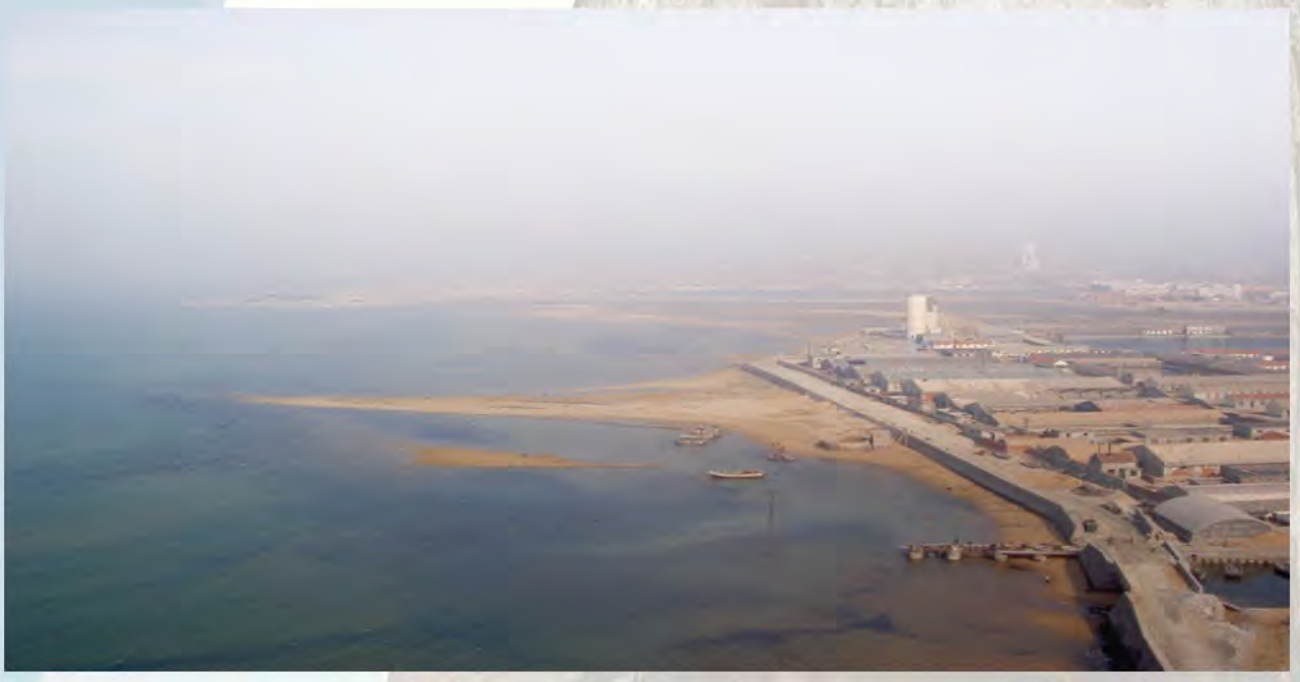
中国第一座海底采矿矿山、第一座井下全无轨矿山
The First Undersea Mining Mine and Trackless Underground Mine in China

三山岛金矿 新立矿区位于山东半岛莱州湾畔， 西面、北面临渤海，东南面与陆地相连，矿体倾斜于海底，通过采用充填法等技术成功地实现了海底矿床的开采。

三山岛金矿首次采用电动卡车运输系统和无轨采掘运输设备，具有机动灵活、生产效率高、工人劳动强度小等优点。

The Xinli mine area of Sanshandao gold mine is located on the bank of Laizhou Bay of Shandong Peninsular, facing the Bohai Sea in the west and north and connected with continent in the southeast. The orebody is dipping under the sea. Undersea mining of the deposit is successfully realized by technologies including filling method.

The Sanshandao gold mine is the first underground mine in China to adopt electrical truck transportation system and trackless excavation and transportation equipment which are advantageously featured with flexibility, high productivity and low labor intensity, etc.



地下采矿 Underground Mining

第一座坑采的钾盐矿山
The First Underground Potash Mine

在**老挝东泰钾盐矿**采选总承包工程中，中国恩菲凭借在岩石力学、水文、采矿、选矿工艺等方面的强大技术基础和研发力量，率先建成了第一座坑采的钾盐矿山。

For the Dongtai potash mining and mineral processing EPC projects, ENFI took the lead in building it into the first underground potash mine in Laos relying on its solid technological foundation and research strength in fields of rock mechanics, hydrology, mining and beneficiation process.

地下采矿 Underground Mining

国内第一座应用膏体充填技术的矿山
The First Mine Adopting Paste Filling System Applied in China

矿山充填为中国恩菲传统优势技术，1999 年，**金川镍矿** 二矿区建成了中国第一套泵送膏体充填工艺系统。针对此矿山，中国恩菲提出了合理的高浓度细砂胶结充填和膏体充填料浆的配比等参数，解决了相应充填工艺中的主要技术问题，开展了连续回采充填体及采场围岩稳定性的研究，满足了金川镍矿的开采要求。

The backfilling technology is the traditional advantage technology of ENFI. In 1999, the first paste filling by pumping system was completed in No.2 mine area of Jinchuan nickel mine. As for the mine, ENFI recommended parameters such as appropriate proportioning for the high-density fine-tailings cemented fill and the paste fill, overcame main technical difficulty in filling system and developed study on continuous stoping of backfilling body and wall rock stability of the stope, which satisfied the mining requirements of Jinchuan nickel mine.

地下采矿 Underground Mining

国内第一座大规模应用全尾砂胶结充填的矿山
The First Mine Adopting Large-Scale Cemented Total Tailings Filling System

近年来，中国恩菲在充填方面成功地开发了一系列核心专利技术，包括锥形底立式砂仓脱水充填技术、尾砂浓缩贮存装置充填技术、深锥脱水充填等技术，突破了大规模推广使用全尾砂胶结充填的技术瓶颈，设计建成了我国第一套大规模全尾砂胶结充填系统——**冬瓜山铜矿**充填系统，目前中国恩菲对许多矿山授权使用了该技术。

In recent years, ENFI has developed successfully a series of core proprietary technologies in the field of backfilling, including conical bottom vertical tailings bin dewatering filling, tailings thickening and storing device for filling and deep cone dewatering, etc. thus breaking through the technical bottleneck of widespread application of cemented total tailings filling; then ENFI has designed and completed the first set of large scale cemented total tailings filling system - Dongguashan copper mine filling system. ENFi has authorized many mines to use the technology.

地下采矿 Underground Mining

开采条件最复杂的矿山
The Mine With Most Complicated Mining Conditions

国内最大的镍矿——**金川镍矿**：

The largest nickel mine in China — Jinchuan nickel mine:

矿岩破碎、高地应力，并已开始进入深井开采

The Jinchuan nickel mine has fragmented ore rock and high ground stress. Deep mining has already begun.

世界上首次采用大面积机械化下向进路胶结充填采矿法

The large-scale mechanized undercut and drifting method with cemented fill is adopted in the world for the first time

巷道采用“先柔后刚”的双层支护

The flexible supporting and rigid supporting are applied sequentially for drift.

采用棒磨砂高浓度胶结充填和全尾砂膏体充填技术

The high-density rod-milled sand cemented filling and total-tailings paste filling methods are adopted.

在进路式采矿中采用了 $6m^3$ 铲运机、双机液压凿岩台车等大型设备

The large-sized equipment, such as $6m^3$ shovel and twin-boom hydraulic drill rig, is adopted for drifting.

地下采矿 Underground Mining

第一座大直径深孔采矿矿山
The First Large-Diameter Deep Hole Stoping Mine

安庆铜矿 采矿中段高度 120m，是我国第一座大直径深孔开采矿山。安庆铜矿在国内率先实现了新模式办矿，劳动生产率位于全国有色矿山首位，成功地实现了高阶段强化开采空场嗣后充填采矿。

The level height of Anqing copper mine is 120m, which is the first large-diameter deep hole stoping mine in China. The Anqing copper mine took the lead in establishing a new mine management model with productivity listed the first among all nonferrous metal mines in China.The strenghened open-stoping with backfill at a high level is adopted.

地下采矿 Underground Mining

现代化的大规模深井矿山
The Modernized Large-Scale Deep Mine

冬瓜山铜矿 是国内第一座深井矿山，井深 1120m，采用千米钢绳罐道，提升速度 12m/s。
中国恩菲与国外咨询公司合作设计的 Oyu Tolgoi 项目 2 号竖井提升能力为 2.5 万 t/d，提升高度 1438m。

Dongguashan copper mine is the first deep mine in China, with shaft depth of 1120m. The over a-thousand-meter steel-rope cage guide is used with lifting speed of 12m/s.
As for the No.2 shaft of Oyu Tolgoi project cooperatively designed by ENFI and international engineering consulting companies, the shaft lifting capacity is 25000t/d and lifting height is 1438m.

地下采矿 Underground Mining

中国规模最大的地下铜矿
The Largest Underground Copper Mine in China

普朗铜矿 品位低，海拔高、气候寒冷，设计采用自然崩落法地下开采技术，生产规模 1250 万 t/a，是国内最大的地下开采铜矿山。设计采用 20m^3 底侧卸式矿车自动化运输、高效选磨设备、长距离尾矿管道输送等工艺装备技术。

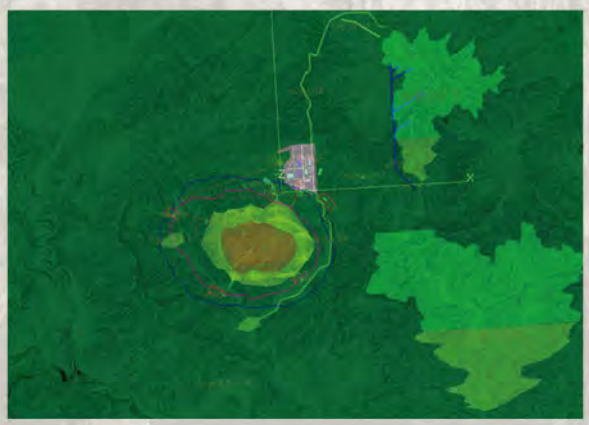
Pulang copper deposit, with low-grade ore, high elevation and cold climate, designed to be extracted by block caving method and to produce 12.5 million t/a of ore, is the largest domestic copper underground mine; it is designed to adopt 20m^3 bottom side dumping cars for automatic transportation, high-efficiency mill and cell for grinding and flotation and long-distance pipeline for tailings transportation, etc.

地下采矿 Underground Mining

中国规模最大开采深度最深的钼矿
The Largest and Deepest Molybdenum Mine in China

中国恩菲承担了国内规模最大、开采深度最深的有色金属矿山的设计咨询工作。其中：**岔路口钼铅锌多金属矿** 设计规模 1650 万 t/a, 开采深度 1300m；**沙坪沟钼矿** 设计开采规模 1000 万 t/a, 开采深度 1300 m。

ENFI has undertaken the engineering design of the largest and deepest non-ferrous mines in China, including Chalukou molybdenum-lead-zinc polymetallic mine with a designed capacity of 16.5 million t/a and a mining depth of 1300m; and Shapinggou molybdenum mine with a designed capacity of 10 million t/a and a mining depth of 1300m.



地下采矿 Underground Mining

中国规模最大开采深度最深的铁矿
The Largest and Deepest Iron Ore Mine in China

中国恩菲承担了国内绝大部分特大规模深井铁矿的设计，其中：

济宁铁矿 生产规模 3500 万 t/a，开采深度 1600m；
思山岭铁矿 生产规模 1500 万 t/a，开采深度 1800m;
陈台沟铁矿 生产规模 2000 万 t/a，开采深度 1600m;
西鞍山铁矿 生产规模 3000 万 t/a。

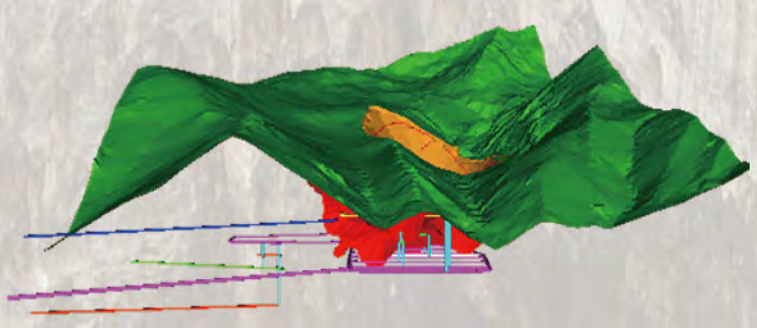
ENFI has undertaken engineering design of most of super-large deep iron-ore mines in China, including Jining iron-ore mine with a designed capacity of 35 million t/a and a mining depth of 1600m. Sishanling iron-ore mine with a designed capacity of 15 million t/a and a mining depth of 1800m. Chentaigou iron-ore mine with a designed capacity of 20 million t/a and a mining depth of 1600m and Xianshan iron-ore mine with a designed capacity of 30 million t/a.

露天采矿 Open Pit Mining

露天与地下联合开采的矿山
Open-Pit Mining Combined With Underground Mining Mine

根据矿床开采技术条件，为使矿山持续稳产，利于矿山企业的发展和稳定，
铜绿山铜矿 采用露天与地下联合开采技术。

The open-pit mining combined with underground mining is adopted by Tonglushan copper mine based on the mining conditions, so as to make mine production continuous and stable and benefit the development and stability of the mine enterprise.



露天采矿 Open Pit Mining

中国规模最大的露天矿
The Largest Open Pit Mine in China

德兴铜矿 日产矿石 13 万 t，年采剥总量约 9000 万 t，它是国内规模最大的金属矿山。

德兴铜矿在国内首次成功地采用了浸出 – 萃取 – 电积工艺，实现了低品位矿石的综合利用。

采用 Datamine 建立矿床模型，优化边界品位和露天境界

采用大型设备：

电铲：10m^3、16.8m^3 斗容

汽车：154t、172t 电动轮卡车

现场混装炸药车

信息化建设：

采用 GPS 卡车调度系统

境界动态优化决策系统

The daily output of Dexing copper mine is 130,000t and annual stripping volume totals about 90 million tons. At present,it's the largest metal mine in China.

Also the leaching-extraction-electrowinning process is adopted for Dexing copper mine for the first time in China, which realizes comprehensive utilization of the low-grade ore.

The deposit model is established by using DATAMINE to optimize the cut-off grade and open pit limit.

The large-sized equipment adopted:

Electric shovel: 10m^3, bucket capacity of 16.8m^3

Truck: 154t and 172t electric-wheel truck

Mine site mixed and charged explosives truck

Improvement of digitalization:

GPS truck dispatching system and the dynamic optimization system of open pit limit are adopted

露天采矿 Open Pit Mining

高海拔和复杂条件下的露天矿山开采
Open Pit Mining at High Elevation and Under Complicated Conditions

西藏玉龙铜矿 地处偏远的高海拔高寒山区，海拔 4569-5118m，设计规模 6 万 t/d，为我国最大的有色金属矿产基地之一，远景铜金属量达 1000 万 t。

Yulong copper mine in Tibet, located in a remote high altitude (4569-5118m)cold mountain area, is one of the largest nonferrous metal mineral bases; its designed capacity is 60,000t/d and the copper potential would be 10Mt.

选矿 Mineral Processing

中国第一套大型半自磨生产工艺
The First Large-Sized SAG Process in China

中国恩菲在安徽 **冬瓜山铜矿** 选矿厂设计中，采用了多项新技术，在国内首次采用了大型半自磨机 + 球磨机的碎磨工艺。浮选采用了单槽容积最大的 130m^3 大型浮选机，浓缩采用高效浓缩机。

中国恩菲在国内许多新建矿山的碎磨系统和选矿系统中采用国际先进水平的 DCS 自动控制系统。

ENFI applied several new technologies to designing of Dongguashan copper concentrator in Anhui province, including applying the comminution process of large-sized SAG+Ball Mill for the first time in China. For flotation, the 130m^3 large-sized flotation cell with the largest single cell volume and the high-efficient ceramic filter are adopted.

ENFI also applied the internationally-leading DCS automation system to comminution and mineral processing system of many newly-built plant in China.

选矿 Mineral Processing

复杂难选的多金属矿
Mineral Processing of Complex and Refractory Polymetallic Mines

冬瓜山铜矿 矿石中含有铜、硫、铁、金、银等多种有用成份，选别工艺过程复杂。设计选矿厂产品为铜精矿（含金和银）、硫精矿和铁精矿。

The ore of Dongguashan copper mine contains several valuable elements including copper, sulfur, iron, gold and silver, etc, which makes beneficiation and separation process complex. The designed concentrator produces copper concentrate (containing gold and silver), sulfur concentrate and iron concentrate.

选矿 Mineral Processing

中国第一座生物氧化工艺选厂
The First Gold Extraction Process by Biological Oxidation in China

烟台生物氧化提金厂设计规模为金精矿 50t/d，是由中国恩菲设计的我国第一座采用生物氧化提金工艺处理含砷难浸金精矿的黄金冶炼厂。

The design capacity of Yantai biological oxidation gold extraction plant is 50t/d gold concentrate, which is also the first gold smelter designed by ENFI in China to adopt the gold extraction process by biological oxidation to treat refractory arsenic-bearing gold concentrate.

中国有色矿山第一例高压辊生产工艺
The First High-Pressure Grinding Roller (HPGR) Process Applied in Nomferrous Metal Mine in China

中国恩菲在 **金堆城钼矿** 选矿工艺升级改造工程中，采用了“三段一闭路破碎 + 高压辊磨机辊磨 + 球磨机磨矿”的新碎磨流程，一次带料试车成功，为中国有色金属行业采用高压辊磨机作为超细碎设备的首例，不仅大幅度降低了碎磨系统能耗，提高了球磨机产能，由此也给业主带来巨大的经济效益。

For beneficiation process upgrading and modification project of Jinduicheng molybdenum mine, ENFI adopted the comminution process of “three-stage crushing with one closed circuit +HPGR +Ball Mill”. Commissioning with load was successfully implemented at one time. The comminution process is the first one using HPGR as ultra-fine crushing equipment in China’s nonferrous metal industry, which greatly reduces energy consumption of comminution system, improves production capacity of ball mill and thus brings significant economic benefit to the owner.

选矿 Mineral Processing

现代化的半露天选矿厂
Modernized Semi-Opened Concentrator

在 **巴布亚新几内亚瑞木镍钴矿、尹格庄金矿** 等矿山选厂采用现代化的半露天设计。其中尹格庄金矿在中国首次采用 CD-20 尼尔森选矿机，在磨矿回路中提前回收单体金，取得了很好的经济效益；同时尹格庄金矿在采矿方面，成功地应用盘区连续回采隔墙尾砂充填采矿法，其劳动生产率等指标位于黄金矿山首位。

The modernized semi-open concentrator is designed for RAMU Ni-Co laterite mine in Papua New Guinea and Yingezhuang gold mine, etc. Yingezhuang gold mine has adopted CD-20 Knelson Concentrator for the first time in China and recovered free gold from the grinding circuit in advance so as to obtain very good economic benefit; in addition, the panel continuous stoping partition and tailings filling has been applied in this mine successfully, so that its labor productivity, etc. rank the first among the gold mines.

尾矿 Tailings Disposal

亚洲最大的尾矿库
The Largest Tailings Pond in Asia

德兴铜矿四号尾矿库，采用先进的堆坝工艺，大坝总长约 1000m，库容 8.35 亿 m^3，汇水面积 15km^2，总堆积坝高 208m，设计尾矿日排放量 9 万 t，是亚洲最大的尾矿库，也是世界上少有的特大型尾矿库之一。

As for the No.4 tailings pond of Dexing copper mine, the internationally-leading damming technology is adopted, with a total dam length of 1000m, pond capacity of 800 million m^3, catchment area of 15km^2 and total dam height of 208m. The designed tailings disposal capacity is 90000t/d. This tailings pond is the largest one in Asia and also one of the very few extra large tailings ponds in the world.

尾矿 Tailings Disposal

长距离矿浆管道输送
Long Distance Slurry Transportation Pipeline

巴布亚新几内亚瑞木镍钴矿 长距离矿浆管道 是世界上第一条投入运行的镍红土矿长输矿浆管道工程，总长约 135km，管道内径 610mm，年输送镍红土矿精矿 321 万 t。主要由矿浆贮槽、喂料泵站、检测环管、主泵站、135km 长输管线、压力监测站、阴极保护站、终端消能站、清管系统、SCADA 系统组成。

The long-distance slurry pipeline project in RAMU Ni-Co laterite mine in Papua New Guinea is the first long-distance slurry transportion pipeline project in the nickel laterite mine that has been put into operation in the world; the total length of the pipeline is 135km and inside diameter 610mm; this pipeline project, with a capacity of transporting 3.21 million t/a of nickel laterite concentrate, is mainly composed of slurry storage tank, charge pump station, test loop, main pump station, 135km-long pipeline, pressure monitoring station, cathodic protection station, terminal choke station, pigging system and SCADA system.

数字化矿山技术 Digitalized Mine Engineering Technology

现代化的控制及信息系统
Modern Control and Information System

全数字式提升机控制系统

Digitalized elevator control system

高浓度及膏体充填智能控制系统

Intelligent control system for high-density filing and paste filling

选矿厂自动化控制系统

Automation system of concentrator

井下安全避险监测监控系统

Underground safety and emergency supervision and monitoring system

尾矿库安全监控及管理系统

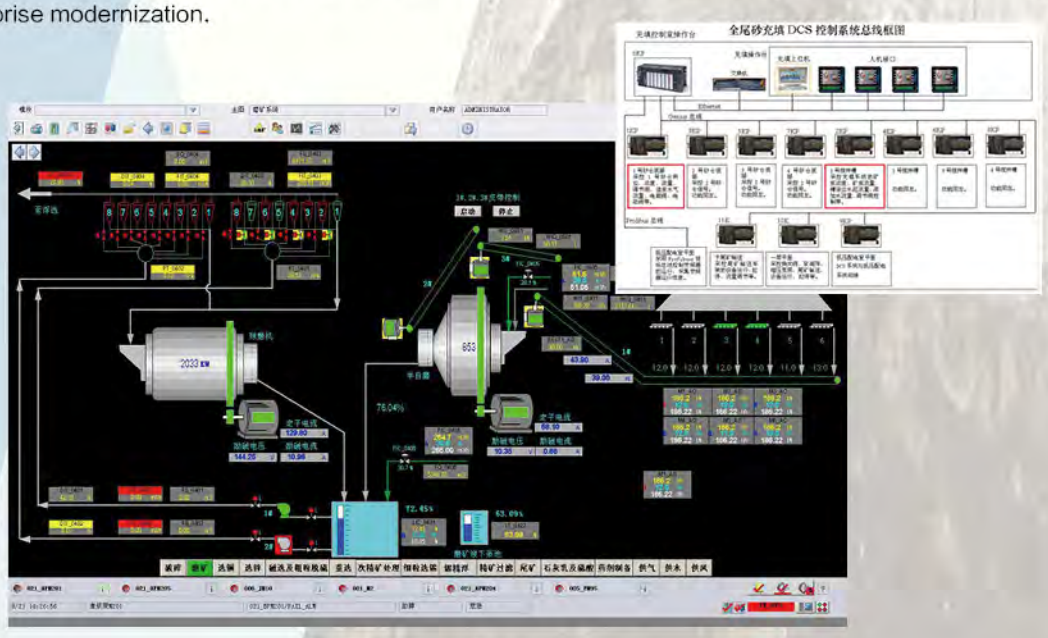
Tailings pond safety monitoring and management system

全面的信息管理系统解决方案

Fully-dimensional information management system and solutions

为提高劳动生产率，实现企业科学、高效、现代化的生产及管理，中国恩菲科技人员依托多年的设计及工程实施经验，以先进的理念和技术，设计和建立现代化的控制及信息系统。智能化操控界面、完善的安全保障、管控一体化平台、实时数据系统、高速信息通道、视频监视系统……满足企业现代化发展对自动化及信息管理的各种需求。

To improve productivity and realize scientific, high-efficient and modern production and management, engineers of ENFI design and establish the modernized control and information system based on years of design and project execution experience as well as advanced concept and technology. The system is integrated with intelligent operational interface, sound safety guarantee, management and control integration platform, in-time data system, information express as well as video monitoring system, which satisfy the need of automation and information management for enterprise modernization.



致力于
成为最值得信赖的
国际化工程综合服务商
及能源环境发展商

ENFI is striving to be the
most trust worthy international company
committed to integrated service for
international projects and energy &
environmental development.

凭借长期工程实践经验和雄厚的技术实力，
中国恩菲赢得了广大业主的高度赞誉。

中国恩菲向业主郑重承诺，
我们在提供最佳技术方案的同时，将为您尽心尽力的服务，
我们期待与您的长期合作！

中国有色工程有限公司
CHINA ENFI ENGINEERING CO., LTD
中国恩菲工程技术有限公司
CHINA ENFI ENGINEERING CORPORATION

电话 \ Tel: +86-10 6393 6826
传真 \ Fax: +86-10 6396 6679
网站 \ Web: www.enfi.com.cn
地址 \ Add: 北京市海淀区复兴路 12 号　邮编：100038
12 Fuxing Avenue,Beijing,China. 100038