

# 共建清洁低碳生活

Building a Clean and Low-carbon Life Together

## ▼ 业务合作 BUSINESS COOPERATION



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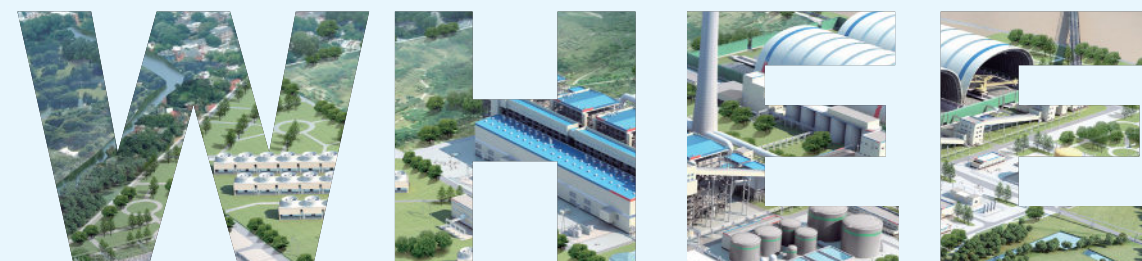
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华光环保



华光环保装备



无锡华光环保能源集团股份有限公司

WUXI HUAGUANG ENVIRONMENT& ENERGY GROUP CO.,LTD.

## 全球领先的环保能源领域系统解决方案服务商

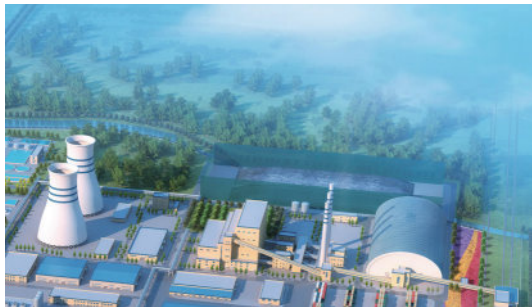
Becoming World's Leading Comprehensive Service Provider in the Field of Environmental Protection and Energy Utilization

诚信·责任·专业·超越

Integrity Responsibility Professionalism Transcendence

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## 卷首语 | PREFACE



华光环能秉承“共建清洁低碳生活”的企业使命，恪守“诚信、责任、专业、超越”的核心价值观，朝着“中国领先的环保能源综合服务商”的目标昂首奋进，我们以改革创新之态不断突破，一次次实现自我的涅槃：A股上市公司、四大业务板块、五十三家投资子公司，近四千余名从业人员，超八十亿营收、中国驰名商标、中国工业行业排头兵企业、国内锅炉行业前五强企业、固废行业核心设备年度领跑企业，国家鼓励发展的重大环保技术装备依

托单位，国家认定企业技术中心、国家知识产权示范企业。

这些荣誉不仅属于华光人，更属于在华光发展历程中给予支持的社会各界人士，我们由衷感谢在华光发展中给予点滴关怀与支持的各级领导，新老客户，合作伙伴以及各界朋友！

华光环能将始终坚持传承“实干兴企”的赤子之心，恪守“诚信为本”的经营之道，携手各方合作伙伴，聚力同行，筑梦百年，共襄未来。

WHEE adheres to the corporate mission of "building a clean and low-carbon life together", scrupulously abides by the core values of "integrity, responsibility, professionalism and transcendence", and strives to be "The leading environmental protection and energy integrated service supplier in China". We have made breakthroughs through reform and innovation: A-share listing; forming 4 business sectors; holding 53 subsidiaries; having nearly 4000 employees; obtaining a revenue of 8 billion; achieving the honors of "Well-known Chinese Trademark", "Leading Enterprise of Chinese Industry", "Top Five Enterprises in Chinese Boiler Industry", "Annual Leader of Core Equipment in Solid Waste Industry", and "Major Supporting Enterprise of Environmental Protection Technology and Equipment Encouraged by the State"; establishing of the enterprise technology center and becoming the "State Intellectual Property Demonstration Enterprise". These honors not only belong to WHEE, but also belong to the people from all walks of life who have given their support in the development of us. We are grateful to the administrations at all levels, the new and old customers, the partners and friends from all walks of life who have given care and support in the development of WHEE! WHEE will always adhere to the spirit of inheriting the "work hard to prosper the enterprise", adhere to the "integrity-based" business approach, join hands with partners, gather strength to walk together, build a dream for a century's prosperity, and jointly contribute to the future.

党委书记、董事长  
Party secretary and Chairman

王圣平

## CORPORATE STRATEGY & CULTURE 企业战略及文化

### 品牌定位

Brand Positioning

为全球提供绿色动能  
Provide green energy for the world

### 企业使命

Corporate Mission

共建清洁低碳生活  
Building a clean and low-carbon life together

### 发展愿景

Development Vision

全球领先的环保能源领域系统解决方案服务商  
Becoming world's leading comprehensive service provider in the field of environmental protection and energy utilization

### 核心价值观

Core Values

诚信 · 责任 · 专业 · 超越  
Integrity, responsibility, professionalism and transcendence

### 企业精神

Enterprise Spirit

务实创新 · 团结拼搏  
Pragmatic innovation, unity and hard-working

### 经营理念

Business Philosophy

产品服务让用户满意，企业发展让股东满意，工作氛围让员工满意，公共责任让社会满意。  
Products and services to customers' satisfaction, enterprise development to shareholders' satisfaction, working atmosphere to staff satisfaction, and public responsibilities to society's satisfaction.



# 01 COMPANY PROFILE

## 集团概况

### 公司简介 ABOUT US



华光环能（原无锡华光锅炉股份有限公司）成立于1958年8月，前身是无锡锅炉厂，2003年7月在上海证券交易所挂牌上市（SH.600475），2017年6月完成重大资产重组，2020年6月公司更名为“无锡华光环保能源集团股份有限公司”。公司为国有控股上市公司。目前总股本7.27亿股，是控股股东无锡市国联发展（集团）有限公司的主要实业投资运营主体。公司现拥有53家投资子公司，员工近4000余名。

公司以建设一体化服务能力为目标，坚持聚焦能源与环保“两大主业”深化“两大转型”（即从传统能源向新能源、市政环保转型，从一般装备制造向环保能源工程总包、投资运营转型），着力整合从设计、制造、建设到运营等核心环节，逐步形成了集电站项目投融资、电力工程设计、电站设备成套、电站工程总包、电厂运营管理以及新能源新材料开发等为一体的相互支撑的完善产业链，形成了装备制造板块、热电运营板块、市政环保板块、投资运营板块等四大业务板块，加快打造中国领先的绿色低碳城市整体解决方案平台型企业。

WHEE (former Wuxi Huaguan Boiler Co., Ltd.), first known as Wuxi Boiler Works, was established in August 1958, listed on the Shanghai Stock Exchange (SH. 600475) in July 2003, and completed major assets restructuring in June 2017 by absorbing Wuxi Guolian Environmental Energy Group, which was one of the main industrial entities held by Wuxi Guolian Development Group pertaining investment and entities operating. In June 2020, the company altered its name to Wuxi Huaguan Environment & Energy Group Co.,LTD. At present, it has 33 invested subsidiaries and more than 4,000 employees.

With the goal of constructing integrated service capability, WHEE continues to engage in the key areas of environment and energy, focusing on integrating the core links including design, manufacturing, construction and operation, and has gradually formed a mutually supportive and all-round industrial chain integrating investment and financing of power station projects, power engineering design, complete sets of power station equipment supply, power station projects EPC, operation and administration of power plants and development of new energy and new materials; and has established 4 business sectors, i.e. Equipment manufacturing, thermal power operation, municipal environmental protection, and investment & operation. We are accelerating our pace in becoming one of China's leading platform enterprises in offering green-city overall-solution.



## 发展历程 DEVELOPMENT HISTORY

### 1958 年 8 月

由“公私合营无锡锅炉厂”与“地方国营湖光机械厂”合并成“国营无锡江苏锅炉厂”。

In August 1958, the "Public-Private Joint Venture Wuxi Boiler Factory" and the "Local State-owned Huguang Machinery Factory" merged into the "State-owned Wuxi Jiangsu Boiler Works".



锅炉“桥”（1959年摄）

### 2017 年 6 月

完成重大资产重组，公司总股本由 2.56 亿股增至 5.59 亿股。

In June 2017, we completed major asset restructuring, the company's total share capital increased from 256 million shares to 559 million shares.



### 2000 年 12 月

改制成为“无锡华光锅炉股份有限公司”。

In December 2000, the company was transformed into Wuxi Huaguang Boiler Co., Ltd..



### 2003 年 7 月

华光股份在上海证券交易所挂牌上市。  
股票简称“华光股份”，股票代码：600475。

In July 2003, the company was listed with abbreviation of "Huaguang shares" on the Shanghai Stock Exchange. The stock code is 600475.



### 2020 年 6 月

“无锡华光锅炉股份有限公司”更名为“无锡华光环保能源集团股份有限公司”，证券简称“华光股份”变更为“华光环能”，更好的推动公司整体发展及战略目标的实现。

In June 2020, in order to better coincide with the company's overall development orientation and support the reaching of strategic goals, "Wuxi Huaguang Boiler Co., Ltd." was renamed into "Wuxi Huaguang Environment & Energy Group Co., Ltd.", and the stock abbreviation "Huaguang Share" was correspondingly changed into "Huaguang Environment & Energy".



### 2022 年起

公司进行新基地筹建和智能化车间布局，从而实现公司产业结构进一步优化、产品结构进一步调整，实现全面协调可持续发展，增强企业的核心竞争力。

Starting from 2022, the company has carried out new base preparation and intelligent workshop layout, so as to further optimize the company's industrial structure and further adjust our product structure to achieve a comprehensive, coordinated and sustainable development, and to enhance the core competitiveness.

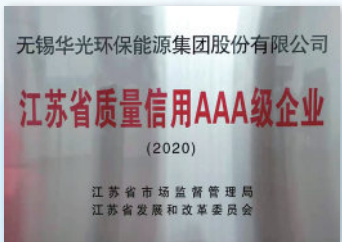




## 资质荣誉 QUALIFICATION & BRAND HONOR

公司是中国机械 500 强企业、中国最具价值固废处理处置装备品牌企业、2019 分布式能源 100 强企业、全国大气污染减排突出贡献企业、中国固废行业细分领域领跑及单项能力领跑企业、国家鼓励发展的重大环保技术装备依托单位、世界环保与新能源产业中国影响力 100 强企业，“中国工业行业排头兵企业”、“中国机械工业百强企业”、“江苏省自主工业品牌五十强”、“江苏省创新型企业 100 强”，拥有国家、省、部级科技进步奖 29 项，国家重点新产品 8 项，江苏省高新技术产品 24 项，省重点推广应用的新技术新产品 11 项。

WHEEL has achieved the honors of “top 500 machinery enterprises in China”, “most valuable brands of solid waste treatment and disposal equipment in China”, “China's top 100 distributed energy enterprises in 2019”, “leading enterprises in air pollution reduction in China”, “leading enterprises in solid waste industry and capability”, “Supplier of major environmental protection technology and equipment encouraged by the state”, “the world's top 100 influential enterprises in environmental protection and new energy industry”, “China's leading industrial enterprises”, “Top 100 enterprises in China's machinery industry”, “top 50 independent industrial brands in Jiangsu Province”, “top 100 innovative enterprises in Jiangsu Province”, with 29 national, provincial and ministerial scientific and technological progress awards, 8 national key new products, 24 high-tech products in Jiangsu Province, and 11 provincial key new technology and new products awards.





## 02 ENERGY EQUIPMENT 能源装备

### 减碳固废发电锅炉 SOLID WASTE BOILER

#### ▼ 生活垃圾炉 Waste-to-energy Boiler

#### 技术引进



Hitachi Zosen



华光环能自上世纪 90 年代开始研制生活垃圾焚烧炉排及余热锅炉，在国内市场占有率高，产品销售到泰国、越南等东南亚国家和地区。公司产品的业绩和技术均处于领先地位。我公司垃圾余热锅炉可与各型炉排进行配合，适应性广泛。

垃圾处理量：1000t/d 及以下

产品类型：垃圾焚烧余热炉、垃圾炉排焚烧炉、循环床垃圾炉

可燃用垃圾热值范围：1000-3000kcal

压力参数：4.0-13.7MPa

业绩：500 台套以上

WHEE has developed the WTE (Waste to Energy) boilers and waste Incinerators since 1990s. With high market share in China, our products also have been supplied to Thailand, Vietnam and other Southeast Asian countries and regions. Our products are the leader of the industry in terms of both performance and technology. Our WTE boilers are capable of matching various kinds of grates, with wide range of flexibility.

Waste disposal capacity: up to 1000t/d

Types of products: WTE boilers, waste incinerators, MSW CFB Boilers

Heat value range: 1000-3000kcal

Pressure: 4.0-13.7MPa

Reference: over 500 WTE boilers.



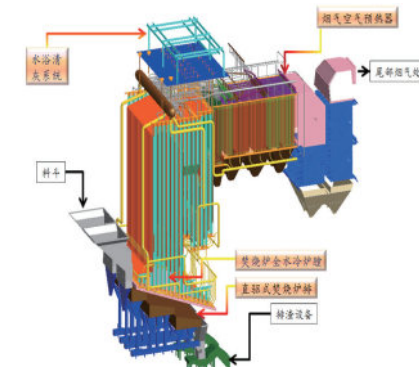
“鲁班奖”获奖项目  
Luban Award  
长沙军信 6×850t/d+4×750t/d 垃圾焚烧余热锅炉（I 期 2017 年投运，II 期 2020 年投运）  
6×850t/d + 4×750t/d WTE boilers of Junxin project (Phase I had been put into operation in 2017 and Phase II in 2020)



2020 年设计日处理最大  
The largest disposal capacity, Asia, 2020.  
中节能环保定 1000t/d 垃圾焚烧锅炉项目（2020 年投运）  
1000t/d waste incineration boiler project of CECEP in Baoding (put into operation in 2020)

#### □ 技术优势

- ◎ 国内最先拥有炉排及锅炉整套核心技术，成套能力强、质量优，契合度高。
- ◎ 具有大容量、高参数、带再热的整套技术及运行业绩。
- ◎ 按垃圾热值定制绝热、空冷、水冷等不同类型的焚烧炉膛，燃料适应性广。
- ◎ 高效的清灰形式和合理的布置位置，确保最优的换热效果。
- ◎ 成熟可靠的炉膛及过热器高温防腐解决方案和省煤器低温防腐解决方案。
- ◎ 独特的结构设计，有效避免受热面结焦。
- ◎ 日立造船等优选合作供方，ASME 钢印产品供货至台湾。
- ◎ 公司采用三维智能化出图，设计质量、速度更具明显优势。



公司垃圾焚烧炉排加余热锅炉典型布置  
Typical arrangement of WTE boiler and waste incinerator of WHEE

#### □ Technology

- WHEE owns a complete set of core technologies of WTE boilers and waste incinerators, and have strong capacity in designing, manufacturing and supplying products with excellent quality.
- With the whole set of technologies and operation references of WTE boilers of large capacities, high parameters and/ or RH system.
- Furnaces of insulating, air cooling and water cooling types are developed to adapt different heating values of MSW(Municipal Solid Waste) and with large fuel flexibility.
- The heating surfaces are provided with efficient soot-blowing arrangement and proper layout to ensure the heat exchange efficiency.
- Mature and reliable anti-corrosion solutions for furnace, Superheater (high temperature corrosion) as well as economizer (low temperature corrosion).
- The structural layout is properly made so as to avoid coking on heat recovery area.
- As selected cooperative supplier of Hitachi Zosen, our product of ASME stamp is supplied to Taiwan.
- WHEE's 3D parametric design is superior in both quality and efficiency.



越南芹苴 400t/d 垃圾焚烧锅炉（2019 年投运） 400t/d WTE boiler in Can Tho, Vietnam (put into operation in 2019)



## 减碳固废发电锅炉 SOLID WASTE BOILER

### 工业固废流化床锅炉 ISW ( Industrial Solid Waste) CFB boiler

华光环能是中国固废领域的领跑企业之一，在工业固废锅炉领域研发设计经验丰富，拥有多个循环流化床锅炉处理固废物的项目，目前均运行效果良好。公司为多个知名造纸企业提供固废锅炉，处理造纸过程中产生的造纸污泥和造纸轻渣、浆渣。

固废处理量：100t/d-2000t/d

处理方式：固废纯烧或掺烧

燃料：纸渣、浆渣、污泥、布条、建筑模板、旧家具等

WHEE is one of the leaders in the Chinese ISW disposal industry, with rich experiences in the R&D and design of the ISW burning boilers. We have a wide variety of references in the CFB (Circulating Fluidized Bed) ISW disposal projects, all of which are operating in good condition. We have supplied the ISW burning boilers for many well-known paper making enterprises to dispose the sludge, the waste residue and the pulp residue generated in the paper making process.

ISW disposal capacity: 100t/d-2000t/d

Disposal method: 100% burning the ISW or mixed with other fuel(s)

Fuels: paper making waste residue, pulp residue, sludge, cloth strip, building form-work, old furniture, etc.

### 技术优势

- ◎ 创新的风帽设计和布风板布置，解决床面不可燃重物的排出问题。
- ◎ 采用外置床式高温过热器，彻底解决高温腐蚀问题。
- ◎ 合理布置烟气再循环系统，降低氮氧化物排放。
- ◎ 成熟可靠的受热面布置，防止受热面积灰腐蚀。
- ◎ 独特的烟道设计满足 CO 排放指标。
- ◎ 前处理要求低，设备投资少。



外置床过热器  
External bed superheater

### Technology

- Innovative air nozzle design and grid layout to solve the problem of deposition of non combustible heavy materials on the bed.
- High temperature Fluidized bed heat exchangers are designed to avoid the corrosion of high temperature heating surface.
- Flue gas recirculating system with proper design to achieve a low emission level of NO<sub>x</sub>.
- Mature and reliable heat recovery area arrangement, effectively prevent the heating surface from suffering ash depositing and corrosion.
- Unique flue gas duct design to satisfy the CO emission requirement.
- Low pre-treatment requirements, less equipment investment.

### 典型项目 Typical Project



龙游金怡 90 t/h 高温高压固废 CFB (2021 年投运)

90t/h High temperature and high pressure ISW CFB of Longyou Jinyi (put into operation in 2021)



光大（宿迁）90t/h 中温次高压固废 CFB (2022 年投运)

90t/h Medium temperature sub-high pressure ISW CFB of Everbright (Suqian) (put into operation in 2022)



玖龙纸业（沈阳）130t/h 掺烧纸渣污泥高温高压 CFB (2017 年投运)

130t/h Blended paper slag sludge high temperature and high pressure CFB of Jiulong(Shenyang)(put into operation in 2017)



## 减碳固废发电锅炉 SOLID WASTE BOILER

### ▼ 污泥焚烧锅炉 Sludge Boiler

华光环能与院校开展产学研合作，开发了鼓泡床污泥焚烧技术，污泥焚烧产生的热量用于产生蒸汽，供污泥干燥装置使用，形成污泥自持焚烧，不需额外添加燃料，该技术在行业内处于领先水平，已有多个项目成功投入运行。

污泥炉单台处理量：100-200t/d

所产生的介质：蒸汽（配合干化机）

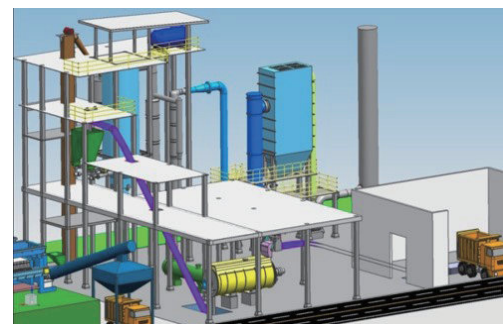
WHEE has cooperated with specialized colleges and universities and developed the BFB ( Bubbling Fluidized Bed) boiler technology for sludge disposal. The heat recovered from sludge burning is utilized to generate steam, which is supplied to the sludge dryer so as to realize a self-sustained sludge combustion without feeding any other fuel. This technology is of industrial-leading and many sludge projects of WHEE have been successfully operated.

Sludge disposal capacity: 100-200t/d

Generated media: steam (to the dryer)

### □ 技术优势

- ◎ 设置有高温旋风分离器，可减少烟气中的飞灰量，大大降低尾部环保设备的投资及处置成本。
- ◎ 无需额外设置处理设备即可完全处理烘干机产生的不凝气体。
- ◎ 相关工艺和排放标准符合国家相关政策。



污泥焚烧系统

Sludge burning system

### □ Technology

- With the high temperature cyclone separator between furnace and back pass, the amount of the fly ash in flue gas is largely reduced and subsequently greatly reduce the investment for boiler flue gas treatment equipment.
- The non-condensable gas generated by the dryer can be 100% disposed without other treatment equipment.
- The technology applied and the emission meet the requirements of relevant national policies.

### □ 典型项目 Typical Project



无锡惠联：1×120t/d 污泥焚烧锅炉（2011 年投运）

Wuxi Huilian: 1×120t/d sludge incineration boiler (put into operation in 2011)



上海石洞口污水处理厂 1×32t/d 污泥焚烧锅炉（2020 年投运）

1×32t/d sludge incineration boiler of sewage treatment plant in Shanghai Shidongkou(put into operation in 2020)



常州武进污水处理厂 2×100t/d 污泥焚烧锅炉（2018 年投运）

2×100t/d sludge incineration boiler of Sewage Treatment Plant in Changzhou Wujin(put into operation in 2018)

## 减碳固废发电锅炉 SOLID WASTE BOILER

### ▼ 污泥干化机 Sludge Dryer

»»»

华光环能通过与院校合作开发具有自主知识产权的污泥干化机，包含导热油型、蒸汽型圆盘干化机。截至目前已生产投运 10 余台套，设备性能稳定，达到设计要求。

污泥干化机单台处理量：50-150t/d

热源：导热油、低压蒸汽（0.2-0.8MPa）

WHEE has Cooperated with specialized colleges and universities and developed the sludge dryer with independent intellectual property rights, including both heat transfer oil type sludge dryers and steam (disc) type sludge dryers. For the time being, more than 10 sets of the sludge dryers were put into operation, the performance of the dryer is stable and all the design requirements are satisfied.

sludge disposal capacity: 50-150t/d

Heating resources: heat transfer oil/ low pressure steam (0.2-0.8MPa)

#### □ 技术优势

- ◎ 热源灵活，可为导热油或蒸汽。
- ◎ 干化机处理量可定制。
- ◎ 可提供污泥干化焚烧处置整体解决方案。
- ◎ 从设计到制造全过程符合压力容器标准。
- ◎ 同等处理量时干化效果更好且占地面积小。

#### □ Technology

- Flexible heat sources: heat transfer oil and steam
- Customized drying capacity( currently, the major capacities are: 100t/d, 120t/d, 150 t/d, etc.)
- Providing overall solution for sludge drying and disposal.
- The pressure vessel criteria are fully observed from design to manufacture.
- Better drying effect and small footprint.

#### □ 典型项目 Typical Project



##### 3 台 150 t/d 卧式圆盘蒸汽污泥干化机项目（主要用来处理太湖蓝藻污泥，2019 年底投运）

3×150t/d horizontal disc steam sludge dryers project (mainly used to treat cyanobacteria sludge from Taihu Lake and put into operation at the end of 2019)



##### 成都万兴一期垃圾处理协同污泥焚烧处理项目配套的 4 台 100t/d 卧式圆盘蒸汽污泥干化机（2021 年投运）

4×100t/d horizontal disc steam sludge dryers for Chengdu Wanxing phase I waste treatment and sludge blending treatment project ( put into operation in 2021)



## 低碳燃气锅炉 GAS BOILER

华光环能具备成熟的  $\pi$  型、D 型、角管式燃油气锅炉技术，结构简单，技术可靠，可为钢铁、化工、造纸、煤化工、供热发电等行业的用户提供定制服务。

**压力参数:** 1.3MPa-18.7MPa

**燃料:** 各类可燃气体（天然气、高炉煤气、焦炉煤气、兰炭尾气、丙烷气及各类化工尾气等）和油类燃料（轻油、重油等）

**燃料热值:** 500kcal/Nm<sup>3</sup>-22000kcal/Nm<sup>3</sup>

WHEE owns the mature technologies of  $\pi$  shape, D shape and corner tube type oil/gas fired boilers, which are featured in simple structure and reliable technology. We provide customized services to clients of steel industry, chemical industry, paper industry, coal chemical industry, heating and power generation industry, etc.

**Pressure:** 1.3MPa-18.7MPa

**Fuel:** Various combustible gases, such as natural gas, blast furnace gas, coke oven gas, blue carbon tail gas, propane gas and various chemical tail gas; Oil fuel, such as light oil, heavy oil, etc.

**Fuel heat value:** 500kcal/Nm<sup>3</sup>-22000kcal/Nm<sup>3</sup>

### □ 技术优势

- ◎ 配置先进的燃烧系统，燃烧效率高，调节比大。
- ◎ 燃料适应性强、可混烧多种燃气，负荷变动能力强。
- ◎ 低氮燃烧 +SCR（选配），确保低 NO<sub>x</sub> 排放。

### □ Technology

- Advanced combustion system with high combustion efficiency and large turn down ratio;
- Wide range of fuel flexibility, capable of firing pure or mixed fuels, with excellent cycle duty capacity;
- Low NO<sub>x</sub> emission + SCR system (optional) to provide a low NO<sub>x</sub> emission.



新疆哈密 265t/h 高温次高压燃兰炭尾气项目（2020 年投运）

Xinjiang Hami 265T /h High Temperature sub-high Pressure Burning Orchid carbon Exhaust Project (put into operation in 2020)



陕西同得利 130t/h 高温高压焦炉煤气焦炉气锅炉（2016 年投运）

Shanxi Tongdeli 130t/h high temperature and high pressure coke oven gas boiler (put into operation in 2016)

## 燃气 - 蒸汽联合循环余热锅炉 HRSG

华光环能与比利时 John Cockerill（原 CMI）公司签订了立式和卧式燃气轮机余热锅炉（HRSG）许可证转让技术引进合作协议，技术共享。产品业绩涵盖 9H、9F、9E、6F、6B 等级别余热锅炉。

With the technology license and cooperation Agreements for vertical and horizontal HRSGs between WHEE and John Cockerill (JC, former CMI, a Belgium company), JC shares the technologies with WHEE, and our reference projects covers the classes of 9H, 9F, 9E, 6F and 6B.

### □ 华光的 HRSG 技术经验

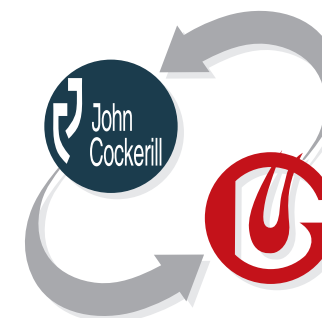
**燃机燃料:** 天然气、高炉煤气、原油、重油、轻油等

**锅炉型式:** 卧式自然循环、立式自然循环、立式直流

**产品系列:** 9H 级、9F 级、9E 级、6F 级、6B 级及以下

### □ 提供定制化的设备和服务

- ◎ 受热面模块上游或模块中间的补燃系统。
- ◎ 烟气旁路系统（单循环改联合循环服务）。
- ◎ 选择性催化还原法（SCR）脱除 NO<sub>x</sub>。
- ◎ BSE 系统：锅炉寿命在线监测。
- ◎ 吹灰系统和受热面离线清洗系统。
- ◎ 去工业化设计等。



### □ WHEE's HRSG technical experiences

**Gas turbine fuel:** natural gas, blast furnace gas, crude oil, heavy oil, light oil, etc

**Types:** horizontal natural circulation, vertical natural circulation, vertical one-through

**Product series:** 9H, 9F, 9E, 6F, 6B and below

### □ WHEE supply customized equipment and services

- Supplementary firing system upstream or in-between the heating surface modules.
- Flue gas bypass system (extension from simple cycle to combined cycle).
- Selective catalytic reduction (SCR), deNO<sub>x</sub>.
- BSE system: on-line monitoring of service life.
- soot-blowing system and heating surface off-line washing system.
- Deindustrialization design, etc.

## 燃气 - 蒸汽联合循环余热锅炉 HRSG

### ▼ 立式燃气轮机余热锅炉 Vertical HRSG



华光环能的立式自然循环 HRSG 技术处于行业领先地位，作为燃气 - 蒸汽联合循环 HRSG 供应商，在市场上具有广泛的影响力。由于立式自然循环余热锅炉固有的结构特点，非常适合两班制循环运行。

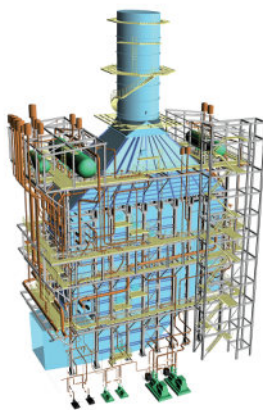
With the industrial leading vertical natural circulation HRSG technology, WHEE, as a gas-steam combined cycle HRSG supplier, having a wide influence in the market. Due to the inherent structural features, our vertical HRSG fit perfectly for the double shift operation.



序号	名称	推广应用产品目录	推广应用产品目录	推广应用产品目录
1	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
2	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
3	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
4	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
5	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
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7	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
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9	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
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17	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
18	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
19	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉
20	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉	燃气轮机余热锅炉

### □ 技术优势

- ◎ 高水平的厂内组装率，安装模块采用液压提升装置，节省时间和成本。
- ◎ 占地面积小。
- ◎ 水平布置的蛇形管便于内部检修维护。
- ◎ 燃烧含灰燃料如重油、原油等的 HRSG 可配置吹灰系统和水洗系统，受热面清洁方便。
- ◎ 创新的立式直流锅炉技术保证了快速的负荷响应能力，尤其适合调峰型电厂。



### □ Technology

- High assembly rate in shop + hydraulic lifting on site, saving time and cost.
- Small footprint.
- Horizontal arrangement of coils: easy internal and maintenance.
- Soot-blowing and water washing system are provided to the HRSG when turbine fuel is heavy oil or crude oil: easy cleaning of the heating surfaces.
- The innovative vertical one-through steam generator technology ensures a rapid load response ability, especially adaptable for peak-shaving power plant.



珠海钰海 2×9F 级立式自然循环余热锅炉（2020 年投运）  
2×9F Vertical HRSG of Yuhai Project, Zhuhai (put into operation in 2020)



伊拉克 10×9E 级立式自然循环余热锅炉（2022 年投运）  
10×9E vertical HRSG in Basra, Iraq ( put into operation in 2022)



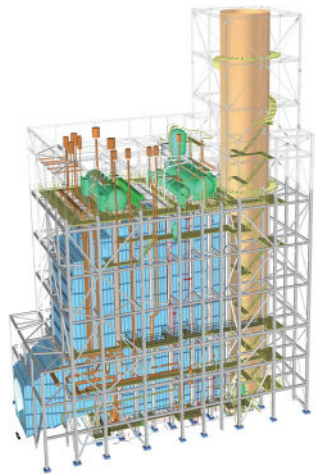
国内首批 9F 级  
The first 9F-class HRSGs in China

中海油福建 4×9F 级立式自然循环余热锅炉（2008 年投运）  
4×9F vertical HRSG of CNOOC Fujian(put into commercial operation in 2008)



## 燃气 - 蒸汽联合循环余热锅炉 HRSG

### ▼ 卧式燃气轮机余热锅炉 Horizontal HRSG

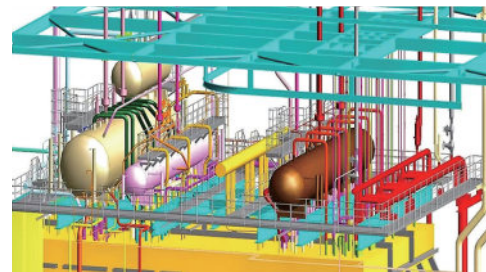


华光环能作为燃气 - 蒸汽联合循环 HRSG 供应商，在市场上具有广泛的影响力。基于华光环能和 JC 的 HRSG 团队持续的研发，华光环能最新一代的卧式燃机余热锅炉是市场上最可靠的解决方案之一，非常适合热电联产项目，可满足市场对卧式燃机余热锅炉的所有需求。

WHEE is a gas-steam combined cycle HRSG supplier with a wide influence in the market. Based on the continuous R&D of the HRSG teams from both WHEE and JC, the latest WHEE horizontal HRSG is one of the most reliable solutions in the market, which can satisfy all needs for horizontal HRSG in the market.

### □ 技术优势

- ◎ 特别加强的集箱管接头和角焊缝结构，消除应力，锅炉可靠性高。
- ◎ 模块组装程度可定制，以适应不同的道路运输条件、施工场地、设备要求等。
- ◎ 可根据用户要求的补燃量，灵活将燃烧器布置于进口烟道或模块中间。



**零件级的建模深度，可进行碰撞检查，完全避免安装问题**  
Parts-level modeling depth allows collision inspection, completely avoiding installation problems

### □ Technology

- Reinforced header nozzles and fillet welds are provided to relief the stress, so as to improve the boiler reliability.
- Customized module assembly plan to adopt the requirements of road transportation, field condition and equipment.
- Flexible arrangement of supplement firing system: the burner can be placed inside the inlet flue gas duct or between the modules based on the client requirements.

### □ 典型项目 Typical Project



**北京京能高安屯 9F 级卧式余热锅炉（2014 年投运）**  
9F horizontal HRSG of Gao Antun project, Beijing (put into operation in 2014)



**华能江阴 2×9F 级卧式余热锅炉（2020 年投运）**  
2×9F horizontal HRSG of Huaneng Jiangyin (put into commercial operation in 2020)



**天津军粮城 1×9HA.01（650MW 级卧式）余热锅炉（2020 年投运）**  
1×9HA.01 (650MW class horizontal) HRSG of Tianjin Junliangcheng (put into commercial operation in 2020)

## 零碳生物质发电锅炉 BIOMASS BOILER

### ▼ 水冷振动炉排炉 Biomass WCVG (Water Cooled Vibrating Grate) Boiler

华光环能是国内最早开始研制生物质水冷振动炉排锅炉的企业，是两个国家示范项目的锅炉设计制造厂家，是国家生物质标准委员会秘书长单位，在生物质锅炉领域处于行业领先地位。

负荷：50t/h-200t/h

压力参数：1.3MPa-9.8Mpa

燃料：可燃用玉米秆、稻壳等多种生物质燃料

业绩：60 余台套



WHEE is one of the earliest enterprises in China to develop the biomass WCVG boilers, our technology is in the leading position in the field of biomass boiler. As the Secretary general member of the Chinese energy industry biomass power generating equipment standardization technology committee, WHEE designed and fabricated the biomass boilers for 2 national demonstration project.

Load: 50 t/h - 200 t/h

Pressure: 1.3Mpa-9.8MPa

Fuel: combustible corn stalks, rice husks and other biomass fuel, with wide fuel flexibility

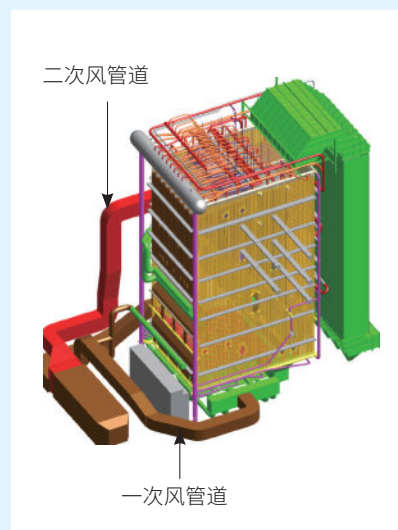
References: more than 60 sets

#### □ 技术优势

- ◎ 专有的水冷振动炉排技术。
- ◎ 燃料适应性广。
- ◎ 燃烧稳定可靠，热效率高。
- ◎ 低氮燃烧技术有效降低污染物排放。
- ◎ 拥有外置式空预器（烟冷气）和管式空预器技术，确保锅炉长周期运行。

#### □ Technology

- Patented WCVG technology.
- Wide fuel flexibility.
- Stable and reliable combustion, high thermal efficiency.
- Low NO<sub>x</sub> combustion, effectively reduce the pollutant emissions.
- External air preheater and tubular air preheater technologies: ensure a long-term operation of the boiler.



## 零碳生物质发电锅炉 BIOMASS BOILER

### ▼ 生物质循环流化床锅炉 Biomass Fired CFB Boiler

华光环能具备掺烧与 100% 纯烧生物质的循环流化床直燃技术，也可解决含有大量铁质杂物的建材模板的出渣问题，拥有众多生物质循环流化床锅炉项目业绩，可针对不同类型的生物质燃料为用户量身定制，设计研发运行经验丰富。

负荷：65t/h-300t/h 全覆盖

压力参数：1.3MPa-13.7Mpa

温度参数：可达 540°C（可带再热系统）

燃料：可燃秸秆、稻壳、稻草、棕榈壳、椰壳、甘蔗渣、树木树皮、建材模板等多种生物质燃料。



WHEE owns the technologies for both mixed fuel and 100% biomass direct firing, and have developed the solution for ash removing when building material template containing a large amount of iron is fired. We have many reference projects of biomass fired CFB boilers, capable of supplying customized boilers based on features of various biomass fuels and has rich experiences in boiler development and design.

Load: 65t/h-300t/h full coverage

Pressure: 1.3Mpa-13.7MPa

Temperature: up to 540°C (with reheat system)

Fuel: combustible straw, rice husk, straw, palm shell, coconut shell, bagasse, tree bark, building materials template and other biomass fuel.

#### □ 技术优势

- ◎ 占地面积较小。
- ◎ 低温燃烧技术可解决床料结团结焦问题。
- ◎ 合理的受热面布置可有效避免烟道积灰堵塞。
- ◎ 过热器的创新蒸汽流程布置可解决高温腐蚀。
- ◎ 独特的布风板技术保证燃烧含铁质杂质较多的建材模板等物料也能出渣顺畅。

#### □ Technology

- Small footprint.
- Low temperature combustion technology can solve the problem of bed material agglomeration and coking.
- Reasonable heating surface arrangement can effectively avoid soot accumulation and blockage of flue.
- The heating surfaces are properly arranged so as to effectively prevent the flue gas duct from blocked by deposited ash.
- The air grid is specially designed so as to ensure smooth ash removing when the building material template containing a large amount of iron is fired.



## 零碳生物质发电锅炉 BIOMASS BOILER

### □ 典型项目 Typical Project

#### ▼ 水冷振动炉排炉 Biomass WCVG (Water Cooled Vibrating Grate) Boiler



##### 上海电气 ( 天长 ) 130t/h 高温高压水冷振动炉排生物质炉 (2018 年投运)

130t/h High temperature and high pressure water-cooled vibration grate Biomass boiler of Shanghai Electric (Tianchang)(put into operation in 2018)



##### 江苏如东 110t/h 秸秆直燃锅炉

110t/h straw direct-fired boiler in Rudong, Jiagnsu

#### ▼ 生物质循环流化床锅炉 Biomass Fired CFB Boiler



##### 中机清能 (沛县) 130t/h 高温超高压中间一次再热生物质循环流化床锅炉 (2020 年投运)

130t/h high temperature ultra high pressure intermediate reheat biomass CFB boiler of China Machinery clean energy(Peixian) Co., Ltd. (put into operation in 2020)



##### 嘉兴新嘉爱斯 130t/h 生物质流化床锅炉 (2015 年投运)

Jiaxing Xinjiaaisi 130t/h biomass CFB boiler (put into operation in 2015)

## 节能环保型燃煤锅炉 COAL-FIRED BOILER

#### ▼ 循环流化床燃煤锅炉 CFB Boiler

华光环能是国内较早开发、研制循环流化床锅炉的企业之一。循环流化床市场占有率在行业内名列前茅。循环流化床锅炉 35t/h~600t/h 中小容量采用自主研发结合产学研合作开发, 600t/h~1200t/h 大容量引进 SFW 技术, 整体技术水平达到国际先进水平。

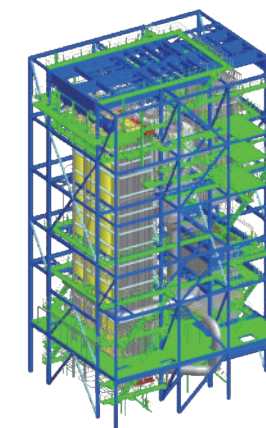
负荷: 35-1200t/h

压力参数: 1.3-18.7MPa

温度参数: 可达 571°C 以上

燃料: 烟煤、贫煤、无烟煤、褐煤、煤矸石等所有煤种

业绩: 累计生产 1800 余台套, 出口约 230 台套



WHEE is one of the pioneers in China in developing and research of the CFB boilers. Our CFB boilers of 35t/h~600t/h capacities are developed by combining the independent R&D and cooperation with specialized colleges and universities; our CFB boilers of 600t/h~1200t/h capacities are of licensed technology from SFW ( Sumitomo SHI FW); the overall technology of our coal fired boilers are of international advanced level.

Load: 35-1200 t/h

Pressure: 1.3-18.7MPa

Temperature: up to 571°C

Fuel: bituminous coal, lean coal, anthracite, lignite, gangue and other coal

Reference projects: more than 1800 sets have been supplied, among which, about 230 sets have been exported.



##### 越南海阳燃煤电厂 4×1005t/h 亚临界 CFB 锅炉 (1#, 2# 机组已经投入商运)

4×1005t/h subcritical CFB boiler of Haiduong Coal-fired Power Plant , Vietnam Unit 1# and 2# have been put into operation)

## 节能环保型燃煤锅炉 COAL-FIRED BOILER

### ▼ 循环流化床燃煤锅炉 CFB Boiler

#### □ 技术优势

##### ◎ 环保性能好

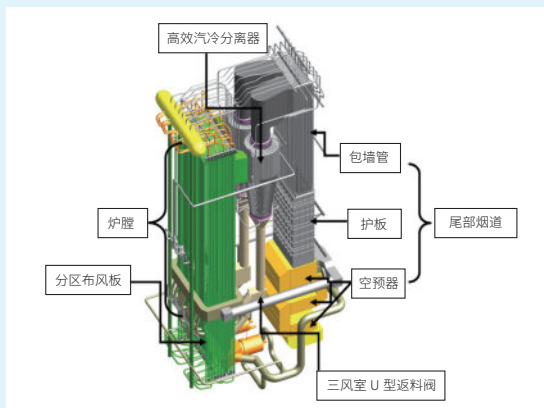
- ◆ 采用分级燃烧方式，防止局部富氧，降低  $\text{NO}_x$  原始排放；
- ◆ 炉内石灰石脱硫效率高， $\text{SO}_2$  达标排放。

##### ◎ 高效节能

- ◆ 着力降低  $q_2 \sim q_6$  各项损失，提高锅炉热效率；
- ◆ 减少一二次风机无效压头和返料风机风量，降低能耗。

##### ◎ 稳定可靠

- ◆ 选择合理的烟气流速，不同部位采用不同的防磨措施，保证锅炉长期稳定安全运行。



#### □ Technology

##### • Excellent environmental performance

- ◆ With the staged combustion method, local oxygen enrichment is avoided so as to reduce the original emission of  $\text{NO}_x$ .
- ◆ With limestone injection, the requirements on  $\text{SO}_2$  emission are satisfied.

##### • High efficiency and energy-saving

- ◆ Reduce  $q_2 \sim q_6$  heat loss and improve boiler thermal efficiency.
- ◆ Reduce the ineffective pressure head of PA and SAFans and the air volume of HP fluidizing fans, and substantially reduce energy consumption.

##### • Stable and reliable

- ◆ We select a reasonable flue gas velocity in our design and provide the targeted anti-erosion measures to ensure a long-term, stable and safe operation of the boiler.



山东临沂电厂低氮  $2 \times 130\text{t/h}$  CFB、 $2 \times 260\text{t/h}$  CFB 项目（2015 年投运）  
 $2 \times 130\text{t/h}$  CFB boiler and  $2 \times 260\text{t/h}$  CFB boiler of Linyi project in Shandong



沈阳金山 745t/h 高温超高压带中间再热 CFB（2015 年投运）

745t/h high temperature ultra high pressure CFB with intermediate reheat of Shenyang Jinshan (put into operation in 2015)



## 节能环保型燃煤锅炉 COAL-FIRED BOILER

### ▼ 煤粉锅炉 PC Boiler

华光环能自上世纪 70 年代开始研制第一台 25MW 中温中压煤粉锅炉，结合自身多年的经验积累，可以为用户量身定制，提供创新性的煤粉炉产品，在行业内具有一定的影响力。



蒸发量：50 -1220t/h

压力参数：17.5MPa 及以下

燃料：贫煤、烟煤、褐煤等各类煤种

业绩：近 500 台套

WHEE developed the first 25MW PC of medium pressure and temperature parameters in 1970s. With years of experiences, we are capable of supplying tailor-made and innovative PCs to the client and has gained influence in the industry.

**Steam capacity:** 50-1220t/h

**Pressure:** 17.5MPa and below

**Fuel:** lean coal, bituminous coal, lignite and other kinds of coal

**Reference projects:** nearly 500 sets



延安能化 4×320t/h 高温高压煤粉锅炉（2018 年投运）

4×320t/h high temperature and high pressure pulverized coal boiler of Yan'an Energy Chemical Co., Ltd.(put into operation in 2018)



利华益 480t/h 高温高压煤粉炉（2018 年投运）

480t/h high temperature and high pressure pulverized coal boiler of lihuayi (put into operation in 2018)

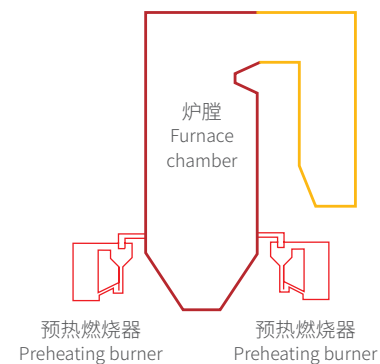
### □ 技术优势

- ◎ 具备多种燃低灰融点煤的结焦解决方案。
- ◎ 具备燃煤（高硫、多灰）高温腐蚀和低温腐蚀的解决方案。
- ◎ 拥有多种低氮燃烧技术。
- ◎ 宽负荷脱硝技术，是国内首创锅炉脱硝一体化布置方式。

### □ Technology

- multiple solutions preventing the furnace from coking.
- Solutions to the problems of high temperature corrosion and low temperature corrosion for coal with high sulfur and ash content.
- Various low NO<sub>x</sub> combustion technologies.
- A proper flue gas temperate window is selected for DeNO<sub>x</sub> under a wide range of boiler load; developed the first integrated boiler DeNO<sub>x</sub> arrangement in China.

### □ 煤粉预燃技术 Pulverized Coal Precombustion Technology



燃烧方式 Combustion mode	氮氧化物排放 Nitrogen oxide emissio(mg/m³)	负荷调节范围 Range of load regulation
煤粉预热燃烧 Precombustion	<150	15%~110%
常规煤粉炉 General	300~600	40%~110%



山东魏桥 350MW（1190t/h）亚临界燃贫煤锅炉（2013 年投运）

Shandong Weiqiao 350MW (1190t/h)  
Sub-critical lean coal burning boiler (put into operation in 2013)



75t/h 工业煤粉锅炉（煤粉预燃技术应用项目）

75t/h industrial pulverized coal boiler (pulverized coal precombustion technology application project)

## 工业锅炉 INDUSTRIAL BOILER

### ▼ 无锡华光工业锅炉有限公司 Wuxi Huaguang Industrial Boiler Co.,Ltd.

华光工锅是由华光环能控股组建的专业生产中小电站锅炉、热水锅炉、工业锅炉、燃油气锅炉、特种燃料锅炉以及锅炉烟气改造设备的股份制企业。主要产品有 6-50MW 中小电站锅炉，7M-168MW 大型热水锅炉，各种等级燃气锅炉，冶金、化工、固废、危废等余热锅炉，20-50MW 燃气轮机余热锅炉，各种等级的生物质锅炉和垃圾锅炉，各种需求的锅炉烟气改造设备等。



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No.197,Xixie Road,Wuxi,P.R.China  
电话 Tel: (86-510) 8858 8905  
网站 Web: <http://www.wuxigl.com>

Wuxi Huaguang Industrial Boiler Co.,Ltd. is a share-holding enterprise formed by WHEE, specializing in the production of small and medium-sized power plant boiler, hot water boiler, industrial boiler, oil/gas boiler, special fuel boilers and boiler flue gas treatment modification equipment. The main products includes 6-50MW small and medium-sized power plant boiler, 7M-168MW large hot water boiler, gas fired boilers of various capacities, waste heat boiler for metallurgy, chemical industry, solid waste and hazardous waste, 20-50MW HRSGs, biomass boilers and waste boilers of various capacities, and various needs of boiler flue gas treatment modification equipment, etc.

### ▼ 危废锅炉 Hazardous Waste (HW) Boiler

公司可为危废处置项目配套提供危废余热锅炉。  
We design, manufacture and supply the boilers for HW disposal projects.

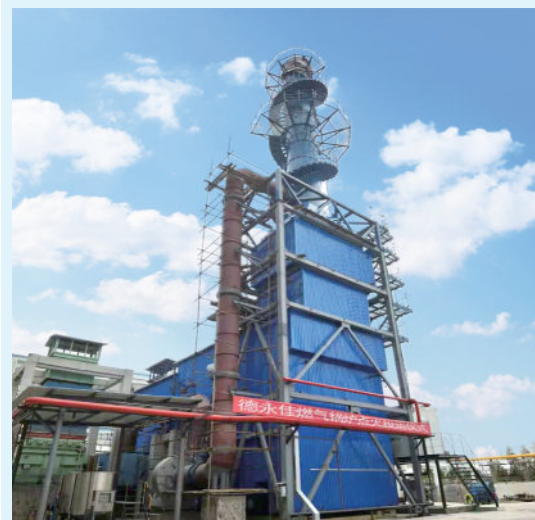


**300t/d 危废（医疗垃圾）焚烧处理系统**  
300t/d hazardous waste (medical waste) incineration treatment system



**50t/d 危废（医疗垃圾）焚烧处理系统**  
50t/d hazardous waste (medical waste) incineration treatment system

### ▼ 燃气 / 油锅炉 Gas/Oil Boiler



**角管式燃气锅炉**  
Corner tube gas boiler



**D 型布置燃气炉**  
Gas boiler of D-shape arrangement

### ▼ 生物质锅炉 Biomass WCVG boiler



**福建圣新能源股份有限公司 75 吨鸡粪锅炉（2019 年投运）**  
75t chicken manure boiler of Fujian Shengxin Energy Co., Ltd. (put into operation in 2019)

### ▼ 燃煤链条炉排锅炉 Coal-fired Chain Grate Boiler



**泗水 3×75t/h 链条燃煤锅炉**  
Surabaya 3×75t/h chain coal-fired boiler



## 03 GENERAL CONTRACTING 工程总包

### 无锡国联华光电站工程有限公司

Wuxi Guolian Huaguang Power Engineering Co.,Ltd.

华光电站 (英文简写 GHPE) 是无锡华光环能能源集团股份有限公司 (上市公司代码 600475) 控股的以电站工程建设及服务为主体的综合性工程公司, 与华光环能能源 (西安) 设计研究院共享资源、共用平台, 集工程设计、设备采购、施工建设、项目管理、运营服务为一体, 是国内同时拥有电力设计院、锅炉制造厂、汽 (电) 机制造厂、电厂为平台的电力建设工程公司之一。

公司主要从事电站建设工程总承包和设备成套、太阳能电站、环保节能工程、锅炉新技术改造等总承包和设备制造, 广泛服务于电力、化工、煤矿、钢铁、造纸、石化、市政、新能源等领域。

公司以华光环能为生产制造基地, 是华光环能海外市场的窗口, 同时承担华光环能在用产品的备品备件及其服务。

公司恪守“诚信、责任、专业、超越”的核心价值观, 以核心技术为基础, 以优化设计为手段, 以系统集成成为优势, 以项目管理为保证, 愿竭诚为用户提供优质的产品和服务。

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电话 Tel: (86-510) 8522 5922  
网址 Web: <http://www.ghpepower.com>

Wuxi Guolian Huaguang Power Engineering Co.,Ltd. (GHPE) is a holding subsidiary of Wuxi Huaguang Environment & Energy Group Co.,Ltd. (with the listed company code of 600475). As a comprehensive engineering company dedicated to power station engineering construction and services, GHPE shares resources and platform with Huaguang Environment & Energy (XI'AN) Design & Research Institute Co., Ltd., and has formed a business configuration integrating project design, equipment procurement, construction, project management, operation and service. GHPE is one of the Chinese power construction engineering companies who owns the platform integrating the power design institute, the boiler/ turbine (generator) manufacturer and the power plants.

GHPE is principally engaged in power plant EPC project and complete set of equipments supply, as well as EPC project and equipment manufactures for solar power plant, environmental protection and energy saving project, and boiler reform with new technology. GHPE serves in broad fields such as power plant, chemical industry, coal mine, iron & steel, paper mill, petrochemical industry, municipal infrastructure and new energy project etc.

Taking WHEE as the manufacture base, GHPE is the window of WHEE for the oversea market, meanwhile, we also supply spare parts and service for the existing boilers supplied by WHEE.

GHPE adheres to the core values of "Integrity, Responsibility, Professionalism and Transcendence", based on our core technology, we continuously optimized our design, improve our advantage in system integration, and strengthen our project management mechanism so as to provide our clients with high quality products and services wholeheartedly.

### 华光环保能源 (西安) 设计研究院有限公司

Huaguang Environment & Energy (XI'AN) Design & Research Institute Co., Ltd.

华光环保能源 (西安) 设计研究院有限公司 (原西安大唐电力设计研究院有限公司) 成立于 1991 年, 其前身是“西安西北电力设计院老年专家设计研究所”, 2004 年经国家建设部批准并颁发了电力行业乙级设计资质证书, 现拥有电力行业 (火电、变电、送电、风电、新能源发电) 乙级资质; 环境工程 (水污染、大气污染防治工程、固体废物处理处置工程) 乙级资质; 市政热力乙级资质; 市政环境卫生工程乙级资质; 建筑行业 (建筑工程) 丙级资质; 照明工程设计专项 (照明工程设计) 乙级资质; 特种设备设计许可证 (压力管道); ISO9001、ISO14001、OHSAS18001 认证。

公司坚持“精心设计, 诚信服务”的宗旨, 具有单机容量 135MW 及以下等级发电厂、220KV 及以下电压等级的送变电工程设计与工程总承包服务等资格; 擅长在设计资格范围内的火力发电厂工程、热电联产工程、城市供热热网工程、送变电工程的设计、技术咨询、电力设备成套销售、工程总承包等业务; 并可承担锅炉、冶金、化工、水泥等行业含有硫化物、氮氧化物、粉尘、脱白、可挥发有机物等烟气净化处理、环保工程的技术开发、系统设计、咨询服务等。

无锡国联华光电站工程有限公司与华光环保能源 (西安) 设计研究院有限公司“一套班子, 两块牌子”, 共享资源、共用平台, 是国内外总承包项目的承接载体。

Huaguang Environment & Energy (XI'AN) Design & Research Institute Co., Ltd. (former Xi'an Datang Power Design and research Institute Co.,Ltd.) was established in 1991. Its predecessor was Xi'an Northwest Power Design Institute - Design Institute of Elderly Experts. It was approved by national Ministry of Construction in 2004 and obtained the power industry Class B design qualification certificate. Now, it has power industry (thermal power, power transformation, power transmission, wind power, new energy power generation) level B qualification, environmental project (water pollution, air pollution control project, solid waste treatment and disposal project) level B qualification, municipal heating level B qualification, municipal environmental sanitation engineering level B qualification, construction industry (construction project) level C qualification; professional lighting engineering design (Lighting engineering design) Class B qualification, special equipment design license (pressure pipe), and ISO9001, ISO14001, OHSAS18001 certifications. The company adheres to the core value of "Elaborate Design and Faithful Service". It has the qualification for design and EPC service of power plants with unit capacity of 135MW and below, and power transmission and transformation projects with capacity of 220KV and below. The institute is specialized in thermal power plant project, cogeneration project, urban heating network project, power transmission and transformation project design, technical consultation, complete set of power equipment sales, project EPC and other businesses within our design qualification scope. We can also undertake the technical development, system design and consulting services of flue gas cleaning treatment and environmental protection engineering in boiler, metallurgy, chemical industry, cement and other industries containing sulfide, nitrogen oxide, dust, plume, volatile organic matter and so on. Wuxi Guolian Huaguang Power Engineering Co., Ltd. and Huaguang Environment & Energy (XI'AN) Design & Research Institute Co., Ltd. share resources and platforms with "one team under two names", and undertake EPC projects both at home and abroad.



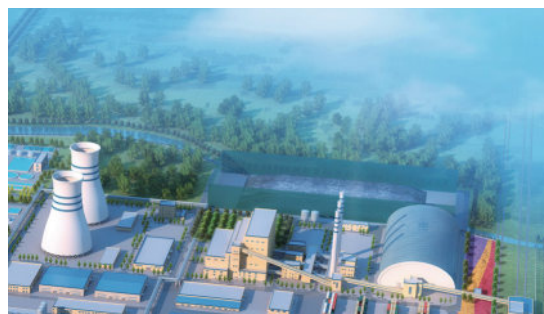


**能源工程**  
ENERGY ENGINEERING

▼ **传统电站 - 燃煤电站总包** EPC of Coal-fired Power Plant >>>

华光传统能源 EPC 总包项目业绩众多，利用主要设备制造厂的优势，保证设备质量，缩短交货工期，为用户提供一流设备。深耕于中国东北地区、东南亚地区，在该地区形成了良好的口碑，在电站建设、锅炉岛建设及电厂系统建设上有较强的实力，先后承担的海外项目有：印尼 DUMAI  $3 \times 130\text{t/h}$  CFB+ $2 \times \text{C16MW}$ 、印尼斯玛特  $2 \times 100\text{t/h}$  CFB+ $2 \times \text{C10MW}$ 、Apical 集团印尼 KRN3  $2 \times 150\text{t/h} + 2 \times \text{C25MW}$  电厂建设；为多个海外集团开发了项目。

WHEE owns a great many references in traditional energy projects, as a manufacturer of power plant major equipment, we provide the first-class products with competitive quality and delivery time. For a long time, we have a large number of reference projects in Northeast China and Southeast Asia and formed a good reputation and have formed a strong capacity in construction of power plant, boiler island and power plant system, our overseas projects include: Indonesian  $3 \times 130\text{t/h}$  CFB+ $2 \times \text{C16MW}$ ,  $2 \times 100\text{t/h}$  CFB+ $2 \times \text{C10MW}$ , and  $2 \times 150\text{t/h} + 2 \times \text{C25MW}$  power plant. We have developed projects for many overseas enterprises.



**黑龙江象屿金谷  $3 \times 260\text{t/h} + 2 \times \text{CB45}$  EPC 项目 (2019 年投运)**  
EPC project of  $3 \times 260\text{t/h} + 2 \times \text{CB45}$  project of Heilongjiang Suihua Xiangyu Jingu Biochemical Technology Co., Ltd. (put into operation in October 2019)



**新加坡金鹰集团印尼 DUMAI  $3 \times 130\text{t/h}$  CFB+  $3 \times \text{C16MW}$  EPC 项目**  
 $3 \times 130\text{t/h}$  CFB+  $3 \times \text{C16MW}$  Indonesia Dumai  $2 \times 16\text{MW}$  power station EPC project of Singapore Golden Eagle Group



**柬埔寨西港热电  $2 \times 90\text{t/h}$  CFB+ $1 \times \text{CC15MW}$  EPC 项目**  
Cambodia Xigang Thermal Power Project Phase I  $2 \times 90\text{t/h}$  CFB boiler + $1 \times \text{CC15MW}$

▼ **固废新能源 - 垃圾发电站** Garbage Power Plant >>>

华光电站依托华光环能在垃圾焚烧锅炉的技术优势，发展垃圾焚烧发电工程 EPC 总承包业务，主要包括焚烧炉预热炉、垃圾预处理、渗滤液处理、烟气净化系统等分系统。

Taking advantage of the advanced WTE boiler technology of WHEE, GHPE develops the EPC business of waste power projects, mainly including the subsystems of waste incinerator, WTE boiler, waste pretreatment, leachate treatment, flue gas cleaning etc.



**公主岭德联  $1 \times 400\text{t/d}$  垃圾焚烧炉 + $1 \times \text{N6MW}$  EPC 项目 (2016 年 4 月投运)**  
 $1 \times 400\text{t/d}$  waste incinerator +  $1 \times \text{N6MW}$  steam turbine generator unit project of Gongzhuling Delian (put into operation in April 2016)



**无锡惠联  $2 \times 850\text{t/d}$  机械炉排垃圾焚烧炉 + $2 \times 4.0\text{MPa}$  中温中压余热锅炉 + $2 \times \text{C18MW} + 2 \times 20\text{MW}$  发电机组项目 (2021 年投运)**  
Wuxi Huilian  $2 \times 850\text{t/d}$  Mechanical Furnace Waste incinerator + $2 \times 4.0\text{MPa}$  Medium-temperature and medium-pressure waste heat boiler + $2 \times \text{C18MW} + 2 \times 20\text{MW}$  generator set Project (put into operation in 2021)



**江西乐联  $400\text{t/d}$  垃圾焚烧锅炉 + $1 \times \text{N7.5MW}$  EPC 项目 (2020 年投运)**  
Jiangxi Lelian  $400\text{t/d}$  Waste Incineration Boiler + $1 \times \text{N7.5MW}$  EPC Project (Put into operation in 2020)



能源工程  
ENERGY ENGINEERING

▼ 新能源电站 - 光伏发电站 PV Power Plant

光伏发电是利用半导体界面的光生伏特效应而将光能直接转变为电能的一种技术，国联华光电站依托华光环能的全产业链优势，利用自身资质技术及工程管理优势，致力于为各类客户提供光伏能源一站式综合服务。聚焦开发、承建大型地面式电站、分布式电站、光伏储能系统、光伏农业大棚、渔光互补、海外 EPC 等光伏工程项目，业务范围覆盖国内 18 个省以及海外近 10 个国家。

Photovoltaic power generation is a technology that directly converts light energy into electric energy by using the photovoltaic effect of semiconductor interface. Taking advantage of the overall industrial chain of WHEE, with our qualifications and our experiences in technology and engineering project management, GHPE is committed to providing all kinds of customers with one-stop comprehensive services of photovoltaic energy. We focus on the development and construction of large-scale ground power stations, distributed power stations, photovoltaic energy storage systems, photovoltaic agricultural greenhouses, fishery-solar hybrid project, overseas EPC and other photovoltaic engineering projects, covering 18 provinces in China and nearly 10 countries abroad.



广东海亮分布式光伏发电项目 EPC 工程总承包  
(2020 年 11 月投运)

EPC of distributed photovoltaic power generation project of Guangdong Hailiang (put into operation in November 2020)



滩涂漂浮光伏电站 65MW

Sui xi floating photovoltaic power station 65MW

▼ 新能源电站 - 生物质能发电站 Biomass-fired Power Plant

华光电站依托华光环能振动炉排生物质焚烧技术，对物料破碎，物料输送有一定的经验，目前可用于发电的生物质有：废木材、农作物秸秆、甘蔗渣、农林废弃物、稻壳等。

With the Biomass WCVG boiler technology of WHEE, GHPE owns rich experiences in crushing and conveying of biomass material. At present, our experienced biomass fuel for power generation include: waste wood, crop straw, bagasse, agricultural and forestry waste, rice husk, etc.



黑龙江鹏程 35t/h CFB 稻壳炉 +N9MW (2014 年投运)

Heilongjiang Pengcheng biomass power generation EPC project  
35t/h CFB rice husk furnace + N9MW (put into operation in 2014)



巴基斯坦 CHINIOT POWER LTD 155t/h 甘蔗渣炉排锅炉岛总包项目

CHINIOT POWER LTD, Pakistan  
155t/h Bagasse grate boiler Island general contract Project



吉林清龙米业 1×35t/h CFB+1×N6MW  
1×35t/h CFB+1×N6MW EPC 项目

Jilin Qinglong Rice 1×35t/h CFB+1×N6MW  
1×35t/h CFB+1×N6MW EPC project

## 环境工程（烟气治理） Environmental Engineering (Flue Gas Treatment)

华光电站环境事业部致力于锅炉行业烟气超净排放的业务领域，在非电行业的尾部烟气处置是细分领域的先行者，可承担锅炉、冶金、化工、水泥等行业含有硫化物、氮氧化物、粉尘、脱白、可挥发有机物等烟气净化处理、环保工程的技术开发、系统设计、咨询服务等。同时，承接流化床锅炉、煤粉炉的低氮改造、垃圾焚烧炉烟气净化、燃气轮机余热炉的脱硝及余热利用工程，也有着出色的业绩。

### 根据不同的业主单位、烟气条件及排放要求，可量身定做最适合的烟气治理方案：

**脱硝：**SNCR、高温 SCR、SNCR+SCR 混合法以及低温 SCR。

**脱硫：**石灰石石膏法、氨法、双（单）碱法、干法及半干法脱硫等。

**除尘：**布袋、电袋、湿电及管式除尘等。

**其他：**脱酸、活性炭吸附、(m) GGH 及 VOCs 治理等。

The environmental division of GHPE is committed to the field of ultra clean emission of flue gas in the boiler industry, and we are the pioneer of the flue gas treatment in the subdivided field of non-power industry . We provide the flue gas treatment , technical development, system design and consulting service on desulfurization, denitration, dust removal, wet plume elimination and volatile organic matter removal for boiler, metallurgy, chemical industry, cement etc. We also have a plenty of reference projects on modification of CFB and PC boilers, flue gas cleaning of WTE boiler, de-NO<sub>x</sub> of HRSG and waste heat utilization engineering projects.

### Tailor-made flue gas treatment solutions are provided based on the requirements of the clients, the flue gas conditions and emission requirements:

**Denitration:** SNCR, high temperature SCR, SNCR + SCR mixed method and low temperature SCR.

**Desulfurization:** limestone gypsum method, ammonia method, double (single) alkali method, dry method, and semi dry method.

**Dust removal:** cloth bag, electric bag, wet electric, and tubular dust removal, etc.

**Others:** deacidification, activated carbon adsorption, (m) GGH and VOCs treatment, etc.

## ▼ 非电行业尾部烟气处置 Exhaust Flue Gas Disposal in Non-power Industry



常州武进污水处理厂生活污水焚烧锅炉脱硫脱硝项目

Desulfurization and denitrification project of domestic sludge incineration boiler for Sewage Treatment Plant in Changzhou Wujin



澠池东能固废利用回转窑烟气除水脱硝项目

Water removal and denitrification project of solid waste utilization rotary kiln flue gas of Mianchi Dongneng

## ▼ 锅炉烟气处置 Boiler Flue Gas Treatment



北京京桥余热锅炉降低烟气 NO<sub>x</sub> 排放改造工程

Waste Heat Boiler Renovation Project on Flue Gas NO<sub>x</sub> Reduction for Beijing Jingqiao



亳州瑞能 3×75t/h 循环流化床锅炉脱硝超低排放改造项目

Denitration Ultra-low Emission Modification Project on 3×75t/h Circulating Fluidized Bed Boiler for Bozhou Ruineng



## 04 LIFECYCLE SERVICE 全生命周期服务

电站的发电及供热离不开设备稳定高效的运行，华光环能作为长期致力于为业主提供全套能源解决方案的供应商更是把这一服务作为我们售后的重点。

结合华光环能的设备制造优势及电厂总包运维经验，我司建立了完善的售后服务体系，服务内容涵盖锅炉本体及锅炉岛、电厂的备品备件服务，电厂的保运及运维，电厂改造等。

The power and heat supplying of the power plant requires a stable and efficient operation. WHEE, as an overall energy solution supplier, has always focused on efficiency and stability.

With the experiences in equipment fabrication, power plant EPC, maintenance and operation, we have established a comprehensive after-sales system, our services cover the supplying of the spare parts for boiler proper, boiler island and power plant, the power plant operation and maintenance and the power plant modification, etc.

### ▼ 技术改造 Equipment Transformation



华光环能致力于电厂节能环保工程的技术改造，随着世界各国对节能减排及环保要求的提高，实施锅炉改造势在必行，公司依托多年的从业经验和强大的设计能力提供各类锅炉技改业务。

在锅炉的技术改造中，根据用户实际要求，在确保锅炉性能的基础上，为用户尽可能的减少改造成本。提高锅炉出力，提升锅炉效率，降低 NO<sub>x</sub> 排放，并能掺烧各类燃料，提高经济效益，满足各国环保要求。

WHEE is committed to the energy-saving and environmental-protection technical transformation of the power plant. As the requirements on Energy saving and emission reduction getting increasingly stringent all over the world, boiler transformation has become necessary. With decades of experiences and strong design ability, WHEE provides transformation services for various kinds of boilers.

We are ready to provide optimized technical transformation solutions according to our clients' practical requirements, and to minimize the transformation cost based on improved boiler performance, including increasing boiler output or efficiency, reducing NO<sub>x</sub> emission, mixing with various fuels, and increasing economic incomes for the power plant, in the meanwhile meeting the environmental protection requirements of different countries.



#### 宁波久丰 150t/h 次高温次高压循环流化床锅炉改 170t/h 高温高压循环流化床锅炉

150t/h high temperature and high pressure circulating fluidized bed boiler to 170t/h high temperature and high pressure CFB in Ningbo Jiufeng



#### 富春环保 500t/d 流化床垃圾焚烧炉改造，降低 CO 到 100mg/m<sup>3</sup> 以下

The 500t/d fluidized bed waste incinerator was reformed to reduce CO to less than 100mg/m<sup>3</sup> in Fuchun environmental protection



#### 光大环保能源（无锡）有限公司 500t/d 垃圾炉扩容改造项目

500t/d garbage furnace expansion and reconstruction project of Everbright environmental protection energy (Wuxi) Co., Ltd



#### 晋煤金石 4×260t/h 锅炉低氮燃烧和 SNCR、SCR 改造项目

4×260t/h boiler low nitrogen combustion and SNCR, SCR transformation project in Jinmei Jinshi

## ▼ 备品备件 Spare Parts

华光环能自建厂以来承接各类备品备件，累计为众多客户解决了备件问题。针对华光品牌的锅炉、设备成套、电厂总包项目，公司以优惠的价格、可靠的质量、及时的供货，提供全电厂备品备件服务。

WHEE has started various spare parts service since founding of the company, we have served many clients for the issue of spare parts. We provide the spare parts service for the overall power plant, with favorable price, reliable quality and timely delivery manner, include the boilers, the complete set of equipment and the EPC projects of our brand.



## ▼ 运行维护 Operation & Maintenance

- **保运：**结合我司众多的总包及运维经验，在电厂建成后，我司可提供完备的运行及检修人员来保证电厂进入正常生产运行状态，并针对电厂运行人员进行实时培训，周期约为 3 个月至 1 年。
- **运维：**针对华光总包的和使用华光锅炉的电厂，我司可提供运行及维护服务。华光环能拥有装备制造及工程总包优势，可为业主提供电厂正常运行服务及提供定期检查、小修及大修服务，保证业主拥有一个高效、节能、安全运营的电厂。

- **Operation:** With our various EPC and operation and maintenance experience, after the completion of the power plant, we provide the operation and maintenance personnel to ensure that the power plant enters the normal production and operation state, and provide real-time training for the operation personnel of the power plant, with a period of about 3 months to 1 year.
- **Operation & Maintenance:** WHEE is able to provide the owners with common operation services and regular inspections, from minor repair to overhaul, so as to help the owner maintaining an efficient, energy-saving, and secured-running power plant.



## LOW CARBON NEW TECHNOLOGY

# 双碳新技术 05

## ▼ 高压电极锅炉 Electrode Boiler

### □ 华光环能电极锅炉形式 Types



ESD 型：

<b>电压 (Voltage):</b> 6-36KV
<b>输出功率 (Output power):</b> 2-90MW
<b>调节率 (Regulation):</b> 0-100%
<b>运行压力 (Operating pressure):</b> ≤ 25bar

EEH/EED 型：

<b>电压 (Voltage):</b> 6-25KV
<b>输出功率 (Output power):</b> 2-50MW
<b>调节率 (Regulation):</b> 10-100%
<b>运行压力 (Operating pressure):</b> ≤ 25bar



### □ 电极式热水锅炉

利用插入水中的电极对水进行直接加热。系统由电极式锅炉、循环水泵、定压补水设备以及换热器等设备组成。将电能转化成热能并将热能传递给介质。

The water is heated directly using electrodes inserted into the water. The system is composed of electrode boiler, circulating water pump, constant pressure water supply equipment and heat exchanger. Convert electrical energy into heat and transfer the heat energy to the medium.



### □ 技术 / 合作优势

- ◎ 电气部件可以耐受更高的电压，转换热效率达到 99% 以上。
- ◎ 50MW 及以上高功率大型电极锅炉是 Vapec 公司（技术合作公司）的拳头产品，被欧洲市场广泛认可，特别是严苛的德国热力公司。
- ◎ 对水的导电率要求更低，宽容度更大。
- ◎ 后期维护成本更低。
- ◎ 华光环能后期可提供长期维护。

### □ Technical / cooperation advantages

- Electrical components can withstand higher voltage, and the conversion thermal efficiency reaches more than 99%.
- High power large electrode boilers of 50MW and above are the flagship products of Vapec (technology partner of WHEE) and are widely accepted in the European market, especially by German thermal power plants.
- Lower requirements for water conductivity and greater tolerance for water.
- Lower maintenance cost after operation.
- WHEE provides long-term maintenance after operation.



## ▼ 碱性电解水制氢技术 Alkaline Electrolysis of Water Hydrogen Production Technologys

»»»

以氢氧化钾、氢氧化钠溶液作为电解质在直流电的作用下将水电解,生成氢气和氧气。

Potassium hydroxide and sodium hydroxide solutions are used as electrolytes to electrolyze water under the action of direct current to produce hydrogen and oxygen.



	AWE	PEM	AEM	SOE
电解质隔膜 electrolyte membrane	30%KOH 石棉膜 / 高分子聚合物膜 30%KOH asbestos film/polymer film	质子交换膜 Proton exchange membrane	阴离子交换膜 Anion exchange membrane	固体氧化物 Solid oxide
电流密度 Current density (A·cm <sup>-2</sup> )	< 0.8	1~4	1~2	0.2~0.4
电耗 / 效率 Power consumption/efficiency (kW·h·N <sup>-2</sup> ·m <sup>-3</sup> )	4.5~5.5	4.0~5.0	-	预期效率 (expected efficiency) ≈ 100%
工作温度 Working temperature(°C)	≤ 90	≤ 80	≤ 60	≥ 800
产氢纯度 Hydrogen purity	≥ 99.8%	≥ 99.99%	≥ 99.99%	-
相对设备体积 Relative equipment volume	1	~1/3	-	-
操作特征 Operating characteristics	需控制压差, 产气需脱碱 The pressure difference needs to be controlled and the gas needs to be dealkalized	快速启停, 仅水蒸气 Quick start and stop, only steam	快速启停, 仅水蒸气 Quick start and stop, only steam	启停不便, 仅水蒸气 Inconvenient to start and stop, only steam
可维护性 maintainability	强碱腐蚀性强 Strong alkali is corrosive	无腐蚀介质 Non-corrosive medium	无腐蚀介质 Non-corrosive medium	-
环保性 Environmental protection	无污染 No pollution	无污染 No pollution	无污染 No pollution	-
技术成熟度 Technology maturity	充分产业化 Full industrialization	初步商业化 Preliminary commercialization	实验室阶段 Laboratory phase	-
单机规模 Unit capacity/(N·m <sup>3</sup> ·h <sup>-1</sup> )	≤ 1300	≤ 200	-	-

### □ 技术优势

华光环能和大连理工大学建有“零碳工程技术研究中心”。

◎ 经验丰富: 在化学环境工程等领域的科研能力、技术成果国内领先。

◎ 技术先进: 技术团队包括多名院士、教授, 团队成员多次在国内外期刊发表论文, 获多项基金支持。

### □ Technical advantages

WHEE and Dalian University of Technology have established "Zero Carbon Engineering Technology Research Center".

• **Rich experience:** With strong R&D ability in chemical environmental engineering and other fields, the technology is leading in China.

• **Advanced technology:** the technical team includes a number of academicians and professors. The team members have published papers in domestic and foreign journals for many times and have been supported by a number of funds.

## ▼ 二氧化碳捕集利用与封存技术 CCUS Technology

»»»

将 CO<sub>2</sub> 从工业过程、能源利用或大气中分离出来, 直接加以利用或注入地层以实现 CO<sub>2</sub> 永久减排的过程。

The process of removing CO<sub>2</sub> from industrial processes, energy use, or the atmosphere and using it directly or injecting it into the formation to achieve permanent CO<sub>2</sub> reduction.

### □ 离子液法优势

- ◎ 吸收 CO<sub>2</sub> 的容量较大
- ◎ 溶剂损耗小
- ◎ 烟气适应范围广
- ◎ 效率高
- ◎ 成本低
- ◎ 不易氧化
- ◎ 安全稳定

### □ Ionic liquid method advantages

- Large capacity
- Low solvent loss
- Wide range of flue gas adaptation
- High efficiency
- Low cost
- Not easy oxidation
- Safe and stable



- ◆ 第一代 CO<sub>2</sub> 捕集技术  
(化学吸收法 - 醇胺法 CO<sub>2</sub> 捕集技术)
- ◆ 第二代 CO<sub>2</sub> 捕集技术  
(化学吸收法 - 离子液法 CO<sub>2</sub> 捕集技术)

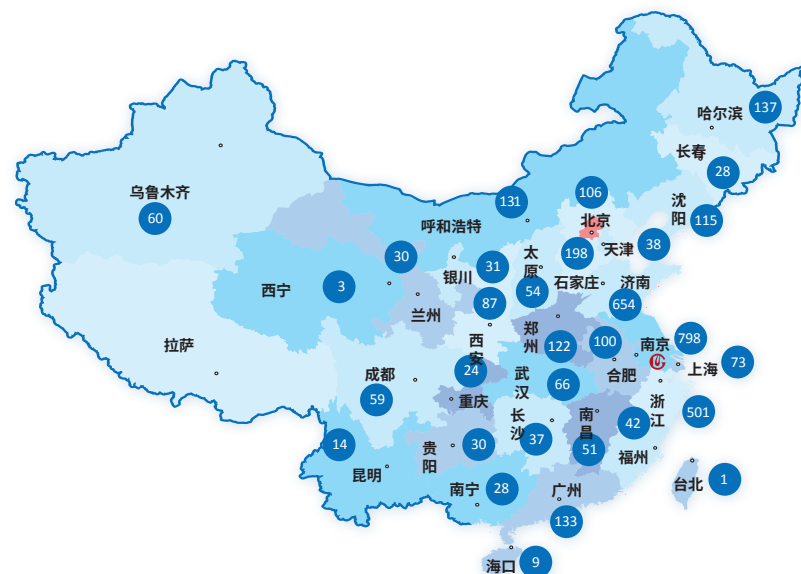
- ◆ First generation CO<sub>2</sub> capture technology  
(Chemical absorption method - alcohol-amine method CO<sub>2</sub> capture technology)
- ◆ Second-generation CO<sub>2</sub> capture technology  
(Chemical absorption method and ionic liquid method CO<sub>2</sub> capture technology)

## 06 MARKET DISTRIBUTION 市场分布



公司产品遍布 38 个国家、地区；品牌影响力深入东南亚地区

WHEE's products have covered 38 countries and regions; Brand influence goes deep into Southeast Asia area.



公司产品及服务覆盖全国 30 多个省、市、自治区，国内市场占有率名列前茅。

The company's products and services cover more than 30 provinces, cities and autonomous regions in China, and the domestic market share ranks first.

### ▼ 国际化 Globalization

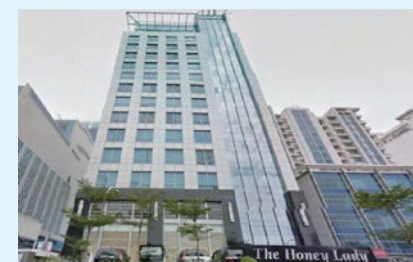
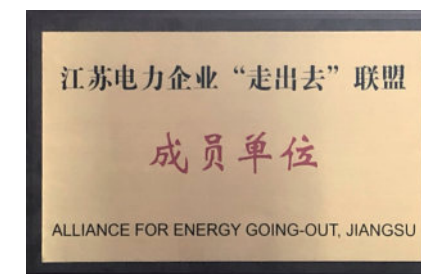
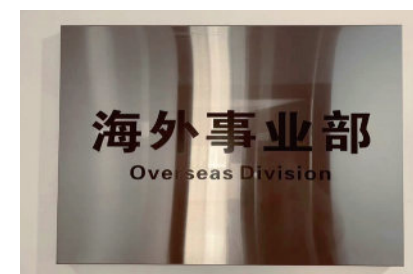


华光环能在“一带一路”全球可持续发展新机遇期，成立海外办事处，加快“走出去”布局，打造了越南海阳（4×300MW 循环流化床锅炉）、伊拉克巴士拉 10 台 9E 级余热锅炉、印度 371B、柬埔寨西港 EPC 等一批优质标杆项目，产品远销东南亚、西亚、非洲、南美洲等 38 个国家、地区。

华光环能海外事业部成立于 2021 年 12 月 30 日，整合了板块海外销售资源，承接了装备板块“十四五”深化国际化转型以及总包服务转型两大战略任务，是装备板块开展海外业务统一且唯一的窗口。

In virtue of the opportunity of the Belt and Road Policy, WHEE established the overseas office to accelerate our efforts to “Go Global”. We have completed many high quality model projects, including the 4×300 MW CFB Boilers in Haiduong, Vietnam; the 10×9E class HRSGs in Basra, Iraq; the 1×265t/h CFB boiler (371B) in India and the EPC project in West Port, Cambodia. Our products have been exported to 38 countries and regions in Southeast Asia, West Asia, Africa and South America.

On December 30, 2021, we established our Overseas Division. WHEE's Overseas Division integrates our overseas sales resources and undertakes two strategic tasks of our “14th Five-Year Plan”, i.e. international transformation and EPC service transformation. The Overseas Division is WHEE's sole window for all kinds of overseas business.



印尼办事处 Indonesia Office



▼ 重点项目 key projects



**越南海阳 4×1005t/h 项目实现了国内锅炉厂家在 100% 燃用越南 6B 无烟煤的大型循环流化床锅炉技术上零的突破，填补国内空白。**

The 4×1005t/h CFB boiler project in Haiduong, Vietnam: the first large CFB boiler project supplied by Chinese boiler manufacturer firing 100% Vietnam 6B anthracite.



**印尼振石项目 2×25t/h 燃气 + 2×N45MW**

The 2×25t/h gas boiler + 2×N45MW of Gebe power plant, Indonesia



**塞内加尔 IRS 20MW 项目**

The 1×20MW boiler of IRS project, Senegal



**印尼 INDORAMA PTIP 40MW 项目**

The 1×40MW boiler of Indorama PTIP project, Indonesia



**伊拉克 10×9E 项目由单循环改联合循环，主燃料为轻柴油，辅助燃料为重油，同时具备燃机满负荷时锅炉起炉能力，设有离线清洗系统。**

The 10×9E HRSG project in Iraq: the units are extended from simple cycle to combined cycle. The main fuel is light diesel oil and the auxiliary fuel is heavy oil. The HRSG, which can be started when GT load is 100%, is provided with off-line cleaning system.



# [ 07 MAIN CUSTOMERS 主要客户 ]

