燃气轮机余热锅炉
HRSG

垃圾焚烧锅炉
WTE Boiler

燃气锅炉
Gas Boiler

生物质锅炉
Biomass Boiler

循环流化床锅炉
CFB Boiler

污泥炉 / 污泥干化机
Sludge Boiler/Sludge Dryer

煤粉锅炉
PC Boiler

工程总包（传统项目）
EPC project(traditional energy)

工程总包（光伏）
EPC project (photovoltaic)

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(SH.600475)

共建清洁低碳生活

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Building A Clean and Low-Carbon Life Together

Achieve long-term development with prudent operation and surpass through ingenuity

华光环能循环流化床锅炉

技术与产品

WHEE CFB Technology & Product Brochure

无锡华光环保能源集团股份有限公司
WUXI HUAGUANG ENVIRONMENT & ENERGY GROUP CO ., LTD.

华光环能成立于 1958 年，前身为无锡锅炉厂，2000 年完成股份制改造，2003 年在上海证券交易所挂牌上市（股票代码 600475），2017 年完成重大资产重组。2020 年更名为“无锡华光环保能源集团股份有限公司”。

华光是江苏省首家既完成资产重组又实现员工持股和股权激励的大型国有控股上市公司。形成了“能源与环保领域的产业投资运营平台”的功能定位，以“共建清洁低碳生活”为企业使命，以“诚信、责任、专业、超越”为公司核心价值观，确立了成为“中国领先的环保能源综合服务商”的发展愿景。

公司是中国机械五百强、中国机械工业百强、中国分布式能源企业百强、中国工业行业排头兵企业。装备板块主营新能源类和传统能源类锅炉装备及总包：

- **传统能源类锅炉：**节能环保型燃煤锅炉（CFB+PC）。
- **新能源类锅炉：**零碳生物质发电锅炉、减碳固废发电锅炉。
- **清洁能源类锅炉：**低碳燃气—蒸汽联合循环余热锅炉（HRSG）。

截至目前累计研制投运环保发电装备达到近五千台套，分布国内各省，以及海外 38 个国家和地区。

WHEE (formerly Wuxi Huaguang Boiler Co., Ltd. 2000-2020) was known as Wuxi Boiler Works when established in 1958. We completed our shareholding reform in 2000, listed on Shanghai Stock Exchange in 2003 (SH. 600475), and completed major asset restructuring in 2017. We altered our name to "Wuxi Huaguang Environment & Energy Group Co., Ltd." in 2020.

WHEE is the first large state-owned listed company in Jiangsu Province to complete asset restructuring and realize employee stock ownership and equity incentive. We have formed the functional orientation of "industrial investment and operation platform in the field of energy and environmental protection". With "jointly building a clean and low-carbon life" as the corporate mission and "integrity, responsibility, professionalism and transcendence" as the company's core values, we establishes the development vision of becoming "China's leading comprehensive environmental protection and energy service provider".

WHEE have been awarded the titles of one of China's top 500 machinery enterprises, China's top 100 machinery industry enterprises, China's top 100 distributed energy enterprises and the leading enterprise of Chinese industry. Our equipment business sector is mainly engaged in design, manufacture supply and EPC of the boiler products in term of both new energy and traditional energy:

- **Traditional energy boilers:** energy-saving and environment-friendly coal-fired boilers (CFB + PC).
- **New energy boilers:** Zero Carbon biomass power generation boiler, carbon reduction solid waste power generation boiler.
- **Clean energy boiler:** low carbon gas steam combined cycle HRSG.

Up to now, nearly 5000 sets of environmental protection power equipment have been developed and put into operation, which are distributed in all provinces in China and 38 countries and regions overseas.

01 华光环能产品简介
WHEE Product Introduction

公司拥有全球领先的特种锅炉生产、检测、探伤设备仪器累计 2200 余台套，具备年产 3 万蒸吨产能，年产汽包数量全球第一。

WHEE owns the world's leading manufacturing, testing, flaw detection equipment and instruments of totaling 2,200 sets, with an annual production capacity of 30,000 t/h and the world's largest in the number of drums produced annually.

一、燃气轮机联合循环余热锅炉 Heat Recovery Steam Generator	同时拥有 B-H，卧式、立式 HRSG 技术，与 JC 业绩共享。 承担北京 5 个煤改气项目中的 4 个。 提供定制化的设备和服务 , 在世界范围内有近 700 台燃机余热锅炉业绩。 WHEE owns B-H, horizontal and vertical HRSG technology, sharing its performance with JC. Undertook 4 out of 5 coal-to-gas projects in Beijing. Provide customized design and services. Nearly 700 gas turbine waste heat boilers manufactured by WHEE are running worldwide.
二、循环流化床锅炉 Circulating Fluidized Bed Boiler	35t/h(6MW) ～ 480t/h(150MW) 循环流化床锅炉系列。 480t/h(150MW) ～ 745t/h(220MW) 超高压再热循环流化床锅炉系列。 745t/h(220MW) ～ 1142t/h(325MW) 亚临界再热循环流化床锅炉系列。 35t / h (6MW) - 480t / h (150MW) circulating fluidized bed boiler. 480t / h (150MW) - 745t / h (220MW) ultra-high pressure reheat circulating fluidized bed boiler. 745t / h (220MW) ～ 1142t / h (325MW) subcritical reheat circulating fluidized bed boiler.
三、煤粉锅炉 Pulverized Coal Boiler	75t/h(12MW) ～ 1217t/h(350MW) 中压、高压、超高压、亚临界煤粉锅炉系列。 75t / h (12MW) - 1217t / h (350MW) medium pressure, high pressure, ultra-high pressure and subcritical pulverized coal boiler.
四、生物质能发电锅炉 Biomass Energy Power Generation Boiler	开发了多种容量，不同参数的生物质能锅炉，燃料包括农作物秸秆、木本植物、稻壳、废木柴、建筑木板、废弃家具、锯木粉、砂光粉、糠醛渣、药渣、咖啡渣、甘蔗渣、棕榈壳、空果串、生物质造粒等。35t/h(6MW) ～ 150t/h(35MW) 中压、次高压、高压、超高压再热生物质能锅炉。 Biomass boilers with various capacities and parameters have been developed, burning natural fuels including crop straw, woody plants, rice husk, waste firewood, construction plank, waste furniture, sawdust, sanding powder, furfural residue, drug residue, coffee residue, bagasse, palm shell, empty fruit string, biomass granulation, etc. 35t / h (6MW) - 150t / h (35mW) medium pressure, sub-high pressure, high pressure and ultra-high pressure reheat biomass boiler.

五、垃圾焚烧发电锅炉 Waste Incineration Power Generation Boiler	形成了引进日立造船 L 型全系列、自主研发华光炉排全系列顺推式往复炉排和循环流化床等垃圾焚烧发电锅炉产品。 100t/d ～ 1000t/d 垃圾焚烧锅炉系列。 Different types of waste incineration boiler products have been formed, including the licenced Hitachi Shipbuilding L-type, independent developed smooth-push type reciprocating grate and CFB type with IP rights. 100t/d ～ 1000t/d waste incineration boiler series.
六、燃气锅炉 Gas Fired Boiler	燃用各类可燃气体，如天然气、高炉煤气、焦炉煤气、兰炭尾气、丙烷气及各类化工尾气等；油类燃料，如轻油、重油等。 容量范围 10-670t/h 压力参数：1.3MPa-18.7MPa Capable of applying various types of combustible gases, such as natural gas, blast furnace gas, coke oven gas, blue carbon exhaust, propane gas and various types of chemical tail gas, etc.; oil fuels, such as light oil, heavy oil, etc. Capacity range 10-670t/h Pressure parameter: 1.3MPa-18.7MPa

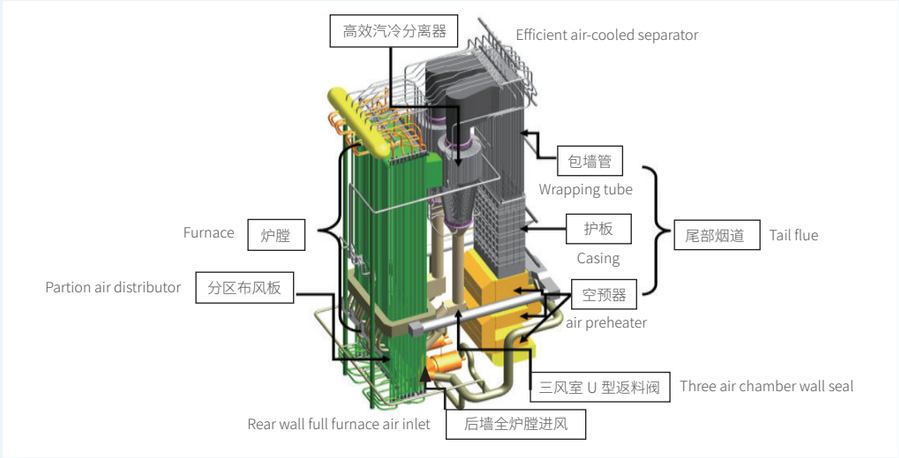
02 华光环能循环流化床锅炉概况
Overview of WHEE Circulating Fluidized Bed Boiler

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。自上世纪 80 年代末起步，目前已研制 2000 余台循环流化床锅炉，循环流化床市场占有率在行业内名列前茅。公司 CFB 产品主要分为低氮环保燃煤 CFB、固废 CFB 和生物质 CFB。

- **负荷 / 处理量：**35-1200t/h（燃煤 CFB）；100-2000t/d （固废 CFB）；35-260t/h(生物质 CFB)
- **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；纸渣、浆渣、污泥、布条、建筑木板、旧家具等工业固废，秸秆、稻壳、树皮、树枝、建筑废木料。
- **业绩：**累计生产 2000 余台套，出口约 250 台套

WHEE is one of the earliest enterprises to develop and research circulating fluidized bed boilers in China. Since the late 1980s, more than 2000 circulating fluidized bed boilers have been made by WHEE, and our market share of which is among the best in the industry. Our CFB products mainly include low nitrogen environmental protection coal-fired CFB,solid waste CFB and biomass CFB.

- **Load/Disposal Capacity:** 35-1200t/h (coal-fired CFB); 100-2000t/d (solid waste CFB); 35-260t/h (biomass CFB)
- **Pressure parameters:** 1.3-18.7MPa
- **Temperature parameters:** up to 571° C or higher
- **Fuel:** all types of coal such as bituminous coal, poor coal, anthracite, lignite, coal gangue, etc.; industrial solid waste such as paper slag, pulp slag, sludge, cloth, construction plank, old furniture, etc., straw, rice husk, bark, branches, construction waste wood.
- **Performance:** more than 2000 sets have been produced and around 250 sets have been exported.



（燃煤 CFB 三维图）3D Model of Coal-fired CFB

03 华光环能循环流化床锅炉优势
Advantages of WHEE CFB

◎ 技术优势 Technical advantages

- 1980 年进入 CFB 领域，与中科院、浙大产学研合作。
- 2006 年独家引进 FW 技术，其 CFB 全球占有率＞ 60%——经过技术沉淀，华光成为国内 CFB 技术领先者。
- CFB 为华光的主导和拳头产品。
- 华光是国内 CFB 最早开发覆盖燃料品种最齐全，种类最多的 CFB 制造商（首台垃圾 CFB、首台工业固废 CFB）。

- In 1980, WHEE entered the field of CFB and cooperated with the Chinese Academy of Sciences and Zhejiang University.
- In 2006, FW technology was exclusively introduced, and its CFB global share is bigger than 60%——After technical precipitation, WHEE has become a leader in domestic CFB technology.
- CFB is one of WHEE's best competitive products.
- WHEE is the first CFB manufacturer in China to develop CFB covering the most complete range of fuels (the first waste CFB and the first industrial solid waste CFB).

◎ 制造优势 Manufacturing advantages

- 华光的车间制造设备 90% 以上均为进口设备。
- 220-520t/hCFB 为华光的主导产品，所有受压部件均是本厂制造，不分包不外协，确保质量稳定可靠。公司积累了成熟的制造工艺经验和质保体系
- 华光年产汽包数量全世界最多。
- 地处长江三角区域，周边拥有全行业最丰富的材料供应商资源。
- 能够为客户提供更快更及时的交货速度。

- More than 90% of equipments applied in WHEE's workshop are imported or industry-leading ones.
- 220-520t/h CFB is the leading product of WHEE. All pressure parts are manufactured by our factory without subcontracting or outsourcing, so as to ensure stable and reliable quality. We have accumulated mature manufacturing process experience and quality assurance system.
- WHEE produces the largest number of steam drums in the world.
- WHEE is located in the Yangtze River Delta region and has the richest material supplier resources in the whole industry.
- WHEE can provide customers with faster and more timely delivery speed.

◎ 业绩优势 Performance advantages

- 华光在 220t/h-520t/hCFB 锅炉产品业绩上远超同行。
- 在 410-520t/h 系列进入时间上晚于主要竞争对手，但后来者居上，证明了市场对华光在该系列 CFB 锅炉综合性价比的高度认可。

- WHEE far exceeds its peers on the performance of 220t / h-520t / h CFB boiler products.
- WHEE's 410-520t/h series entered the market later than our major competitors, however, this line of products are now top-ranked in the market share, which proves that our CFB has earned recognition widely from our customers.

◎ 服务优势 Service Advantages

- 华光秉承“以客户为中心”宗旨、以全生命周期终身服务和高度快速响应服务为原则，以用户满意为标准
- 410 -520t/hCFB 锅炉为华光的主导产品，每一个该系列产品项目都作为公司重点项目，高度重视并享受最高级别的服务体系，确保项目保质保期圆满完成
- 公司售后服务已采用智能 CRM 客户服务系统，创新采用行业首个远程诊断智能服务系统，可以更好的为客户提供更优质、更及时的全生命周期服务

- WHEE adheres to the tenet of "customer-centric", the principle of life-long service and instant response service, and takes user satisfaction as our basic standard.
- 410-520t/h CFB boiler is the leading product of WHEE, each project of this series of products is regarded as the key project of WHEE, which is highly valued and enjoys the highest level of service system to ensure the successful completion of the project timely with quality.
- WHEE has adopted the intelligent CRM customer service system for after-sales service, and has creatively adopted intelligent diagnosis system among peers, so as to guarantee full life cycle services of high quality to our customers.

04 华光环能循环流化床锅炉亮点
Highlights of WHEE CFB

◎ 亮点一：低 NO_x 高效解决方案 Efficient Solutions for Low NO_x

早期低氮 CFB 技术存在不足
There's Inadequacy in early stage low nitrogen CFB technology

为满足 NO_x 排放，采用低床温、低氧量运行。
In order to meet NO_x emission, low bed temperature and low oxygen volume operation are adopted.

底渣、飞灰含碳量较高，影响锅炉热效率，燃料耗量上升。
The carbon content of bottom slag and fly ash is high, which affects the thermal efficiency of the boiler and increases the fuel consumption.

应用无锡华光 CFB 新技术
Application of WHEE's CFB technology

优化的一次风进风结构
Optimized primary air intake structure

优化的二次风布置
Optimized secondary air arrangement

在低 NO_x 的同时保证高效燃烧
Realization of low NOx and high efficient combustion

以一台蒸发量 260t/h 的 CFB 锅炉为例，效率每提升 1%，全生命周期可节省约 60000t 标准煤，约等于 8400 亩森林一年吸收的碳排放。

Taking a CFB boiler with the capacity of 260t/h as an example, for every 1% increase in efficiency, about 60,000t standard coal can be saved in the whole life cycle, which is nearly equal to the carbon emission absorbed by 8400 mu of forest in one year.

◎ 亮点二：宽负荷调节技术 Wide Load Range Regulation Technology

□ 保证燃烧稳定的措施 | Measures to ensure stable combustion

- ◆ 合理设计炉膛温度。
- ◆ 选择合理的一二次风配比。
- ◆ 选择适当的床压。

- · Reasonably design furnace temperature.
- · Scientifically decide on the ratio of primary & secondary air.
- · Choose appropriate bed pressure.

□ 保证低负荷运行性能的设计（循环灰量可调）| Design to ensure low load operation performance (adjustable circulating ash amount)

- ◆ 通过返料和排渣系统的优化设计，做到循环灰量可调，保证低负荷时有足够的床温。
- ◆ 锅炉可在 30%-110% BMCR 内稳定运行。

- · Through optimized design on material return system and slag discharge system, make sure the circulating ash amount is adjustable, and there's adequate bed temperature under low load.
- · The boiler can operate stably within 30%-110% BMCR.

□ 保证低负荷汽温的措施 | Measures to guarantee low load steam temperature

- ◆ 根据辐射过热器和对流过热器的汽温特性，合理配比屏式过热器（辐射）和尾部对流过热器。
- ◆ 采用汽冷分离器，可作为过热器的一部分。
- ◆ 过热器结构采用宽节距形式，减少积灰。

- · According to the steam temperature characteristics of radiation superheater and convection superheater, the platen superheater (radiation) and tail convection superheater shall be reasonably proportioned.
- · Steam-cooled separator can be used as a part of superheater.
- · The superheater structure adopts the form of wide pitch to reduce ash deposition.

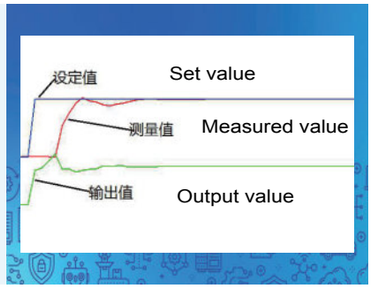
◎ 亮点三：智能化运维系统 Intelligent Operation and Maintenance System

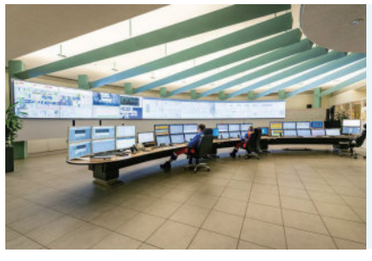
◆ 运维数字化、智能化升级：提升产品运行控制和诊断维护水平。

· Digitalization and intelligent upgrade of operation and maintenance: improve the level of product operation control and diagnostic maintenance.

◆ “一步到位”精确控制：在纯滞后时间内，将输出值提前动作到位，当测量值经过纯滞后时间后开始变化时，输出值即可回调，实现仿人化智能动作。

· 'One step' precise control: within the pure lag time, the output value is moved into place in advance, and when the measured value starts to change after the pure lag time, the output value can be called back to realize the humanized intelligent operation.





◆ CFB 智慧控制优化：供热 + 一次调频、床温控制、主汽温度控制、汽包水位控制、炉膛负压控制、脱硝优化。

· Optimization of CFB intelligent control: heat supply + primary frequency regulation, bed temperature control, main steam temperature control, drum water level control, furnace negative pressure control, denitration optimization.

◎ 亮点四：稳定高效、连续运行时间长 Stable and efficient, long continuous operation time

□ 保障锅炉连续运行时间≥ 8000 小时 | Ensure continuous operation time ≥ 8000 hours

- ◆ 降低炉膛烟气流速、采用先进防磨结构，降低炉膛区域和分离器区域的磨损
- ◆ 尾部受热面根据烟气及工质温度合理选择管材
- ◆ 顺畅的给料系统保证锅炉入煤连续稳定不堵塞
- ◆ 可靠的炉底排渣布置结构、合理的冷渣器形式、均匀布风结构来保证锅炉底部出渣安全可靠

- · By lowering the flow rate of furnace flue gas and adopting advanced anti-wear structure, reduce the wear of the furnace and separator.
- · The tail heating surface shall reasonably select pipes according to the temperature of flue gas and working medium.
- · Smooth feeding system ensures continuous and stable coal feeding without blockage.
- · Reliable bottom slag discharge layout, reasonable slag cooler and uniform air distribution structure help guarantee the safety and reliability of slag discharge at the bottom of the boiler.

菲律宾康塞普森电厂 135MW 锅炉无故障连续运行时间达到 500 天以上

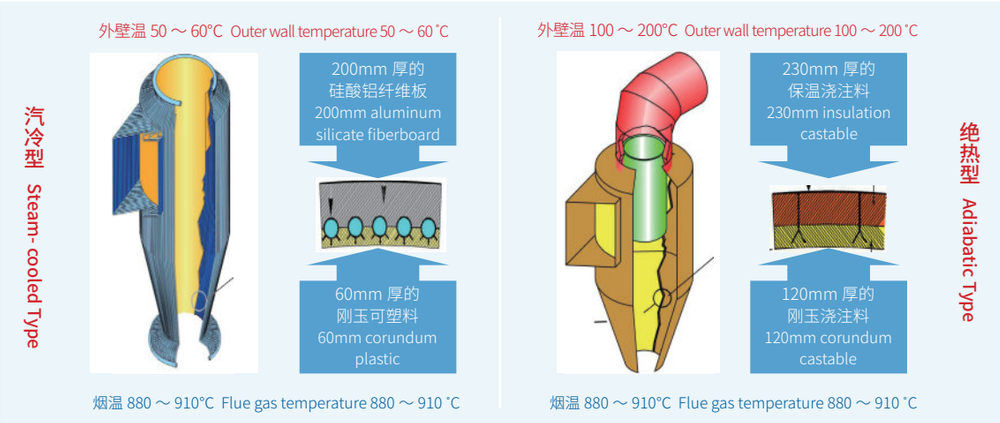
135MW CFB Power Plant in Concepson, Philippines has been continuously running for over 500 days, failure-free.

◎ 亮点五：高效汽冷分离 High efficient steam-cooled separation

- 分离效率高，达 99.8% 以上，使循环物料量得到可靠保证
- 合理的内部设计使其具有磨损轻、阻力低、不超温、可靠性好的特点
- 具有良好的导热性能，不易开裂和脱落，且现场施工方便，运行维护费用低
- 分离器热惯性小，锅炉启停和变负荷速度快
- 汽冷旋风分离器的吸热可有效控制旋风分离器内温度水平，避免结焦
- 悬吊结构，热膨胀问题容易解决好，布置简单
- 分离效率高，对细颗粒粒子的捕捉能力强，循环灰浓度高，燃烧充分
- 有效减小尾部飞灰量，飞灰粒径控制在适当范围内，减少尾部受热面磨损
- 运行维护费用低

- The separation efficiency is high, up to 99.8%, so that the circulated material quantity can be reliably guaranteed.
- Reasonable internal design helps to realize light wear, low resistance, non-overheating and high reliability.
- Our separator has good thermal conductivity, resistant of cracking and falling off; provide convenience for on-site construction, and has low operation and maintenance costs.
- The thermal inertia of the separator is small, and the boiler startup, shutdown and load change is speedy.
- The heat absorption of steam-cooled cyclone separator is able to effectively control the temperature in the cyclone separator and avoid coking.
- Suspension structure is easy to arrange and makes it easy to solve the problem of thermal expansion.
- High separation efficiency, strong ability to capture fine particles, high circulating ash concentration and sufficient combustion.
- Effectively reduce the amount of fly ash at the tail, control the particle size of fly ash within an appropriate range, and reduce the wear of the tail heating surface.
- Lower operation and maintenance costs.

□ 汽冷分离器与绝热分离器的对比 | Comparison between the steam-cooled separator and adiabatic separator



汽冷分离器外壁温度低，所以散热损失小（~0.3% 差异）
The outer wall temperature of the steam-cooled separator is low, so the heat dissipation loss is small (~0.3% difference)

◎ 汽冷型分离器与绝热型分离器对比 The comparison between steam-cooled type and adiabatic type

项目 Item	汽冷型 Steam- cooled Type	绝热型 Adiabatic Type
厂内制造工艺 Manufacturing technique	膜式结构 Membrane structure	钢板卷制 Rolled steel plate
生产成本 Manufacturing cost	厂内整体制造且焊上密排销钉、完成后扁钢处切开分片出厂（运输尺寸限制）。由于结构相对复杂，每台成本比绝热型略高。 It shall be manufactured in the factory as a whole and welded with closely spaced pins. After completion, it shall be cut into several pieces at the flat steel (transportation size limit). The manufacturing cost of each set is relatively higher than that of insulation one because of its complex structure.	钢板卷制、工艺简单、制造成本低、均需工地现场制作 Steel plate rolling, simple process, low manufacturing cost, all need to be made on site
安装成本 Installation cost	现场将分片沿扁钢缝拼接，工地工作量小、安装成本低 The flat steel joint will be spliced in pieces on site, so the workload on the site is small and the installation cost is low	安装成本高 High installation cost on the site
安装周期 Installation period	2 人 2 天可完成拼对 Two people can complete the matching in two days	20 天拼对工作量 20 day alignment workload
现场安装 Field erection	方便、时间短 Convenient and short time	复杂、时间长 Complex and time-consuming
组装成型 Assembly molding	符合图纸尺寸 Conform to drawing size	偏离图纸尺寸 Deviation from drawing size
筒内耐火材料 Refractory in cylinder	内衬 50mm Lining 50mm	内衬 350mm Lining 350mm
耐火材料施工 Refractory construction	汽冷型无需架模，仅 50MM 厚 Requires no formwork erection, only 50mm thick	需架设模板、3 层材料共 350MM 厚 Formwork to be erected, 3 layers of materials, 350mm thick in total
材料使用寿命 Material service life	10-15 年免维修、10 年可节约费用 150 万以上 Maintenance free in 10-15 years and cost saving of more than 1.5 million in 10 years	1 年小修、4 年大修 1-year minor repair and 4-year overhaul
锅炉烘炉时间 Boiler drying time	烘炉时间短 5 天以上，节约费用 10 万元（按每天烘炉成本 2 万元计算） The drying time is shorter by 5 days, and the cost saved is 100000 yuan (based on the daily drying cost of 20000 yuan)	多 5 天以上 Longer by 5 days
锅炉启动时间 Boiler startup time	4-5 小时，每次点火节约燃油 6T 4-5 hours, each ignition saves 6T of fuel	7-8 小时 7-8hours
分离器外壁温度 Separator outer wall temperature	60°C以下、热损失小 Below 60 °C , small heat loss	100 ～ 200°C、年热损失 100 万以上 100 ~ 200 °C , annual heat loss over 1million
膨胀差（膨胀方向） Differential expansion (expansion direction)	小（向下） Small (downward)	大 (向上、向下) 容易泄露 Huge (upward and downward) easy to leak
分离效率 separation efficiency	高 High	随着使用年限的延长逐渐下降 Gradually decrease with the extension of service life
煤种适应性 Coal adaptability	广泛、不结焦 Extensive, non coking	较差、易结焦 Narrow and easy to coking

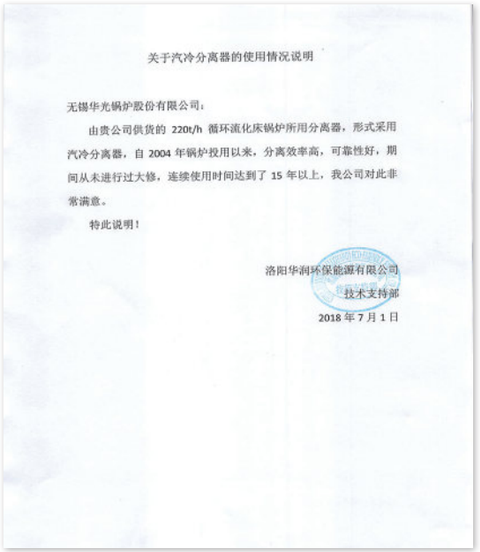
汽冷型分离器制造厂厂内整体生产成型，经加固后切割成 3-5 片（便于运输），加工工艺复杂、生产成本高，现场安装只需扁钢对接，安装工艺简单，成本低，耐火材料使用量少，以 260t/h CFB 为例，每台炉工程基投可减少 100 万元以上。

The steam cooled separator is manufactured in the factory as a whole and cut into 3-5 pieces after reinforcement (convenient for transportation). Though the processing procedure is complex and the production cost is relatively higher for steam cooled separator, only flat steel butt joint is required by site installation, which is easy to handle and cost smaller. In the meanwhile, the application amount of refractory is smaller, so that the whole funds paid for each boiler applying steamed cooled separator are smaller by around 1 million yuan compared with the ones applying insulation type (taking 260t/h CFB as calculation mode).

◎ 亮点六：浇注料使用寿命长、投资小 Long service life and small investment in castables

- 由于汽冷分离器的磨损问题大大减轻，浇注料使用寿命可达十年以上。
- 选用过硬的耐磨材料，使用寿命延长，保证炉膛内浇注料 4 年内不出现大面积脱落情况。
- 采用汽冷分离器，浇注料用量相比绝热分离器大幅降低，可为用户节省可观的投资费用。以 260t/h 锅炉为例，15 年未大修，从材料用量和运行维护成本上测算，整体为用户节省了近 150 万元 / 单台。

- As the wear of steam-cooled separator is greatly reduced, the service life of castable can reach more than ten years.
- Excellent wear-resistant materials are selected to prolong the service life and ensure that the castables in the furnace will not fall off in huge pieces within 4 years.
- With the steam-cooled separator, the amount of castable is greatly reduced compared with the adiabatic separator, which can save considerable investment costs for the plant. Taking one of our 260t/h boilers as an example, it has not been overhauled for 15 years according to our information. Based on the calculation of material consumption and operation & maintenance cost, totally 1.5 million yuan per unit has been saved for the plant .



关于汽冷分离器的使用情况说明

无锡华光锅炉股份有限公司：

由贵公司供货的 220t/h 循环流化床锅炉所用分离器，形式采用汽冷分离器，自 2004 年锅炉投用以来，分离效率高，可靠性好，期间从未进行过大修，连续使用时间达到了 15 年以上，我公司对此非常满意。

特此说明！

洛阳华润环保能源有限公司
技术支持部
2018 年 7 月 1 日

洛阳华润（用户）采用汽冷分离器 15 年未大修

Luoyang CR Prower (our user) has not overhauled its steam-cooled separator for 15 years.

◎ 亮点七：采用 FW 先进技术 Adopt FW advanced technology

- FW 公司是全球著名的锅炉设计制造厂商，在全球具有极高的知名度和良好的信誉，在循环流化床锅炉技术领域，始终走在前列。2006 年公司选定了美国 FW 公司，全面引进其循环流化床锅炉技术。目前无锡华光环保能源集团股份有限公司是唯一引进 FW 公司 150-350MW 等级并有运行业绩的大型循环流化床锅炉最新技术的国内厂家。

- FW is among the world-most-renowned boiler designers and manufactures, with high popularity and good reputation in the world. FW is always at the forefront in the field of CFB technology. In 2006,WHEE has chosen FW USA to fully introduce its CFB technology. At present, WHEE is the only domestic manufacturer who introduced the latest technology of FW’s 150-350mw large CFB and also has plenty of operating performances.

◎ 亮点八：结合“双碳政策”和“建设新一代电力系统”行动方案，华光开展了一系列创新活动

In combination with the “carbon peaking and carbon neutrality goals” and the plan of “building a new generation of power system”, WHEE has carried out a series of innovative activities.

- 针对新上燃煤锅炉，一是通过提升锅炉效率降低煤耗进而降低碳排放，二是通过与大连理工大学合作开发 CCUS 碳捕集系统，直接降低碳排放。
- 针对在用燃煤锅炉， 进行提效升级改造（锅炉效率可以提升 1-2 个点），或多元低碳燃料掺烧改造（平湖一原纯烧煤锅炉经改造后可掺烧 60% 固废），比如生物质、固废、污泥、垃圾等。
- 已开发完成高参数高可靠性生物质及固废燃料锅炉，替代燃煤锅炉。目前超高压再热生物质锅炉 (江苏一 130t/h 项目、黑龙江一 130t/h 项目)、高温高压固废炉（浙江一 100t/h 项目） 均已成功投运，性能优良、连续运行时间长。

- For coal-fired boilers under plan, firstly, by improving boiler efficiency, we undertakes to reduce coal consumption so as to cut down carbon emissions; second, we directly reduce carbon emission by cooperating with Dalian University of Technology to develop CCUS carbon capture system.
- For coal-fired boilers in use, efficiency improvement upgrades (boiler efficiency can be increased by 1-2 points) or multi-low carbon fuel (such as biomass, solid waste, sludge, garbage, etc.) blending transformation are to be carried out. For example, One Thermal Power's original pure coal-fired boiler can be transformed to be able to use coal mixed with 60% solids waste.
- New products such as high-parameter and high-reliability biomass and solid waste boilers have been developed to replace traditional coal-fired boilers. At present, ultra-high pressure reheat biomass boilers (130t/h boiler in Jiangsu Province, 130t/h project in Heilongjiang, etc.) and high temperature and high pressure solid waste boilers (100t/h boiler in Zhejiang Province) have been successfully put into operation, with excellent performance and long continuous operation time.

05 华光环能循环流化床锅炉产品开发历程
Developing Process of WHEE CFB

1985
鼓泡床锅炉技术
Bubble-bed boiler technology

1989
两级分离技术
中科院合作开发
Two-stage separation technology
Developed in cooperation with Chinese Academy of Sciences

1995
高温绝热分离器技术
中科院合作开发
High Temperature Adiabatic Separator Technology
Developed in cooperation with Chinese Academy of Sciences

1997
异形分离器技术
清华大学合作开发 Shaped separator technology
Developed in cooperation with Tsinghua University

2002
◆ 高温圆形汽冷分离技术，中科院合作开发
◆ 生物质掺烧发电锅炉
· High temperature circular steam-cooled separation technology, developed in cooperation with Chinese Academy of Sciences
· Biomass mixed combustion power boiler

2006
引进 FW 技术
Introduction of FW technology

2007
与东南大学合作开发 75-110t/h 生物质锅炉
Cooperate with Southeast University to develop 75-110t/h biomass boiler

2013
与中科院合作研制浙江嘉兴新嘉爱斯 100% 纯烧生物质 CFB
Cooperated with Chinese Academy of Sciences to develop Zhejiang Jiaxing xinjiaaisi 100% pure biomass CFB

2014
◆ 改进型高温圆形汽冷分离技术
◆ 低氮节能高效 CFB 中科院合作开发
· Improved high temperature circular steam-cooling separation technology
· Low nitrogen energy saving and high efficiency CFB
Developed in cooperation with Chinese Academy of Sciences

2015
南京科远沛县 130t/h 高温超高压一次再热纯烧生物质锅炉
Peixian County, Keyuan, Nanjing 130t/h high temperature and ultra-high pressure primary reheat pure biomass fired boiler

2017
越南海阳 4*1005t/h FW 合作开发
Haiduong, Vietnam 4*1005t/h FW Co-Development

2020
成功研发纯烧固废炉 CFB 技术
Successfully developed CFB technology for pure burner solid waste furnace

2021
◆ 越南安庆 2*1143t/h FW 合作开发
◆ 张家港长源热电 150t/h 纯烧生物质 CFB（德国 PNPP 技术）
· Vietnam Anking 2*1143t/h FW cooperation development
· Zhangjiagang Changyuan Cogeneration 150t/h pure burning biomass CFB (German PNPP technology)

06 不同燃料循环流化床锅炉技术特性
Characteristics of CFB Applying Different Fuels

◎ 燃煤 CFB　Coal fired CFB

□ 低氮环保

从 CFB 锅炉 NO_x 生成的机理着手，采用分级燃烧方式，使炉膛底部为较强的还原性气氛，防止局部富氧。同时采用低床温的运行方式，降低 NO_x 原始排放（NO_x 原始排放浓度小于 100mg/Nm^3）。

□ 高效节能

从锅炉热损失的组成出发，分析各项热损失的控制因素，着力降低每项损失，提高锅炉热效率；在设计中采取措施，降低一二次风机压头和返料风机风量，降低能耗，从而降低厂用电率（锅炉热效率 92~93%，厂用电 ~8%）。

□ 稳定可靠

选择合理的烟气流速，并对锅炉各部位的磨损机理进行分析，对不同部位采用不同的防磨措施，减轻整体磨损，防止局部磨损，提高各部件的使用寿命，对给煤和落渣采用特有的结构，保证锅炉长期稳定安全运行（连续运行时间大于 8000 小时）

□ Low nitrogen environmental protection

Starting from the mechanism of NO_x generation in CFB boilers, graded combustion is adopted to make the bottom of the furnace a strong reducing atmosphere and prevent local oxygen enrichment. At the same time, low bed temperature operation is adopted to reduce the original NO_x emission (NO_x original emission concentration is less than 100mg/Nm^3).

□ High-efficiency and energy-saving

Starting from the composition of boiler heat loss, analyze the control factors of each heat loss, focus on reducing each loss and improving the boiler thermal efficiency; take measures in the design to reduce the pressure head of the first and second fans and the air volume of the return fan to reduce energy consumption, thus reducing the plant electricity rate (boiler thermal efficiency 92-93%, plant electricity - 8%).

□ Stable and reliable

Select a reasonable flow rate of flue gas, analyze the wear mechanism of each part of the boiler, and adopt different anti-wear measures for different parts to reduce overall wear, prevent local wear, and improve the service life of each component. The unique structure ensures the long-term stable and safe operation of the boiler (continuous operation time is more than 8000 hours).

◎ 固废 CFB　Solid waste CFB

□ 全国首台

华光固废 CFB 为全国首台、自主研发，符合“双碳”减排政策，各项污染物排放值均优于国家规范要求。

□ 防腐防沉积

- 创新的风帽设计和布风板布置，特殊的风帽孔动量设计，可解决床面不可燃重物的沉积问题。
- 采用外置床式高温过热器，可解决高参数下高温受热面腐蚀问题。
- 成熟可靠的尾部受热面布置，有效防止受热面积灰腐蚀。

□ 环境友好

- 合理布置的烟气再循环系统，可达到氮氧化物低排放。
- 独特烟道设计，满足 CO 排放指标。

□ 投资成本低，运行简单

前处理要求低，前处理设备投资少。运行方式同常规流化床锅炉相似，简单可靠。

□ The pilot plant in China

As the first self-developed solid waste CFB in China, it complies with the “double carbon” emission reduction policy, and the emission values of various pollutants are better than the national specifications.

□ Anti corrosion and anti deposition

- Innovative hood design and air distributor arrangement,special hood hole momentum design can solve the problem of non combustible weight deposition on the bed surface.
- The external bed type high-temperature superheater can solve the corrosion problem of high-temperature heating surface under high parameters.
- Mature and reliable tail heating surface arrangement to effectively prevent ash corrosion of the heating surface.

□ Environment-Friendly

- The reasonably arranged flue gas recirculation system can achieve low NO_x emissions.
- The unique flue design to meet CO emission target.

□ Low investment cost and simple operation

Low pre-treatment requirements and less investment in pre-treatment equipment. The operation mode is similar to that of conventional CFB, which is simple and reliable.

◎生物质 CFB　Biomass CFB

□ 形式灵活

多种形式的布风结构，既能满足传统生物质燃料底部正常排渣，又能满足特殊的、带有较多金属等杂质的燃料底部顺畅出渣。

□ 耐腐可靠

- 采用屏式高温过热器，配合耐腐蚀材料，可解决高参数下高温受热面腐蚀问题。
- 成熟可靠的尾部受热面布置，有效防止受热面积灰腐蚀。
- 先进的汽冷式气固分离装置，可有效防止分离器、返料结焦。

□ 环境友好

合理布置的配风系统，可达到氮氧化物低排放。

□ 操作简单

运行方式同常规流化床锅炉相似，简单可靠。

□ Flexible forms

Various air distribution structures can not only meet the needs of normal slag discharge at the bottom of traditional biomass fuel, but also the smooth slag discharge at the bottom of special fuel with more metal and other impurities.

□ Corrosion resistance and high reliability

- The use of platen type high-temperature superheater and corrosion-resistant materials can solve the corrosion problem of high temperature corrosion of heating surface under high parameters.
- Mature and reliable tail heating surface arrangement can effectively prevent ash corrosion.
- Advanced steam-cooled gas-solid separation device can effectively prevent coking of separator and return materials.

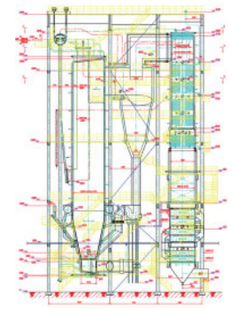
□ Environment-Friendly

The reasonably arranged air distribution system can achieve low NO_x emissions.

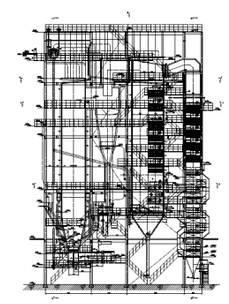
□ Easy operation

The operation mode is similar to that of conventional CFB, which is simple and reliable.

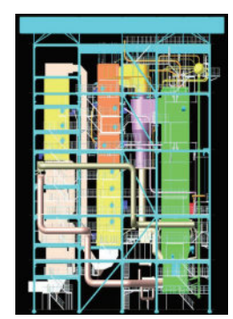
07 不同燃料 CFB 炉型及部分专利证书
CFB Types Applying Different Fuels and Regarding Patent Certificates



燃煤 CFB
Coal-fired CFB



固废 CFB
Solid waste CFB



生物质 CFB
Biomass CFB

公司 CFB 有效授权专利共计 81 件，其中发明 21 件

There are 81 valid patents authorized by CFB of WHEE, including 21 inventions.

专利清单（部分）如下：

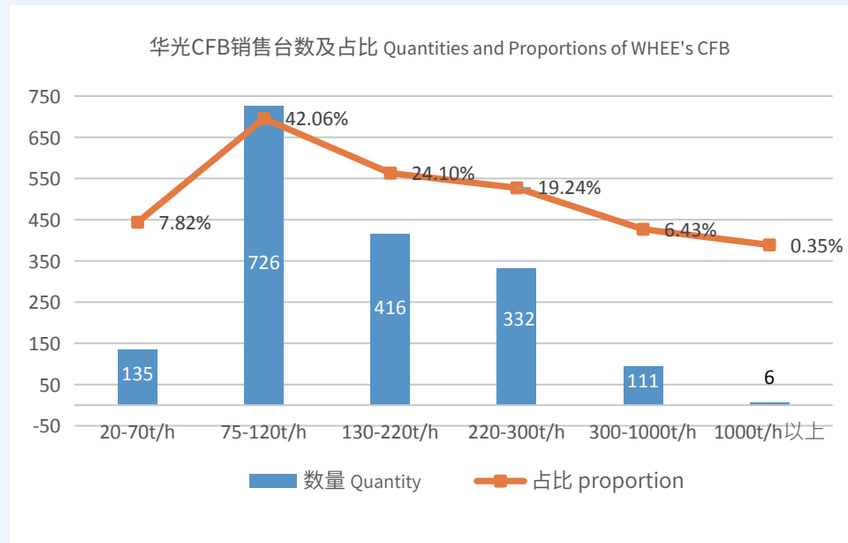
序号 No.	专利清单 List of patents	专利名称 Name of patents	产品类型 Type of products	专利类型 Type of Patents
1	201821647240.0	循环流化床垃圾锅炉结构 CFB structure	固废 CFB Solid waste CFB	实用新型 Utility Model Patent
2	201922307312.8	燃用生物质的燃煤 CFB Biomass fired CFB	生物质 CFB Biomass CFB	实用新型 Utility Model Patent
3	201922323530.0	燃烧固废物的循环流化床焚烧锅炉 CFB for burning solid waste	固废 CFB Solid waste CFB	实用新型 Utility Model Patent
4	200910212236.0	循环流化床垃圾焚烧炉尾部烟道内的受热面布置结构 Arrangement structure of heating surface in the flue at the tail of CFB	固废 CFB Solid waste CFB	发明专利 Invention Patent
5	201010502771.2	循环流化床的床下油枪的送风结构 Air supply structure of oil gun under the CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
6	200910212235.6	一种改良的燃煤 CFB 旋风分离器进口烟道清灰装置 An improved dust cleaning device for inlet flue of coal-fired CFB cyclone separator	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
7	201010502773.1	用于燃煤 CFB 四角处的水冷壁管防磨结构 Anti-wear structure of water wall tube at the four corners of coal-fired CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
8	200910223548.1	一种改进的水冷壁与屏式受热面穿墙处的防磨结构 An improved anti-wear structure of water-cooled wall and screen heating surface passing through the wall	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
9	201110060603.7	燃用生物质秸秆的高温高压燃煤 CFB High temperature and high pressure coal-fired CFB burning biomass straw	生物质 CFB Biomass CFB	发明专利 Invention Patent
10	201210042067.2	燃煤 CFB 的给煤装置 Coal feeding device of coal-fired CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
11	201210229205.8	返料风帽结构 Return hood structure	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
12	201210178187.5	循环流化床垃圾锅炉用的大口径排渣管 Large diameter slag discharge pipe for garbage CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
13	201310398774.X	一种用于防止燃煤 CFB 中心筒脱落的支承结构 A supporting structure for preventing the central cylinder of coal-fired CFB from falling off	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
14	201410120238.8	一种防止物料反串的膨胀节结构 An expansion joint structure for preventing material from anti cross flow	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
15	201310399485.1	一种用于燃煤 CFB 的矩形给煤管 A rectangular coal feeding pipe for coal-fired CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
16	201410130463.X	一种用于燃煤 CFB 的中心筒固定结构 A central tube fixing structure for coal-fired CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
17	201310398792.8	一种用于锅炉包墙下集箱的布置结构 An arrangement structure for header under boiler package wall	燃煤 CFB Coal fired CFB	发明专利 Invention Patent

序号 No.	专利清单 List of patents	专利名称 Name of patents	产品类型 Type of products	专利类型 Type of Patents
18	201310399403.3	一种燃烧棕榈渣的燃煤 CFB A coal-fired CFB burning palm residue	生物质 CFB Biomass CFB	发明专利 Invention Patent
19	201410120217.6	一种用于燃煤 CFB 的抗磨型给煤管结构 An anti-wear coal feeding pipe structure for coal-fired CFB	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
20	201510135189.X	一种风帽结构 A hood structure	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
21	201510314411.2	一种反应器框架和省煤器护板一体化结构 An integrated structure of reactor frame and economizer guard plate	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
22	201510269227.0	一种风帽和接管之间的固定连接结构 A fixed connection structure between a hood and a nozzle	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
23	201610399767.5	一种用于锅炉过热器吊挂卡座结构 A hanging clamp structure for boiler superheater	燃煤 CFB Coal fired CFB	发明专利 Invention Patent
24	201810694327.1	一种燃用印尼煤的燃煤 CFB A coal-fired CFB burning Indonesian coal	燃煤 CFB Coal fired CFB	发明专利 Invention Patent

截止 2022 年 6 月，CFB 累计销售 1726 台套 By June 2022, CFB has been sold 1726 sets in total

不同等级 CFB 产品台套占比如下

The proportion of sets of different grades CFB is as follows



◎ CFB 产品荣获奖项（部分） CFB product awards (partial)

CFB 锅炉国家科学技术进步奖
National Science and Technology Progress Award won by WHEE's CFB

国家火炬计划项目证书
National Torch Program Project Certificate

2009 年中国机械工业科学进步奖
China Machinery Industry Science and Technology Award-2009

2017 年中国机械工业科学进步奖
China Machinery Industry Science and Technology Award-2017

08 CFB 典型业绩及测试、鉴定、用户报告
CFB Typical Projects, Performance Test Report, Official Identification, User Evaluation Reports

◎ 220t/h 高温超高压 CFB 220t/h HT & Ultra HP CFB

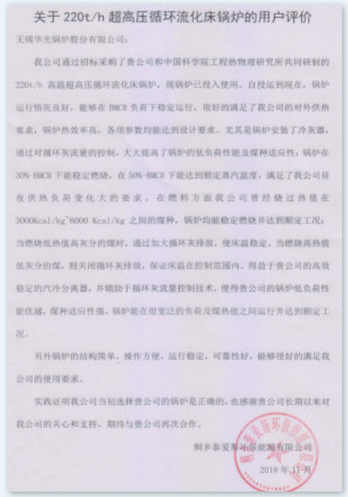
浙江桐乡泰爱斯 3x220t/h 高温超高压 CFB 锅炉
Zhejiang Tongxiang Taiaisi 3x220t/h high temperature and ultra high pressure CFB

NO_x 实测效率达 93.25%，NO_x 初始排放浓度仅 59mg/Nm^3
The measured NO_x efficiency is 93.25%, and the initial NO_x emission concentration is only 59mg/Nm^3.

◎测试报告 Test Reports

锅炉烟气净化装置环保测试报告
Boiler Energy Efficiency Test Report

◎用户评价 User Evaluation Report



关于 220t/h 超高压循环流化床锅炉的用户评价
Thanks to WHEE's high-efficient and stable air-cooled separator and the application of circulating ash flow control technology, the boiler we purchased from HWEE has excellent low-load performance and strong coal adaptability.
Considering the stable operation and good reliability of this boiler, we look forward to cooperate with WHEE again.

◎ 1005t/h 亚临界 CFB　1005t/h Subcritical CFB

越南海阳 4X1005t/h 亚临界 CFB　Vietnam Haiduong 4x1005t / h Subcritical CFB

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。

It has achieved a breakthrough in the technology of large circulating fluidized bed boilers burning 100% Vietnam 6B anthracite coal by domestic boiler manufacturers, filling the technological gap in China.

越南海阳项目满负荷稳定运行
Vietnam Haiduong project operates stably at full load

越南海阳 4 台 CFB 锅炉由 FW 公司提供基本设计，包括锅炉全套性能计算、结构图纸、控制逻辑等，由我公司进行详细设计和生产，同时 FW 公司还提供性能保证、工厂监造、现场服务。本项目锅炉采用世界领先的成熟结构，包括专为越南 6B 无烟煤设计的燃烧系统、全冷却型炉墙结构、一体化热膨胀系统、优化的一次风室进风系统、再热蒸汽旁路调温装置等，热效率、可靠性优于同类型锅炉。

优秀的燃烧系统设计使锅炉飞灰含碳量低于 6%，大大降低了锅炉的煤耗，提升了电厂的效益。全冷却型炉墙结构大幅降低了耐火材料的用量，缩短了锅炉的启动时间，也降低了锅炉的维护成本。

一体化热膨胀系统、优化的一次风室进风系统、再热蒸汽旁路调温装置提高了锅炉的可用率和环保性能。

FW provides basic design for four CFB boilers in Haiduong, Vietnam, including a full set of boiler performance calculation, structural drawings, control logic, etc., which are designed and produced in detail by WHEE. At the same time, FW also provides performance assurance, factory supervision and on-site services. The boiler of the project adopts the world’s leading mature structure, including the combustion system specially designed for Vietnam 6B anthracite coal, full cooling furnace wall structure, integrated thermal expansion system, optimized primary air chamber air inlet system, reheat steam bypass temperature regulating device, etc. The thermal efficiency and reliability are better than those of the same type of boilers.

The excellent combustion system design makes the carbon content of boiler fly ash less than 6%, which greatly reduces the coal consumption of the boiler and improves the efficiency of the power plant. The fully cooled furnace wall structure greatly reduces the amount of refractory, shortens the start-up time of the boiler and reduces the maintenance cost of the boiler.

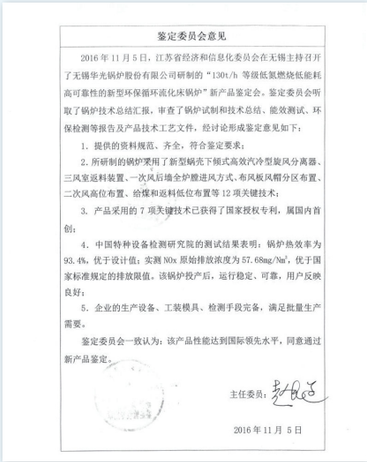
The integrated thermal expansion system, optimized primary air chamber intake system, and reheat steam bypass thermostat device improve the boiler’s availability and environmental protection performance.

◎ 260t/h+130t/h 高温高压 CFB　260t/h+130t/h HT & HP CFB

山东临沂阳光 3X260t/h 高温高压 CFB + 2x130t/h 高温高压 CFB
Shandong Linyi Yangguang 3x260t/h high temperature and high pressure CFB + 2x130t/h high temperature and high pressure CFB

◎鉴定报告 Identification Reports

□ 130t/h CFB



鉴定委员会意见

2016 年 11 月 5 日，江苏省经济和信息化委员会在无锡主持召开了无锡华光锅炉股份有限公司研制的“130t/h 等级低氮燃烧低能耗高可靠性的新型环保循环流化床锅炉”新产品鉴定会。鉴定委员会听取了锅炉技术总结汇报，审查了锅炉试制和技术总结、能效测试、环保检测等报告及产品技术工艺文件，经讨论形成鉴定意见如下：

1、提供的资料规范、齐全，符合鉴定要求；

2. 所研制的锅炉采用了新型蜗壳下倾式高效汽冷型旋风分离器、三风室返料装置、一次风后墙全炉膛进风方式、布风板风帽分区布置、二次风高位布置、给煤和返料低位布置等 12 项关键技术；

3. 产品采用的 7 项关键技术已获得了国家授权专利，属国内首创；

4. 中国特种设备检测研究院的测试结果表明：锅炉热效率为 93.4%，优于设计值；实测 NOx 原始排放浓度为 57.68mg/Nm³，优于国家标准规定的排放限值。该锅炉投产后，运行稳定、可靠，用户反映良好；

5. 企业的生产设备、工装模具、检测手段完备，满足批量生产需要。

鉴定委员会一致认为：该产品性能达到国际领先水平，同意通过新产品鉴定。

主任委员：

2016 年 11 月 5 日

鉴定（或验收）主持单位意见：

盖章

年 月 日

鉴定（或验收）组织单位意见：

盖章

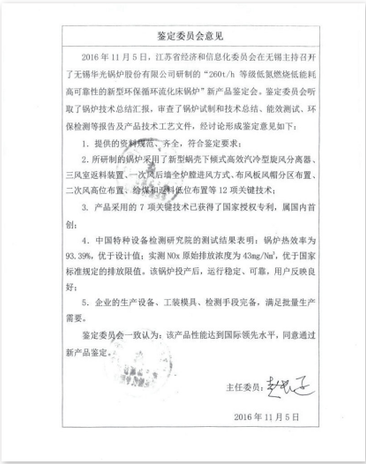
年 月 日

130t/hCFB 鉴定报告结论 | Appraisal Conclusion

The thermal efficiency of the boiler is 93.4%, which is better than the design value; the original measured NO_x emission concentration is 57.68mg/Nm^3, which is better than the emission limit specified by the national standard. After the boiler was put into operation, the running condition is stable and reliable, and the users responded well.

The appraisal committee unanimously agreed that the performance of this boiler has reached the international leading level.

□ 260t/hCFB



鉴定委员会意见

2016 年 11 月 5 日，江苏省经济和信息化委员会在无锡主持召开了无锡华光锅炉股份有限公司研制的“260t/h 等级低氮燃烧低能耗高可靠性的新型环保循环流化床锅炉”新产品鉴定会。鉴定委员会听取了锅炉技术总结汇报，审查了锅炉试制和技术总结、能效测试、环保检测等报告及产品技术工艺文件，经讨论形成鉴定意见如下：

1. 提供的资料规范、齐全，符合鉴定要求；

2. 所研制的锅炉采用了新型蜗壳下倾式高效汽冷型旋风分离器、三风室返料装置、一次风后墙全炉膛进风方式、布风板风帽分区布置、二次风高位布置、给煤和返料低位布置等 12 项关键技术；

3. 产品采用的 7 项关键技术已获得了国家授权专利，属国内首创；

4. 中国特种设备检测研究院的测试结果表明：锅炉热效率为 93.39%，优于设计值；实测 NOx 原始排放浓度为 43mg/Nm³，优于国家标准规定的排放限值。该锅炉投产后，运行稳定、可靠，用户反映良好；

5. 企业的生产设备、工装模具、检测手段完备，满足批量生产需要。

鉴定委员会一致认为：该产品性能达到国际领先水平，同意通过新产品鉴定。

主任委员：

2016 年 11 月 5 日

鉴定（或验收）主持单位意见：

盖章

年 月 日

鉴定（或验收）组织单位意见：

盖章

年 月 日

260t/hCFB 鉴定报告结论 | Appraisal Conclusion

The thermal efficiency of the boiler is 93.39%, which is better than the design value; the original measured NO_x emission concentration is 43mg/Nm^3, which is better than the emission limit specified by the national standard. After the boiler was put into operation, the running condition is stable and reliable, and the users responded well.

The appraisal committee unanimously agreed that the performance of this boiler has reached the international leading level.

◎测试报告 Test Reports

中国特种设备检测研究院
国家锅炉压力容器质量监督检验中心

报告编号：16E0026-BG01

No. CNAS L0694 （2015）国认监认字（197）号 2015003329Z

锅炉环保测试报告

锅炉型号：UG-130/9.8-M

制造单位：无锡华光锅炉股份有限公司

委托单位：无锡华光锅炉股份有限公司

测试地点：山东省临沂市费县阳光热力有限公司

测试日期：2016-05-19

中国特种设备检测研究院
国家锅炉压力容器质量监督检验中心

锅炉环保测试报告
Boiler Environmental Test Report

中国特种设备检测研究院
国家锅炉压力容器质量监督检验中心

报告编号：16E0025-BG01

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锅炉环保测试报告

锅炉型号：UG-260/9.8-M

制造单位：无锡华光锅炉股份有限公司

委托单位：无锡华光锅炉股份有限公司

测试地点：山东省临沂市费县阳光热力有限公司

测试日期：2016-05-21

中国特种设备检测研究院
国家锅炉压力容器质量监督检验中心

锅炉能效测试报告
Boiler Energy Efficiency Test Report

测试项目（锅炉额定出力）	烟尘初始排放浓度，NO_x 初始排放浓度， SO_2 初始排放浓度，烟囱出口烟气黑度。		
测试结论	测试过程中脱硝运行（脱硝方式为SNCR），未投石灰石	烟尘初始排放浓度	15812.62mg/m³
		SO_2 初始排放浓度	1261.22mg/m³
		NO_x 初始排放浓度	43.99mg/m³
		烟囱出口烟气黑度	<1

测试负责人：常勇强 测试人员：常勇强、倪松松、王钊、李德标

报告编制：倪松松 日期：2016.9.20

审 核：常勇强 日期：2016.9.20

批 准：王钊 日期：2016.9.20

（测试机构测试专用章或者公章）
年 月 日

测试项目（锅炉额定出力）	烟尘初始排放浓度，NO_x 初始排放浓度， SO_2 初始排放浓度，烟囱出口烟气黑度。		
测试结论	测试过程中脱硝运行（脱硝方式为SNCR+SCR），未投石灰石	烟尘初始排放浓度	12904.11 mg/m³
		SO_2 初始排放浓度	1430.34 mg/m³
		NO_x 初始排放浓度	6.78 mg/m³
		烟囱出口烟气黑度	<1

测试负责人：常勇强 测试人员：常勇强、倪松松、王钊、李德标

报告编制：常勇强 日期：2016.9.20

审 核：常勇强 日期：2016.9.20

批 准：王钊 日期：2016.9.20

（测试机构测试专用章或者公章）
年 月 日

◎用户评价 User Reviews

关于 2X130t/h 循环流化床锅炉的用户评价

无锡华光锅炉股份有限公司：

我公司通过招标采购了我公司和中国科学院工程热物理研究所共同研制的2台130t/h高温高压循环流化床锅炉，现两台锅炉均已投入使用，自投运到现在，锅炉运行情况良好，能够在100%负荷下稳定运行，且锅炉最大连续蒸发量达到145t/h，很好的满足了我公司的对外供热要求。锅炉热效率高，各项参数均能达到设计值要求。尤其突出的是其低 NO_x 环保性能，锅炉的送风分为一次、二次风两段，一次风保证流化，二次风分两层进入炉膛补充氧气，设计床温在870—900℃，运行床温处于该区域，采用分级送风和低床温燃烧技术的设计保证了锅炉在不同负荷下 NO_x 的原始排放均<100mg/Nm³，经中国特种设备检测研究院现场测试，未喷氨工况下测试值为 30 mg/Nm³，通过 DCS 系统数据后，锅炉尾部烟气 NO_x 排放低于 50 mg/Nm³，完全满足国家超低排放的环保要求。

另外锅炉的结构简单，操作方便，运行稳定，可靠性好，能够很好的满足我公司的使用要求。锅炉经长期运行后停炉检查，发现炉膛水冷壁管无磨损现象，炉膛及分离器进出内连接料处无开裂脱落现象，中心筒外形完好，尾部对流受热面无磨损。

实践证明我公司当初选择贵公司的锅炉是正确的，也感谢贵公司长期以来对我公司的关心和支持，期待与贵公司再次合作。

山东费县阳光热力有限公司
2016年5月

关于 2X260t/h 循环流化床锅炉的用户评价

无锡华光锅炉股份有限公司：

我公司通过招标采购了我公司和中国科学院工程热物理研究所共同研制的2台260t/h高温高压循环流化床锅炉，现两台锅炉均已投入使用，自投运到现在，锅炉运行情况良好，能够在100%负荷下稳定运行，且锅炉最大连续蒸发量达到260t/h，很好的满足了我公司的对外供热要求。锅炉热效率高，各项参数均能达到设计值要求。尤其突出的是其低 NO_x 环保性能，锅炉的送风分为一次、二次风两段，一次风保证流化，二次风分两层进入炉膛补充氧气，设计床温在870—900℃，运行床温处于该区域，采用分级送风和低床温燃烧技术的设计保证了锅炉在不同负荷下 NO_x 的原始排放均<100mg/Nm³，经中国特种设备检测研究院现场测试，未喷氨工况下测试值为 43 mg/Nm³，通过 DCS 系统数据后，锅炉尾部烟气 NO_x 排放低于 50 mg/Nm³，完全满足国家超低排放的环保要求。

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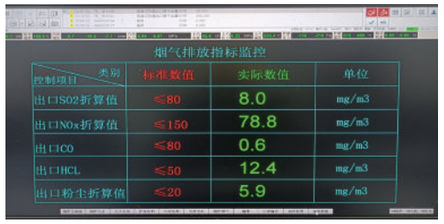
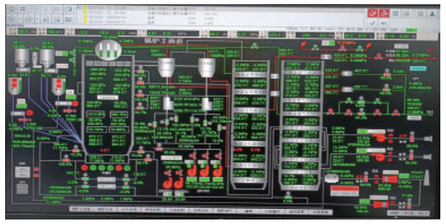
山东费县阳光热力有限公司
2016年5月

用户评价报告主要内容
User Reviews：
WHEE’s boiler has simple structure, convenient operation way, stable operation and good reliability, which can sufficiently meet the requirements of our company.

◎ 90t/h 高温高压固废 CFB　90t/h HT & HP Solid Waste CFB



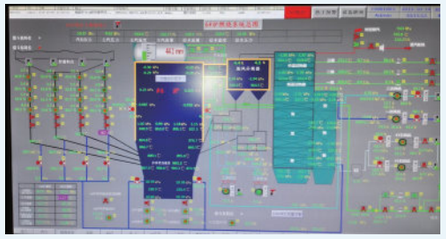


龙游金怡 90t/h 高温高压固废炉 CFB
Longyou Jinyi 90t/h high temperature and high pressure solid waste CFB

造纸废渣、污泥占比燃料总量的 80% 以上，纸渣处理量 380t/d

Papermaking waste residue and sludge account for more than 80% of the total fuel, and the treatment capacity of paper residue is 380t/d

◎ 其他典型项目　Other Typical Projects



新嘉爱斯 130t/h 纯烧生物质秸秆 CFB
New Jies 130t/h pure biomass straw CFB

南京科远生物质能 130t/h CFB 沛县项目
Nanjing Sciyon Biomass energy 130t/h CFB Peixian project

铁力宇翔 130t/h 生物质循环流化床
Tieli Yuxiang 130t/h biomass CFB

09 研发制造能力篇
R & D and Manufacturing Capabilities

□ 研发 & 制造能力 | R&D and manufacture capacity

200+ 名

拥有性能，标准，受热面，钢结构，工艺等专业的 200 多名工程师。

200+ Engineers

specialized in performance, standard, heating surface design, steel structure design, processing technology, etc.

+90%

采用参数化定制设计，设计出图效率提升 90%，可视化模拟安装现场，保障安装可靠性。

+90%

Design efficiency Tailor designed for client, the design efficiency increased by 90%, Visual simulation of erection procedure to ensure the reliability of Erection.

10000m²

10000 平米的厂房，专为余热锅炉模块组装新建。

10000 m²

workshop Specially built for the assembly of HRSG modules.

□ 研发 & 制造能力 | R&D and manufacture capacity

9 大体系
9 Systems

◆ ASME 体系	· ASME
◆ 质量管理体系	· Quality management system
◆ 环境管理体系	· Environmental management system
◆ 职业健康安全管理体系	· Occupational health and safety management system
◆ 知识产权管理体系	· Intellectual property management system
◆ 两化融合管理体系	· Information and industrialization integration management system
◆ 测量管理体系	· Measurement management system
◆ 研发管理体系	· R & D management system standardized management
◆ 党建标准化管理体系	· System of Party Building

10 企业战略及文化
Corporate Strategy & Culture

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.