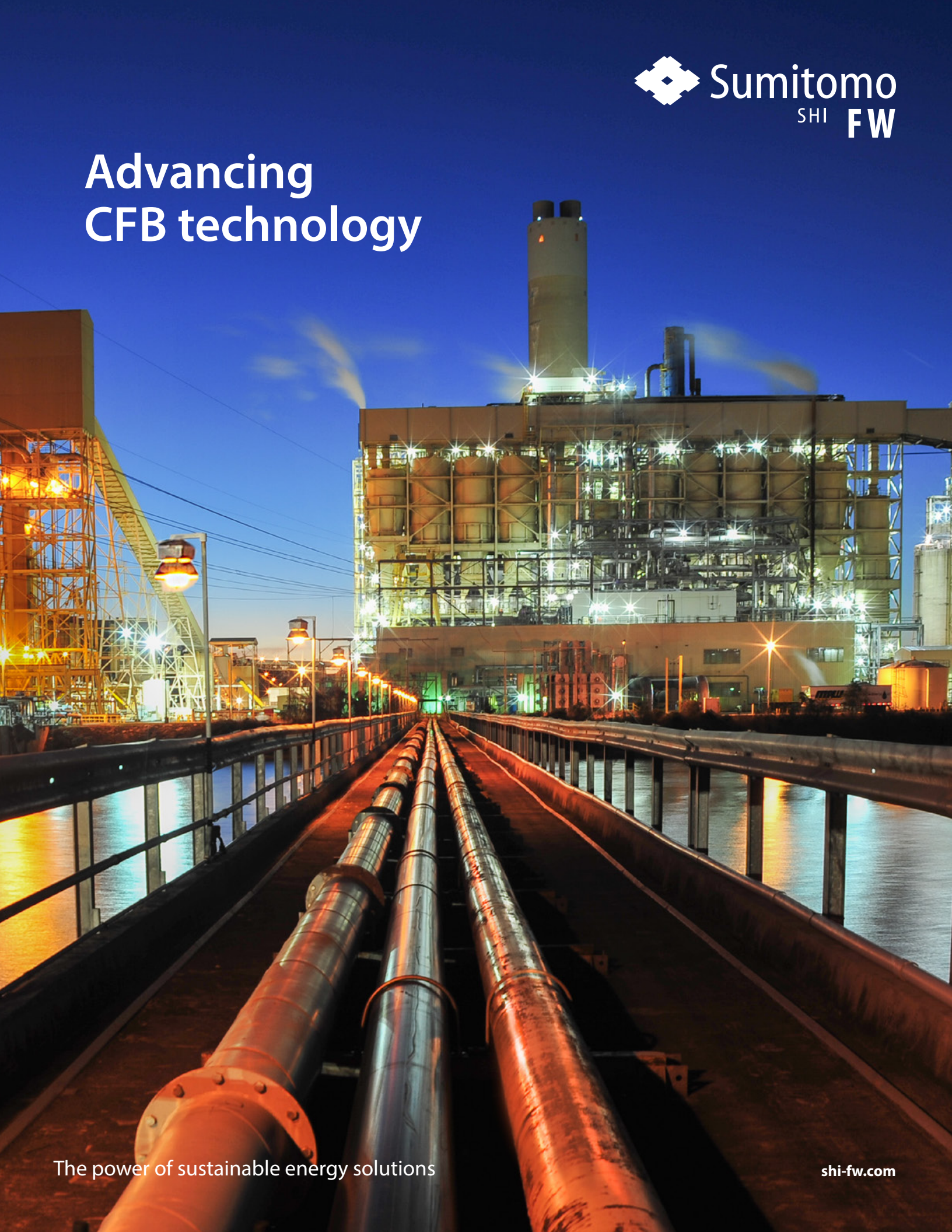
Sumitomo SHI FW

Advancing CFB technology



The power of sustainable energy solutions

shi-fw.com

Korean Southern Power Company's Green Power Plant in Samcheok, South Korea features four SFW advanced 550 MWe ultra supercritical CFBs

Pioneering CFB technology

We have steadily increased unit size and integrated advanced field-proven design features into our CFB technology. Our CFBs first reached small-scale utility application in 1987 on the 110 MWe Tri-State Nucla power project in the U.S., then went on to the medium utility scale in 2001 with the 2 x 300 MWe units for the Jacksonville Energy Authority. Over the 1998-2004 period we delivered six CFB units totaling nearly 1500 MWe for the largest CFB repowering project ever in history—the Turów project in Poland.

Our success has come from a track record of satisfying clients' reliability, environmental, and efficiency goals with innovative technology for converting economical solid fuels into valuable steam and power. Through our experience of supplying over 625 fluidized bed units to industrial and utility customers worldwide, we have steadily scaled-up and improved our technology. Nearly 500 of these fluidized bed steam generators have been CFB designs.

Our latest pioneering can be seen in Korean Southern Power Company's (KOSPO) most advanced supercritical CFBs to power its Green Power Plant in Samcheok, South Korea. This impressive greenfield power facility features four SFW 550 MWe ultra supercritical CFBs at its center.

Think green

Low emissions are a key benefit of our CFB technology allowing them to meet the strictest environmental standards. Our CFBs stage the combustion process and operate at low combustion temperatures while giving the fuel long burning times, resulting in naturally low nitrogen oxide (NOx) formation and high combustion efficiency. They can also capture the fuel's sulfur as the fuel burns by using low-cost limestone and employing selective-non-catalytic-reduction (SNCR) to achieve very low NOx and sulfur oxide (SOx) emissions in the most economical way, and in most cases, avoiding add-on pollution control equipment.

The CFB advantage is particularly highlighted in repowering projects. SOx and particulate emissions can often be cut by over 90% and NOx emissions by over 50%. Carbon dioxide emissions are often cut by 25% or more due to the dramatic improvement in boiler and plant efficiency when older equipment is replaced. For the lowest emissions, our supercritical, once-through-unit (OTU) CFB technology can reduce all these emissions another 5-10%, due to its ability to further increase overall plant efficiency.

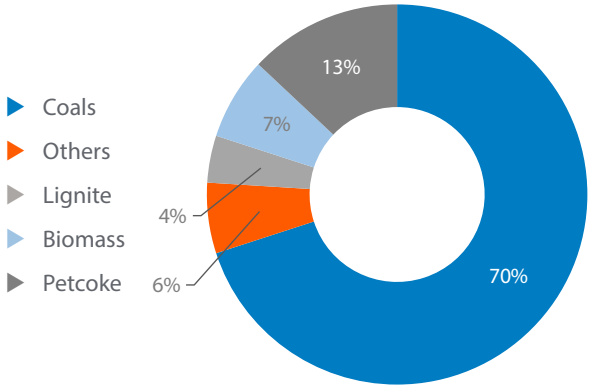
For climate change concerns, we offer Flexi-Burn® carbon capture technology for our utility CFBs. Flexi-Burn® allows the CFB to operate in either an economical air fired mode, as all plants do today, or in a carbon capture mode without requiring significant plant modifications. In the carbon capture mode, the CFB produces a carbon dioxide rich flue gas that can be stored underground. The technology will give power producers the flexibility to operate in either mode depending on regulation and market conditions.

Fuel flexibility

Our CFB units are capable of firing nearly all solid fuels—including waste products that otherwise would have been land-filled—while maintaining the lowest levels of emissions, and the highest equipment reliability and efficiency. Our fuel experience is unmatched as proven by our capability to design units for even the lowest-quality fuels. Our CFBs give plant owners the flexibility to source fuel from the widest base of suppliers and industries, improving their fuel supply security while taking advantage of attractive fuels price discounts.

OUR CFB FUEL EXPERIENCE

% of operating SFW CFB capacity by primary fuel type

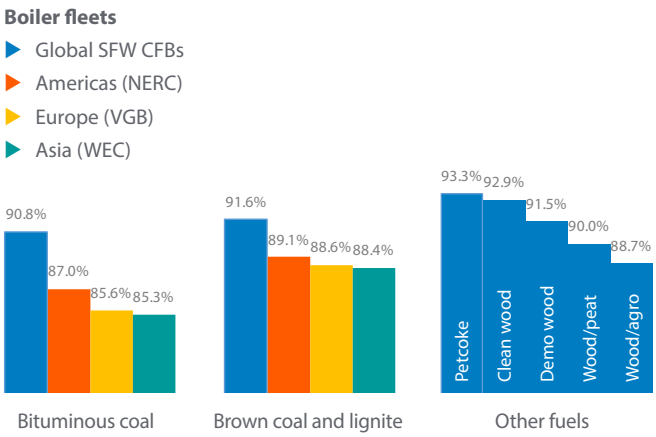


Reliability

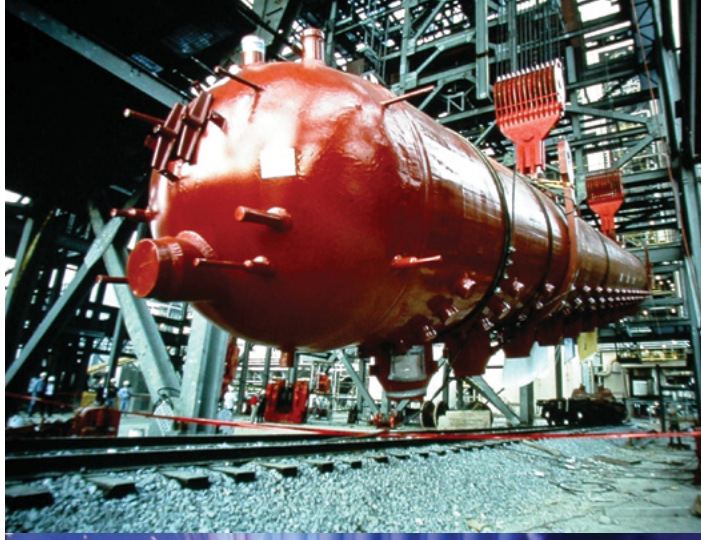
Our advanced CFB designs can achieve the highest plant availability, proven by over 37 million hours of operational experience, even after years of operation. Preventative conditions monitoring, expert maintenance and SmartBoiler™—all supplied by our service teams—help ensure maximum reliability—year after year.

AVERAGE ANNUAL PLANT AVAILABILITY*

% of 8760 hours

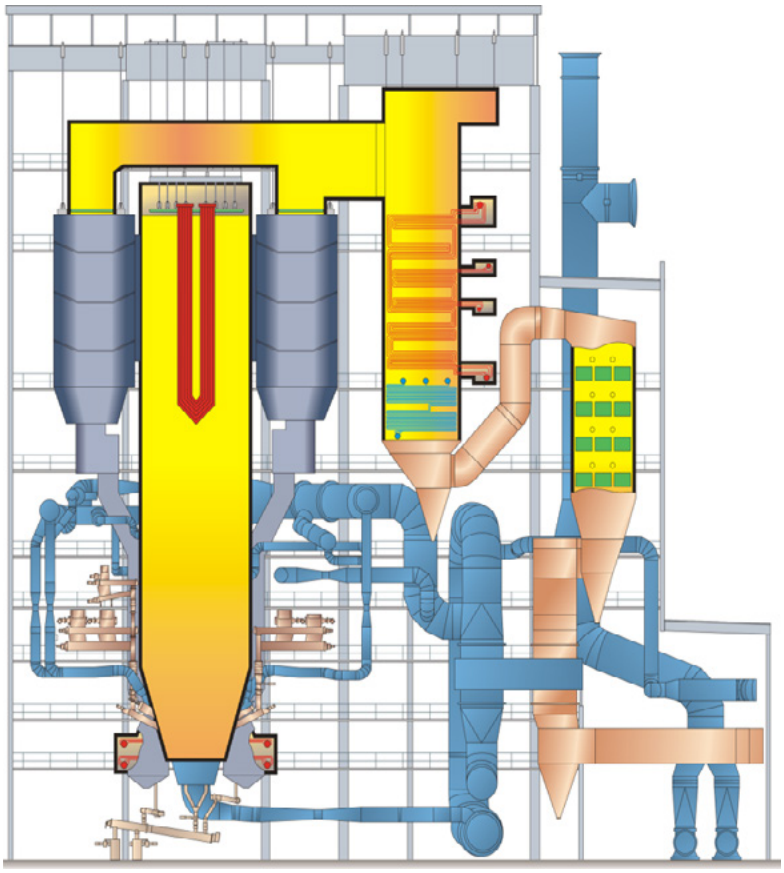


*Note: Availability means total time plant is available to run accounting for both planned and unplanned downtime. Sumitomo SHI FW CFB values based on client supplied data reported over 2000-2015 period for units mainly located in Europe. NERC (North America Reliability Copr), VGB and WEC (World Energy Council) availability data based on thermal steam power plant data reported over 2000-2015 period.



The longest running supercritical CFB plant

The Lagisza Power Plant in Poland, operating since 2009, features a 460 MWe SFW vertical tube supercritical CFB



Utility CFBs

What started off as a solution for hard-to-burn fuels has become a mainstream boiler technology for utility power generation

CFB value for utilities

Our utility customers have turned to CFBs due to their fuel flexibility, low emissions and high reliability. Many are seeing value in petroleum coke, lignite, waste coal and biomass fuels from both an economic and fuel security aspect. Our technology can reliably and cleanly burn these fuels fully or in combination with other fuels over the life of the plant, giving power generators the flexibility to alter their fuel strategies and take advantage of fuel market opportunities and changes in environmental regulation.

Going supercritical

Our advanced supercritical once-through CFB designs incorporate Siemens' BENSON vertical-tube evaporator technology for units above 300 MWe. This allows us to offer our utility clients all of the benefits of CFB combustion technology, together with the high efficiency of supercritical steam technology.

Supercritical technology improves overall plant efficiency by 5-10% compared to conventional natural circulation steam technology, which translates directly into a 5-10% reduction in the plant's air and ash emissions as well as its fuel and water consumption for each megawatt generated. When we say a reduction in air emissions, we mean all air emissions like SOx, NOx, mercury and particulates as well as greenhouse gases, like carbon dioxide.

RECENT UTILITY CFB PROJECTS

Soma Kolin Thermal Power Plant

Location:	Soma, Turkey
Customer:	Harbin Electric International Co. Ltd.
Start-Up Year:	2018
Capacity:	2 x 255 MWe
Fuel:	Turkish lignite

Samcheok Green Power Plant

Location:	Samcheok City, Gang Won Do, Korea
Customer:	Korean Southern Power Co., Ltd
Start-Up Year:	2017
Capacity:	4 x 550 MWe
Fuel:	Coal, Biomass

Mong Duong 1

Location:	Mong Duong, Vietnam
Customer:	Vietnam Electricity (EVN)
Start-Up Year:	2015
Capacity:	4 x 250 MWe
Fuel:	Vietnamese Anthracite Coal

A leader in CHP and industrial CFBs

Our Circulating Fluidized Bed (CFB) steam generators are well known in the industry for their low emissions, reliability and long life

Our history of developing innovative combustion technologies for industry began with our bubbling fluidized (BFB) steam generators, from which we developed our robust CFB technology for a diverse range of industrial fuels and energy needs. We are a leading supplier of industrial CFB technology, supplying over 175 units with sizes approaching 200 MWe for industrial applications.

Proven experience

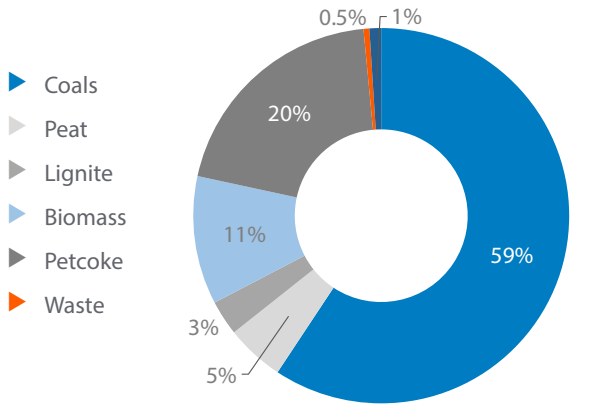
The solutions we have provided have been as diverse as our clients' needs. The CFB we supplied to a Swedish paper mill to convert their waste bark and sludge into useful steam needed by the mill, as well as the 26 petcoke-fired steam generators we delivered to Sinopec in China, demonstrate our ability to customize units to meet clients' needs. Our industrial boiler designs have been proven and advanced based on 40 years of operating experience.

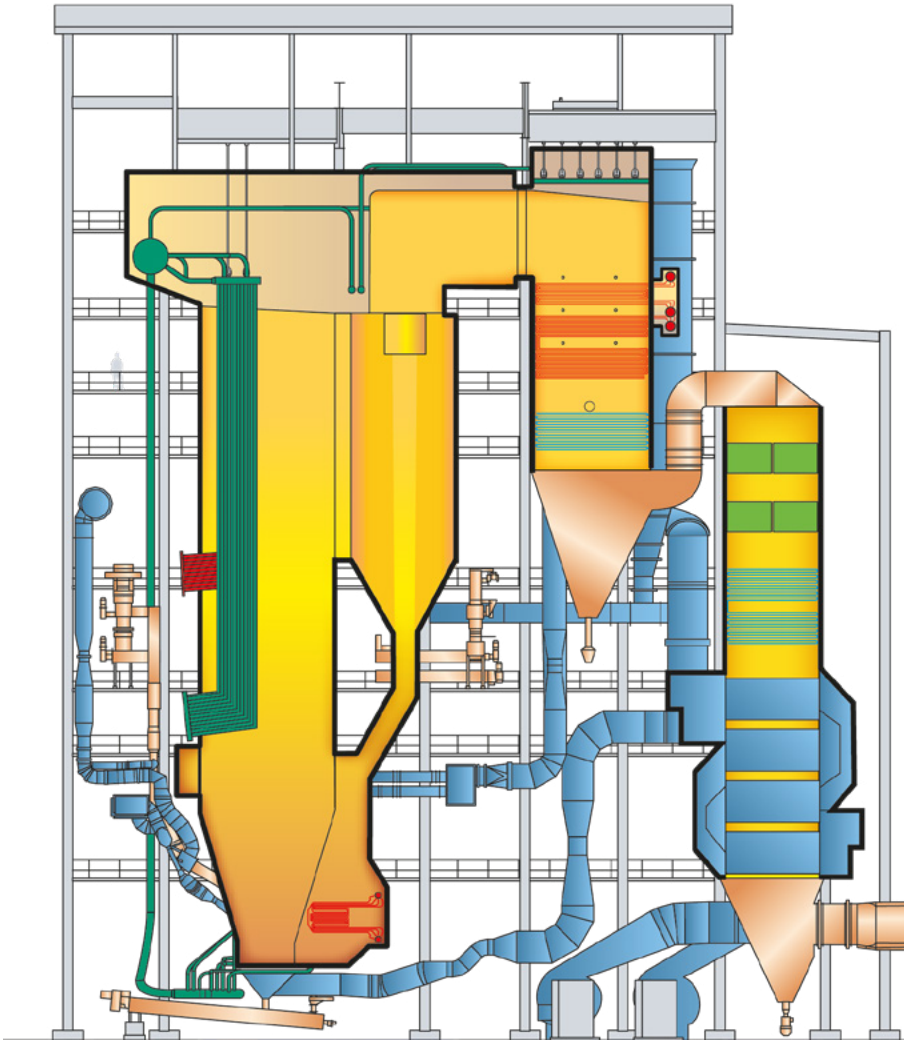
Widest fuel experience

Multi-fuel firing is particularly important in industrial and CHP applications where utilizing local and on-site waste has a high value. Fuel flexibility is a key factor in unlocking the value of these waste streams since both their quality and volumes can vary on a daily basis.

OUR INDUSTRIAL CFB FUEL EXPERIENCE

% of operating SFW CFB capacity by primary fuel type





Highly reliable

Industry and district heating relies on high availability: day in, day out, year round. Our CFBs have a proven track record of being highly reliable.

Our CFBs have excellent load-following capabilities, enabling them to accommodate rapid swings in process steam requirements. Their wide turn-down range means that they can adapt to temporary or seasonal changes in steam or district heat needs.

To achieve the highest reliability, we offer SmartBoiler™ to all CFB plant owners and operators. SmartBoiler™ is an intelligent operation and service support tool for monitoring, diagnosing, analyzing and optimizing steam generation and power plant operation. SmartBoiler™combines our experience and expertise in fluidized bed combustion with advanced Iot technology.

RECENT INDUSTRIAL CFB PROJECTS

HPCL Mittal Guru Gobind Singh Refinery

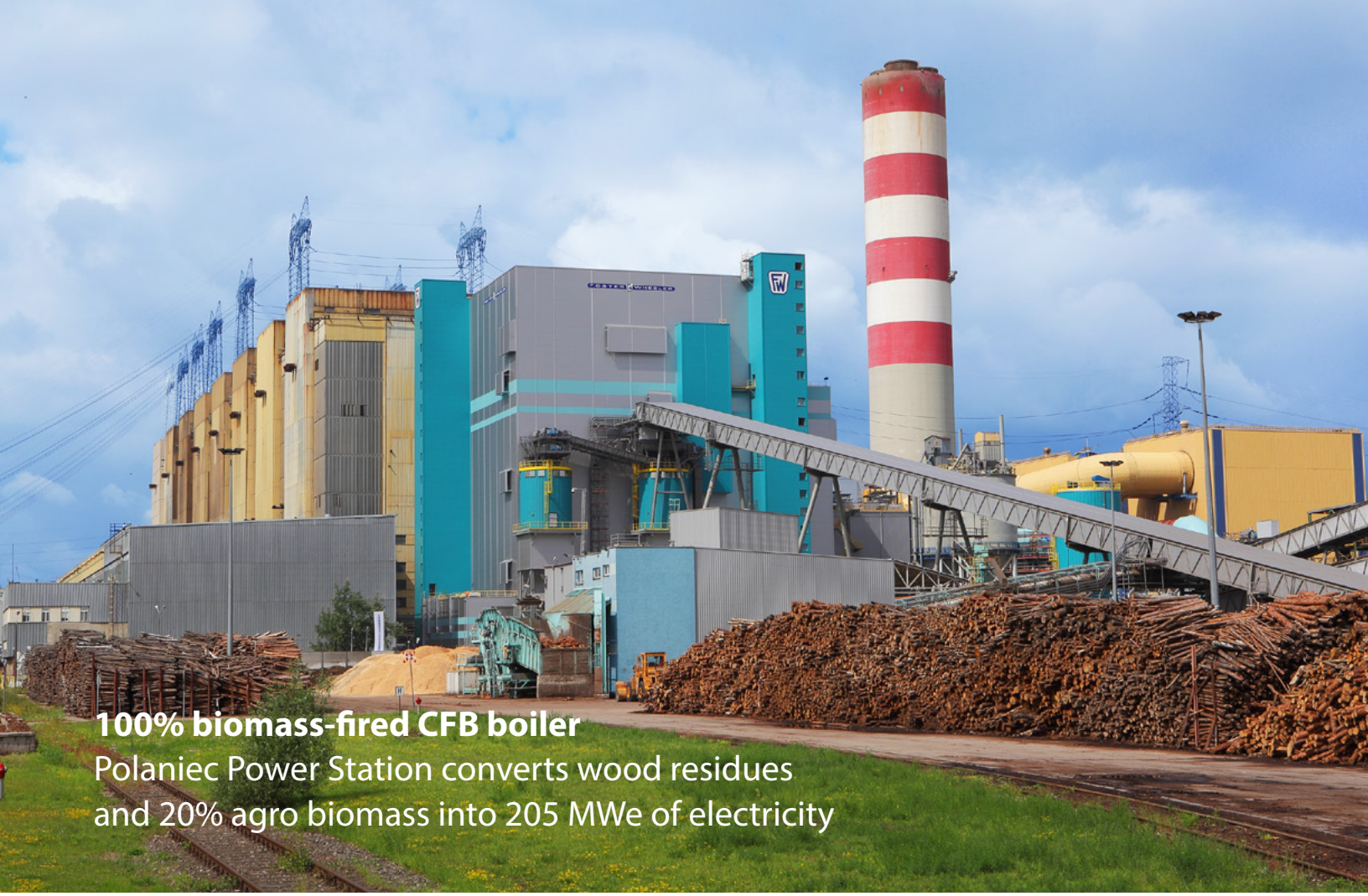
Location:	Punjab, India
Customer:	HPCL Mittal Energy Limited
Start-Up Year:	2018
Capacity:	2 x 50 MWe
Fuel:	Petroleum coke, imported coal, Indian coal, refinery fuel gases and oils

Zabrze

Location:	Zabrze, Poland
Customer:	Fortum Heat Polska
Start-Up Year:	2018
Capacity:	75 MWe
Fuel: Waste	RDF, biomass, bituminous coal

Hanwha Gunsan Cogeneration Plant

Location:	Gunsan City, South Korea
Customer:	Hanwha Energy
Start-Up Year:	2019
Capacity:	100 MWe
Fuel:	Sub-bituminous coal



100% biomass-fired CFB boiler
Polaniec Power Station converts wood residues and 20% agro biomass into 205 MWe of electricity

Renewable & WTE CFBs

Biofuels and waste are two of the fuel groups ideally suited for our CFB technology.

A green technology

Concern about climate change is a key factor for developing and implementing renewable energy solutions today.

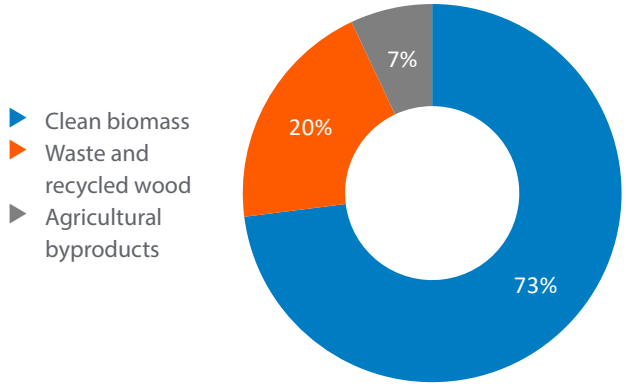
Use of biomass in power generation can contribute significantly to reducing emissions of carbon dioxide—a greenhouse gas. The fuel flexibility of our CFB technology allows them to utilize a wide range of renewable and waste fuels and fuel mixes to reduce greenhouse gas emissions.

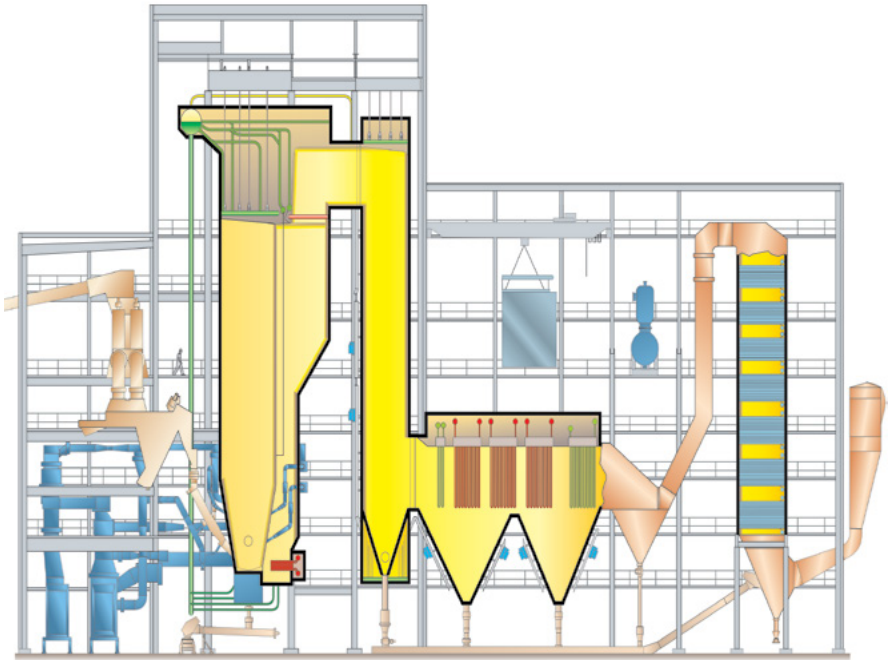
Our CFBs can also divert waste headed for land-fills and instead convert this waste into valuable steam and electricity to support our growing energy needs.

Our state-of-the-art "Advanced Bio CFB" can co-fire high alkaline, quick-growing agro biomass in utility CFBs.

OUR RENEWABLE CFB FUEL EXPERIENCE

% of operating SFW CFB capacity by primary fuel type





Becoming more green

Co-firing renewable fuels in a CFB plant originally designed for coal is an excellent, cost-effective option for helping our environment. In most cases, our operating coal-fired CFBs can co-fire biomass or waste fuels by simply adding a biomass fuel handling and feeding system, and modifying boiler operating procedures.

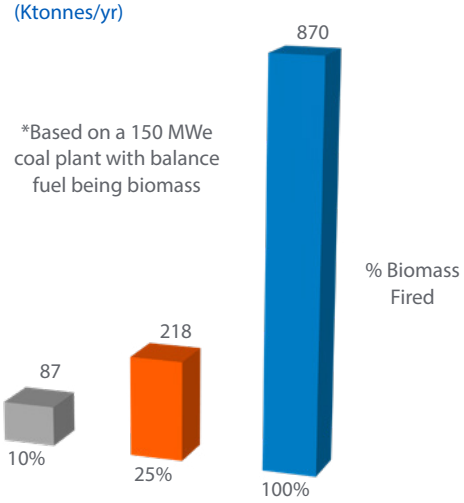
Green fuels

Biofuels include natural materials and waste produced by various industrial or other processes.

- Forestry operations
  - thinnings
  - harvesting waste
  - bark
  - stumps
- Wood processing waste
  - offcuts
  - sawdust
  - demolition wood
- Pulp & papermaking waste
- Fast-growing energy crops
- Agricultural waste
- Industrial waste
- Municipal Refuse-Derived Fuel (RDF)

Avoided CO2 Emissions*

(Ktonnes/yr)



*Based on a 150 MWe coal plant with balance fuel being biomass

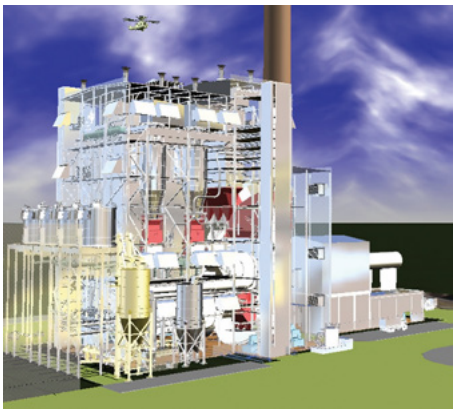
RECENT RENEWABLE CFB PROJECTS

Green Energy Centre

Location:	Daegu, South Korea
Customer:	GS Engineering and Construction
Start-Up Year:	2016
Capacity:	23 MWe
Fuel:	Waste - RDF

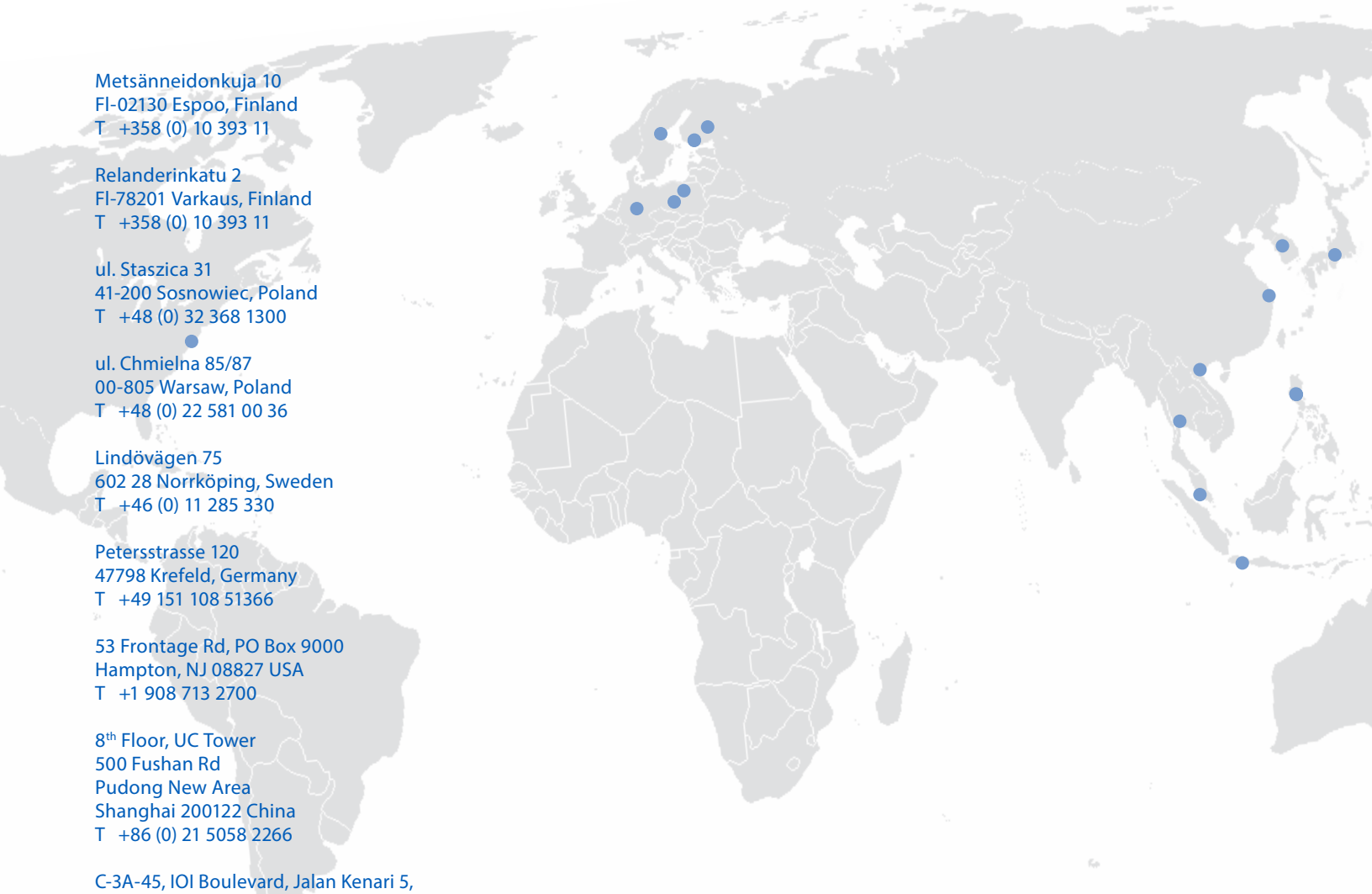
Dangjin Bio-1 Power Plant

Location:	Dangjin, South Korea
Customer:	GS Engineering and Construction
Start-Up Year:	2015
Capacity:	105 MWe
Fuel:	Biomass



Tees Renewable Energy Plant

Location:	Teesside, UK
Customer:	MGT Teesside Ltd.
Start-Up Year:	2020
Capacity:	299 MWe
Fuel:	Biomass



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Our Values

Respect for people Valuing and inviting differing views and ideas
Committed to customers Exceeding expectations and providing value
Safety, integrity and teamwork Incorporating ethics in everything we do
Ownership of results Personally ensuring that success is achieved
Passion to innovate and grow Setting challenging goals for growth

We are the premier global supplier of innovative circulating fluidized bed (CFB) technologies, providing sustainable value to our customers through our relentless drive for environmentally sound and reliable power solutions while we grow.

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