

ClimateBright™ Decarbonization Technologies

Since 1867, Babcock & Wilcox (B&W) has been a global leader in the supply of innovative technologies, such as steam generation, emissions control, and other energy solutions for a wide range of industries.

Research and development of new technologies have played key roles in our continuing ability to service major industries. As the world moves toward a lower-carbon future, we understand that clean energy is driving the demands of today's energy marketplace, and we are poised to respond with our innovative ClimateBright™ suite of decarbonization solutions. Since the early 2000s, we have been a leader in the development of carbon dioxide (CO₂) capture technologies.

We continue to build on our more than 155 years of innovation history to develop the technologies that will protect, fuel and energize our world in the future.



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BrightLoop™ Chemical Looping

For more than a decade, B&W and our university partner have collaborated to develop a chemical looping process for steam/power and hydrogen generation with CO₂ capture.

The team considers chemical looping a platform technology to convert a wide range of fuels, e.g., coal, petroleum coke (petcoke), methane, biomass, and other industrial process off-gases and materials, into multiple products including hydrogen, synthesis gas (syngas), and steam for power, process, and heating while inherently isolating a concentrated CO₂ stream. The chemical looping platform is also highly scalable, and its benefits can be applied to a wide array of industrial processes.

Process

Our BrightLoop technology is a chemical looping process based on the oxidation and reduction of an oxygen carrier particle. The fuel reacts with oxygen-carrier particles in a reducer reactor (fuel reactor), forming combustion byproducts, predominantly CO₂, while reducing the oxygen-carrier particles. The reduced oxygen-carrier particles then move to a partial oxidizer (hydrogen reactor) where they react with steam to partially oxidize the particles and generate a stream of hydrogen.

The oxygen-carrier particles are then transported to a combustor reactor (air reactor) where they are regenerated with air back to their original state. Well-proven technologies are used for the fuel and hydrogen reactors (moving bed) and the air reactor (fluidized-bed).

Gaseous products generated in each reactor are cooled (using heat traps including steam generators that produce autothermal steam for injection into the process) and cleaned using standard emissions control technologies.

The process can also be configured to produce steam, syngas for hydrogen production, liquid fuel or methanol, all with CO₂ isolation.



SolveBright™ Post-Combustion Carbon Capture

The SolveBright™ post-combustion CO₂ scrubbing system provides carbon capture for storage or beneficial use utilizing advanced solvent absorption technology.

We began initial research of post-combustion carbon capture processes in 2005, progressing from bench-scale testing in the laboratory to a pilot facility. This led to the development of the SolveBright regenerable solvent absorption technology scrubbing process which used an advanced amine-based solvent with demonstrated superior performance to that of competing solvents at the National Carbon Capture Center.

Our design has evolved to allow solvent flexibility to provide solutions which are adapted to customers' unique applications. Having completed pilot-scale testing we designed a full-scale commercial carbon capture plant suitable to capture 1500 metric tons of CO₂ per day from a flue gas source.

Process

The SolveBright CO₂ scrubbing system works by absorbing CO₂ directly from flue gas in an absorber using a regenerable solvent. The CO₂-laden solvent is sent to a regenerator where it is heated, and the CO₂ is released as a concentrated stream for compression and transport to a CO₂ sequestration hub or liquified and used for beneficial purposes. The solvent is then recycled to the absorber for additional CO₂ capture.



OxyBright™ Oxy-Fuel Combustion

Oxy-fuel combustion for use with coal to produce CO₂ in an enhanced oil recovery application was evaluated by B&W initially in 1979 at the request of a major oil company. Beginning in 2001 and with the support of the U.S. Department of Energy (DOE) and others, B&W has worked to develop this advanced carbon capture technology for steam generation. The steam can be supplied at various temperatures and pressures for use in processes or for use in a steam turbine if electrical generation is desired. This oxy-fuel combustion process can be applicable to coal, natural gas, biomass, or oil-fired units.

Process

In the oxy-fuel process, boiler combustion air is replaced with nearly pure oxygen from an air separation unit (ASU). Nitrogen that would normally be conveyed with the air through conventional air-fuel firing is excluded. Instead, a portion of the CO₂-rich flue gas is recirculated to a conventional pulverizer/burner/fluidized-bed system, substituting CO₂ for the nitrogen in the furnace. Oxy-combustion creates a flue gas that is primarily CO₂, rather than nitrogen, and includes typical products of combustion. The non-recirculated flue gas leaving the boiler is cleaned using conventional particulate and sulfur removal systems and sent to the compression purification unit (CPU) where a high-purity CO₂ stream is produced suitable for transportation or other uses.



BrightGen™ Hydrogen Combustion

B&W's BrightGen™ hydrogen combustion technology produces no CO₂ and is commercially ready and currently in operation worldwide. In fact, we have more than 60 industrial water-tube package boilers firing hydrogen and hydrogen-blended fuels. Burning cleaner hydrogen in industrial processes results in lower-carbon intensive byproducts from the combustion process.

BrightGen technology can be retrofit onto existing equipment or provided with new installations to fire hydrogen efficiently and safely. When considering the potential for fuel switching from a solid or gaseous fuel, and integrating hydrogen into the combustion process, B&W conducts a complete evaluation of the entire boiler system. This includes all combustion equipment such as burners, ignitors, flame scanners and fuel trains, as well as boiler heating surfaces and air systems, and all boiler control systems.



CO₂llaborate 2 Decarbonize

Decarbonization for a **net zero future**



Babcock & Wilcox has been on the clean energy “trend” for many decades. We make big things happen through our ClimateBright™ technologies that generate needed power, while lowering greenhouse gases and other emissions. And it all happens through B&W innovation.

Visit [babcock.com/decarbonization](https://www.babcock.com/decarbonization) for more details or to contact us.

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RENEWABLE | ENVIRONMENTAL | THERMAL

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