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CLIMATEBRIGHT™ DECARBONIZATION TECHNOLOGIES BABCOCK & WILCOX

SUMMARY

The ClimateBright™ suite of revolutionary hydrogen and decarbonization technologies from Babcock & Wilcox (B&W) is designed to help customers in energy and industrial sectors aggressively combat greenhouse gas emissions and climate change. ClimateBright technologies further strengthen B&W's commitment to clean energy progress and to helping customers worldwide address the most significant environmental challenges in industrial processes and energy generation.

ClimateBright has a wide range of clean energy solutions to drive the energy transition through capture carbon and production of hydrogen for industries including energy production, food manufacturing, steel, cement, oil and gas, pharmaceutical, petrochemical, carbon black, and pulp and paper. Our technologies build on B&W's core talents in steam generation, combustion, and flue gas treatment, and

each addresses the emissions of CO₂ from the combustion of carbon-based fuels in a unique way:

1. BrightLoop™ uses a chemical looping process around a ferrous oxygen carrier to separate the products of combustion of a carbon-based fuel into separate streams of CO₂ and oxygen depleted air, allowing for the capture of CO₂.
2. SolveBright™ is a post combustion capture process using regenerable solvents.
3. OxyBright™ purifies the flue gas stream to near pure CO₂, simplifying its capture.
4. BrightGen™ eliminates the generation of CO₂ by switching to a non-carbon-based fuel.
5. Flue gas pre-treatment for post-combustion CO₂ capture.

DESCRIPTION



BRIGHTLOOP™ CHEMICAL LOOPING

Babcock & Wilcox partnered with The Ohio State University to develop our BrightLoop chemical looping technology, which can use a variety of fuel stocks to produce hydrogen, syngas, steam, liquid fuel or methanol, and/or power while also producing a stream of concentrated CO₂ for sequestration and storage or other uses.

The patented BrightLoop process is based on the oxidation and reduction of an iron-based oxygen carrier particle and has the ability to capture a pure stream of hydrogen and CO₂ from gas and solid fuels – including biomass, coal, waste fuels, natural gas, biogas, petroleum coke (petcoke) or others. In this process, fuel reacts with the 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. The fuel and hydrogen reactors use moving bed technology while the air reactor uses fluidized-bed technology, both well-proven technologies with which B&W has extensive experience. Other emissions can be controlled using B&W's complete suite of environmental control technologies.

We are confident our BrightLoop technology will play a major role in helping the world transition to a more sustainable future, supporting the international goal of net-zero greenhouse gas emissions by 2050.



SOLVEBRIGHT™ POST-COMBUSTION CO₂ SCRUBBING

B&W's SolveBright regenerable solvent absorption technology scrubbing process came from decades of decarbonization research and development. The SolveBright carbon dioxide scrubbing system is a post-combustion carbon capture technology that captures 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 storage or beneficial uses. The solvent is then recycled to the absorber for reuse.

While B&W's solvent demonstrated superior performance compared to more than 100 competing solvents during our extensive testing procedures at the National Carbon Capture Center, a major advantage of the SolveBright process is solvent flexibility, which allows customization of an optimal CAPEX and OPEX solution for each application. SolveBright can be used with a variety of solvents and we have the expertise and ability to use a wide range of potential solvents.

B&W has extensive knowledge of combustion processes – including many decades of experience with waste-to-energy and biomass-to-energy plants – and thermal management associated with combined heat and power systems and can effectively integrate the carbon capture system into an existing facility. This experience gives us the ability to optimally integrate the SolveBright solution with virtually any new or existing facility.

B&W's solvent-based CO₂ capture experience spans a wide range of industries with various fuels and we can offer total solution support -- from feasibility studies, pre-FEED and pilot unit definition, to full-scale plants -- tailored to the customer's specific needs.



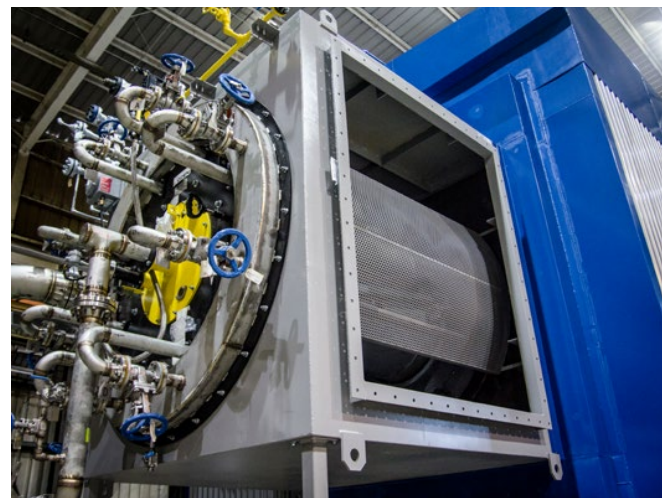


OXYBRIGHT™ OXY-FUEL COMBUSTION - ADVANCED CARBON CAPTURE TECHNOLOGY FOR STEAM GENERATION

B&W's oxy-combustion process can be used to generate steam and power using a variety of fuels, including coal, natural gas, biomass, oil and others. In the oxy-fuel process, combustion air is replaced with nearly pure oxygen and recirculated CO₂. Nitrogen that would normally be conveyed with the air through conventional air-fuel firing is excluded and the resulting flue gas consists of nearly pure CO₂. 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 that is suitable for transportation or other uses.

B&W provided oxy-fuel technology for use with coal on the U.S. Department of Energy's FutureGen 2.0 demonstration project in Illinois, which was to be a retrofit of a 167-megawatt coal-fired power plant. Although construction began in 2014, the project was canceled in 2016 due to redirection of DOE funding support. B&W has continued to develop oxy-fuel technology and it is ready for full-scale commercialization and deployment.

In March 2022, B&W announced its OxyBright and biomass boiler-fired technologies would be part of the world's largest net-negative CO₂ biomass-to-energy facility to be developed by Fidelis New Energy at the Port of Great Baton Rouge, Louisiana. Using B&W's proprietary BrightLoop™ technology, the plant will be designed to turn biomass into low-carbon intensity hydrogen more efficiently and affordably than any other processes, spurring the production of 15 tons of it every day.



BRIGHTGEN™ HYDROGEN COMBUSTION

B&W's BrightGen hydrogen combustion solution is currently in operation at multiple refineries and industrial facilities around the world and is available to customers seeking a powerful hydrogen combustion solution for utility and industrial applications where efficient, zero-carbon dioxide-emissions energy generation is a goal.

Our highly reliable utility, industrial and FM package boilers can be manufactured or retrofitted with BrightGen technology to safely burn hydrogen or hydrogen-blended fuels for virtually any need, including power, heating and steam generation, and for industrial applications such as refineries and petrochemical facilities.

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.

Our BrightGen technology is currently in use in more than 60 industrial boilers around the world.



FLUE GAS PRE-TREATMENT FOR POST-COMBUSTION CO₂ CAPTURE

Acid gases degrade the solvents used in a post-combustion carbon capture system. B&W offers a complete suite of environmental control technologies to control sulfur dioxide (SO₂), sulfur trioxide (SO₃) – which can form aerosols and cause loss of CO₂ capture solvents - hydrogen chloride (HCl), and hydrogen fluoride (HF) in the pre-capture flue gas stream, as well as technologies for other pollutants such as metals and particulates. Nitrogen oxides (NO_x) are also detrimental for CO₂ capture solvents and can lead to hazardous degradation products in the process. CO₂ scrubbing may also improve when particulate matter is removed from the flue gas prior to the scrubbing process.

B&W has many decades of experience in emissions control solutions, pioneering technologies that have helped customers comply with stringent emissions regulations for more than 50 years.

Our solutions include:

- Wet flue gas desulfurization (FGD) scrubbers
- Wet gas scrubbers (WGS)
- Spray dryer absorbers (SDA)
- Circulating dry scrubbers (CDS)
- Dry sorbent injection (DSI)
- Wet and dry electrostatic precipitators (ESP)
- Fabric filter baghouses
- Direct contact coolers (DCC)

SUMMARY

B&W has a broad range of unique and innovative technologies and processes for carbon capture, hydrogen generation and hydrogen combustion, including:

- CO₂ Removal – Capture (OxyBright, SolveBright, BrightLoop) Direct Carbon Removal CDR (DAC)
- CO₂ Reduction – Efficiency improvements and fuel mixing (CH₄ + H₂ – coal + biomass)
- CO₂ Avoidance – Replacing carbon-intensive power generation with renewables (green steam, LDES, solar) or fuel switching and combustion of hydrogen or ammonia – (BrightGen, electrolyzers, BrightLoop)
- CO₂ Reuse – Capture carbon for beneficial use – P2X (biogenic CO₂), food & beverage use (OxyBright, SolveBright, BrightLoop)
- CO₂ Storage – Capture and store (OxyBright, SolveBright, BrightLoop)
- Low Carbon Intensity Hydrogen Generation – (BrightLoop, electrolyzers)
- Hydrogen Combustion (BrightGen)
- Flue Gas Pre-Treatment (full suite of B&W environmental technologies)

More information on B&W's ClimateBright suite of products is available at www.babcock.com.