BREF Compliance Solutions for Large Combustion Plants

An experienced and full-scope provider of AQCS technologies

Babcock & Wilcox

ENERGY | ENVIRONMENTAL

Babcock & Wilcox: Experience with National Regulations

B&W

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U.S. EPA Clean Air Interstate Rule (CAIR)

- primarily SO_2 and NO_x
- technologies: wet and semi-dry scrubbers and SCR
- 4 years to comply
- B&W supplied 20 to 25% of market

U.S. EPA Mercury and Air Toxics Standards (MATS)

- primarily mercury and PM
- technologies: ESP upgrades and fabric filters
- 3 years to comply
- B&W supplied 20 to 25% of market

EU Waste Incineration (WI) BREF and Industrial Emissions Directive (IED)

- primarily dust, HCl, HF, SO_x, mercury, dioxin and NO_x
- supplied technologies to several plants that operate within the BAT emissions levels proposed in the new WI BREF
- technologies: dry/semi-dry baghouse filter systems, wet scrubbers/condensers, ADIOX® technology for dioxin removal, and MERCOX™ process for mercury removal

The European BREF regulations will require all large combustion power plants to comply with stricter air emissions limits by 2022. This includes limits on mercury (Hg), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM).

The time to act is now. Turn to Babcock & Wilcox (B&W), an industry leader in providing a full suite of options and technologies to meet these challenges. We have the proven technical experience, know-how and responsiveness to help you lower air emissions to acceptable levels.

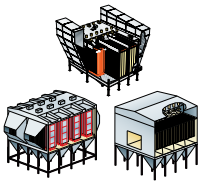
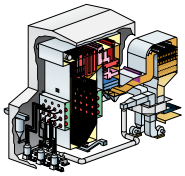
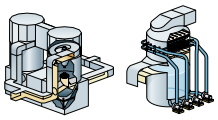
Our vast experience with helping customers meet a wide range of national air regulations at power plants across the United States and Europe includes large-scale implementation planning, system design and project execution.

In addition, our experience with boiler design and combustion fundamentals makes us uniquely qualified to consider how each environmental solution will affect performance and operation of existing power plant equipment.

Proven Full-scope Technology Provider

Babcock & Wilcox applies our experience, innovation and responsiveness to provide a proven portfolio of advanced and integrated emissions control solutions that are customized to meet your needs. Our environmental technologies are working every day in utility and industrial steam generation applications around the world.

Babcock & Wilcox Emissions Control Solutions Experience

Emission		Technology Solutions	B&W Experience*
Particulate Control **PM**		• Pulse Jet Fabric Filter / Baghouse	• 989 units • >27,000
		• Dry ESP	• 1160 units • >50,000 MW
		• Wet ESP	• 446 units • 3885 MW
NO_x Control **NOx**		• SCR	• 83 units • 32,800 MW
		• SNCR	• 13 units • aqueous ammonia and urea-based systems
		• Low NO_x Burners	• >10,600 burners • >157,000 MW of installed capacity
SO_2 / Acid Gas Control **SO2**		• Wet FGD	• 297 units • 108,000 MW
		• Semi-Dry FGD	• 68 units • 17,600 MW
		• Dry Sorbent Injection	• 23 units • >13,000 MW
Mercury Control **Hg**		• Powdered Activated Carbon (PAC) Injections	• 22 units • >7000 MW
		• Absorption Plus™, Merc Plus™, Mitagent™	• 989 units • >27,000

** Experience includes power and industrial installations, both new and retrofit, as of the date of publication; MW numbers are power installations only*

Multi-Pollutant Emissions Control Technologies

Air Emissions	Wet FGD	Dry FGD	DSI	SCR	SNCR	ACI	ESP	FF
SO_2, SO_3, HCl	1	1	2	4			3	3
PM	1						1	1
NO_x				1	1			
Mercury	1	1		4		2	3	3

1. This technology directly captures this pollutant or, in the case of NO_x, converts it into nitrogen and water.
2. This technology captures a gas or ultra-fine particulate on a readily filterable sorbent.
3. This technology filters or precipitates previously injected sorbent laden with the pollutant.
4. This technology oxidizes the pollutant which then has positive downstream effects.

Source: adapted from IHS CERA's Post combustion emission control technology cheat sheet.

Mercury Control

B&W has been actively involved in mercury control systems since the early 1990s. We have multiple solutions focused on integrating a variety of technologies with other air quality control systems that may already exist at a power plant.

Our MercPlus™ fuel additive system is designed to enhance mercury emissions reduction and minimize the use of powdered activated carbon (PAC) at power plants using low chlorine coals. Our Absorption Plus (Hg)™ system is designed to inhibit mercury re-emission and to increase the total mercury captured and retained in a wet FGD system. And the Mitagent™ fuel additive allows less halide usage to attain the same oxidized fraction of mercury in the flue gas. These technologies may be combined with or even replace PAC injection, thereby reducing the volume of PAC required to achieve the required mercury emission levels.

By understanding the interrelationship between various technologies, as well as the co-benefits achieved with other air quality control systems, our solutions can save significant cost throughout the life of the plant.

NO_x Control

Low NO_x Burners and Combustion Systems

Since 1971, B&W has provided more than 157,000 MW of low NO_x combustion capacity (more than 10,600 burners) in both new and retrofit boiler applications. Our low NO_x burner technology has been successfully applied to units with varying fuel characteristics and boiler arrangements.

Our latest and most advanced designs, the DRB-4Z® and the AireJet™ burners, offer significant NO_x reduction capabilities across the full range of boiler configurations, solid fuels, and combustion firing patterns. Rugged construction provides superior mechanical reliability and operation.

Selective Catalytic Reduction (SCR) Systems

B&W's post-combustion SCR systems are installed on nearly 33,000 MW of generating capacity, including both new boiler installations and retrofit applications.

Customized designs provide a comprehensive and integrated SCR package that considers reactor design, flue work, catalyst type and cleaning, ash management, temperature control, ammonia injection, mixer design, control systems, and balance of plant equipment.

SO_2 Control

Spray Dryer Absorber Systems

are licensed by B&W from GEA Process Engineering A/S for the GEA Niro spray dryer absorption (SDA) process. Our customers benefit from high SO_2 removal efficiencies, high system availability, low capital costs, and low operation and maintenance costs, as well as the inherent capture of oxidized mercury.

Wet Flue Gas Desulfurization Systems

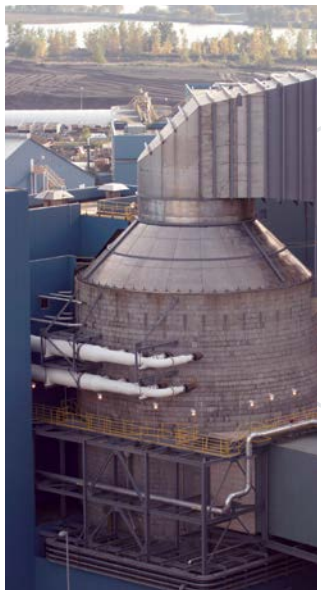
are B&W's solution to achieving high SO_2 and HCl removal and system availability on boilers burning fuels containing various sulfur levels. A variety of configurations are available to meet plant requirements.

Our limestone forced oxidation process improves scrubber operation while producing a marketable gypsum byproduct with low waste disposal requirements.

As a full-scope supplier we provide the absorbers, along with the reagent storage and preparation, dewatering, and other auxiliary equipment.

Dry sorbent injection

B&W's dry sorbent injection (DSI) systems provide a low-cost solution to capture acid gases, either separately or combined. When used solely for SO_2 control, DSI systems are ideal for smaller coal-fired boilers (typically less than 300 MW), biomass boilers and industrial applications. On larger units, DSI systems also can be used for HCl or SO_3 control when combined with other air emissions control technologies.



Particulate Matter Control

PM

Fabric Filters

B&W provides cost-effective control of particulate emissions and opacity with our proven pulse jet fabric filter technologies. Integrating fabric filters with our sorbent injection and FGD technologies provides high removal efficiencies of air pollutants in a variety of applications.

We have provided some of the largest fabric filters in the world. Innovative design features such as long bag technology, integral gas and dust distribution devices, as well as on-line maintenance capability provide benefits of increased reliability while achieving lower emissions.

Dry Electrostatic Precipitators

B&W's particulate control experience began with the first electrostatic precipitator (ESP) installation in the U.S. in 1907. Our dry ESP combines the advantages of maximum collection efficiency and low operating and maintenance costs with extensive application experience.

Wet Electrostatic Precipitators

As a final filter, B&W's wet ESP provides the lowest overall emissions of fine particulate and acid mist. Our wet ESP system utilizes both intermittent and continuous washing for efficient cleaning. We provide a robust all-alloy wet ESP design and are experienced with proper material selection. System benefits include low operating and maintenance costs, and a flexible, stand-alone design that can be integrated with other pollution control devices.

Project Execution Options

Babcock & Wilcox has a wide range of proven and successful project execution experience, including strategic partnerships, equipment design and supply, or EPC turnkey utilizing preferred partners.

Auxiliary Systems and Services

In addition to our emissions control solutions, we provide a wide range of auxiliary systems and aftermarket products and services, including:

- Boiler cleaning (Diamond Power® sootblowers)
- Ash and material handling systems (Allen-Sherman-Hoff®)
- Controls and diagnostics
- Equipment inspections, troubleshooting and optimization
- Engineering studies
- Engineered equipment upgrades
- Startup and commissioning services
- Performance testing and optimization
- Replacement parts

Choose Babcock & Wilcox

Babcock & Wilcox is well positioned to support your BREF compliance needs and collaborate on solutions for optimizing your fleet.

- ***Technology leader*** – Full portfolio of environmental compliance solutions
- ***Global organization*** with dedicated sales and service support at local offices
- ***Vast experience*** with:
  - National air regulations
  - Large environmental projects – multiple units, compressed schedules
  - New equipment retrofits on existing units
  - Upgrades to OEM competitor designs
  - Variety of contracting methods
- ***Global alliances*** with key suppliers for critical equipment
- ***Range of supply*** options including equipment design & supply and EPC turnkey utilizing preferred partners

To find out how B&W can help you meet the LCP BREF regulations, contact us today.

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Established in 1867, Babcock & Wilcox is a global leader in advanced energy and environmental technologies and services for the power, industrial and renewable markets.

For more information or to contact us, visit our website at www.babcock.com.

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