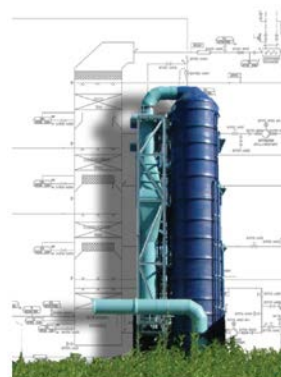


# GMAB™ Flue Gas Treatment Technologies for Waste Incineration Applications

Babcock & Wilcox Environmental (B&W) provides GMAB™ flue gas cleaning and flue gas condensation technologies for a wide range of applications, including waste-to-energy, co-incineration and hazardous waste incineration plants. Our capabilities include complete process engineering, project execution, equipment supply, installation and commissioning on a turnkey basis. We also supply associated water treatment and energy recovery technologies for district and local heating solutions. Our unique, integrated technologies provide an efficient removal of toxic pollutants. In addition, our team of expert service engineers are available to assist with plant improvements, retrofits and maintenance for optimal performance from your equipment.

FLUE GAS CLEANING | ENERGY RECOVERY | WATER TREATMENT | SERVICE & SUPPORT



RENEWABLE | ENVIRONMENTAL | THERMAL



# GMAB™ Flue Gas Treatment and Energy Recovery

## Flue gas cleaning

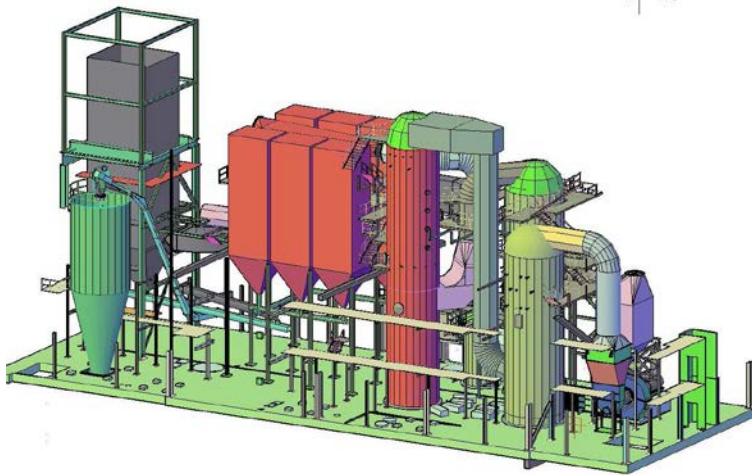
B&W maintains a recognized strength and long tradition in building complete flue gas treatment systems for waste-to-energy plants. Our experienced engineering team, project expertise and reliable designs allow us to deliver high-quality state-of-the-art technologies, whether dry, semi-wet, wet, or a combination of these solutions is needed.

## Wet flue gas cleaning

We are specialists in wet flue gas cleaning along with associated water treatment. Our wet scrubber systems provide extremely reliable and efficient flue gas treatment. Our core competence covers the complete process including water treatment technologies.

### Benefits

- Reliable and effective emissions control
- Operation with high availability
- High buffer capacity to handle peak variations
- Minimum chemicals consumption
- Low residue generation
- Most suitable to combine with flue gas condensation



Wet flue gas cleaning system at Däva 1, Umeå, Sweden



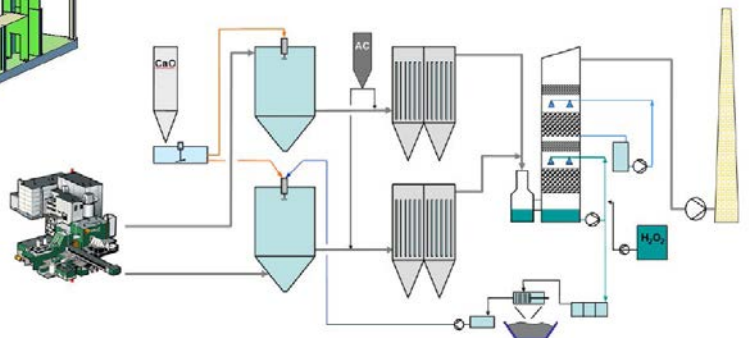
Condensing wet scrubbers at Maabjerg Energy Center, Denmark

## Combination dry/wet flue gas cleaning

Dry or semi-wet flue gas cleaning can often be combined with a condensing scrubber for energy recovery and/or an integrated polishing function to meet the most stringent performance standards.

### Benefits

- Optimal chemicals costs/consumption
- High tolerance to peak loads
- Wastewater free operation
- Enhanced energy recovery



Semi-wet flue gas cleaning system at Fortum/Ekokem, Sweden

## *Energy recovery*

Modern incineration plants are equipped with a boiler system, transforming a major part of the energy content in the flue gases into steam. The steam generates electric power in turbine generators and produces heat in turbine condensers. The heat is fed into a district heating system.

## *Flue gas condensation*

We have taken the recovery of energy one step further. By cooling the flue gas to below its dew point, it is possible to recover large quantities of latent heat. If the flue gas temperature after the boiler is approximately 150°C it is possible by means of flue gas condensation, to increase the energy efficiency by up to 20%.

Condensation may take place either as a direct heat exchange between gas and district heating water, in some cases utilizing an intermediate cooling water circuit, and/or by using an intermediate heat pump. For optimum energy efficiency, a combination of these methods are used.

The flue gas condensation can be combined with ADIOX® tower packings in the scrubber stages for dioxin removal and memory-effect prevention.

## *Absorption technology*

We supply absorption heat pumps for enhanced energy recovery (as described above) and absorption chillers to produce profitable comfort cooling in the summer. The chillers are placed locally in properties or centrally in a district cooling system and use excess heat from the district heating network as the energy source. The installation requires very little maintenance. Besides the financial gains, the technology is eco-friendly and helps in reducing CO<sub>2</sub> emissions.

## *Water treatment*

Our total system experience includes designing and supplying technologies to treat the waste water from scrubbers to minimize and potentially eliminate the discharge of harmful substances into waste water treatment systems or to the environment.

## *Service and support*

B&W has extensive experience in servicing and maintaining flue gas cleaning systems as well as compressors and absorption heat pumps. Our servicing activities include a complete programme, from delivery of spare parts to full servicing of entire plants.

Conversions, upgrades and optimizations are carried out to ensure optimum efficiency and to meet the demands of stricter environmental legislation. We offer service agreements for preventive maintenance including guaranteed call-out service to avoid unexpected stoppages. Our service organisation also provides installation, commissioning and servicing of absorption chillers.



*Absorption heat pump at Vestforbrænding, Denmark.*



# Unique Technologies

*B&W has developed a number of unique technologies that can be retrofitted into existing plants and integrated with our total package solution.*

## **ADIOX® dioxin removal**

The ADIOX® dioxin removal process is based on the high affinity of dioxins to carbon. By dispersing small particles of carbon in PP-plastics, a material excellent for dioxin abatement is produced.

A dioxin molecule that is present in the flue gas is initially absorbed into the PP and then migrating to a carbon particle where it is strongly adsorbed (connected to its surface). The plastic material acts as a selective membrane with a preference for molecules like dioxins. When the service life of the ADIOX material has come to an end, the material is incinerated. The dioxins are destroyed during the incineration process and removed from the ecocycle.



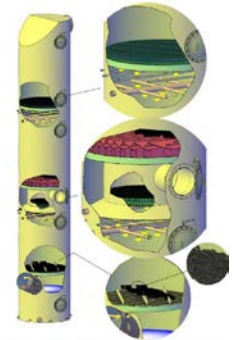
Tower packings and droplet separators, produced of ADIOX material, can be installed in wet, saturated and dry applications.

## **MERCOX™ mercury removal**

MERCOX™ is used in wet scrubber systems to oxidise metallic mercury ( $Hg^0$  to  $Hg^{2+}$ ), which is separated from the flue gas. MERCOX is a very reliable process, capable of managing a wide range of mercury loads while maintaining emissions targets.

## **Sulfur recirculation for corrosion reduction**

It is well-known that with a higher  $SO_2/HCl$  ratio in the flue gas, the high-temperature corrosion in a boiler is reduced. We have developed a process, where sulfur is recirculated from the flue gas system to the boiler. It has been documented that the Sulfur Recirculation process can decrease the corrosion rate by more than 50% in full scale operation. Also other positive effects derive from this technology, such as decreased dioxin formation.



## **Multifunctional scrubbers**

B&W offers standardized gas treatment scrubbers based on our different gas treatment technologies including acids removal, gas condensation, ADIOX dioxin removal and/or MERCOX mercury removal. The units are compact and designed for a minimum on-site erection work.

### **Babcock & Wilcox**

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Established in 1867, Babcock & Wilcox is a global leader in renewable, environmental and thermal technologies and services for power and industrial applications.

For more information or to contact us, visit our website at [www.babcock.com](http://www.babcock.com).