

Atmospheric Fluidised Bed Combustion Boilers for Firing Solid Fuels



Advanced Technologies for Power Generation

Historically, Thermax Babcock & Wilcox Energy Solutions (TBWES), a wholly owned subsidiary of Thermax Limited has maintained an ongoing program to develop advanced technologies which offer the potential for more efficient, cost effective and reliable steam generation. One of these advanced technologies is Atmospheric Fluidised Bed Combustion (AFBC), which promises to provide a viable alternative to conventional coal fired and other solid fuel fired boilers for utility and industrial applications.

TBWES began investigating various aspects of the AFBC process in the mid -70s and has become the technological leader among boiler manufacturers in AFBC development for utility and industrial use.



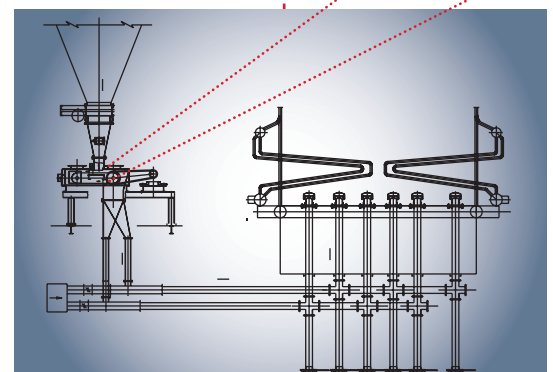
Shop assembled, machine welded membrane panels allow for less refractory and make a gas tight enclosure resulting in less leakage and improved efficiency.



Secondary Over Fire Air Arrangement

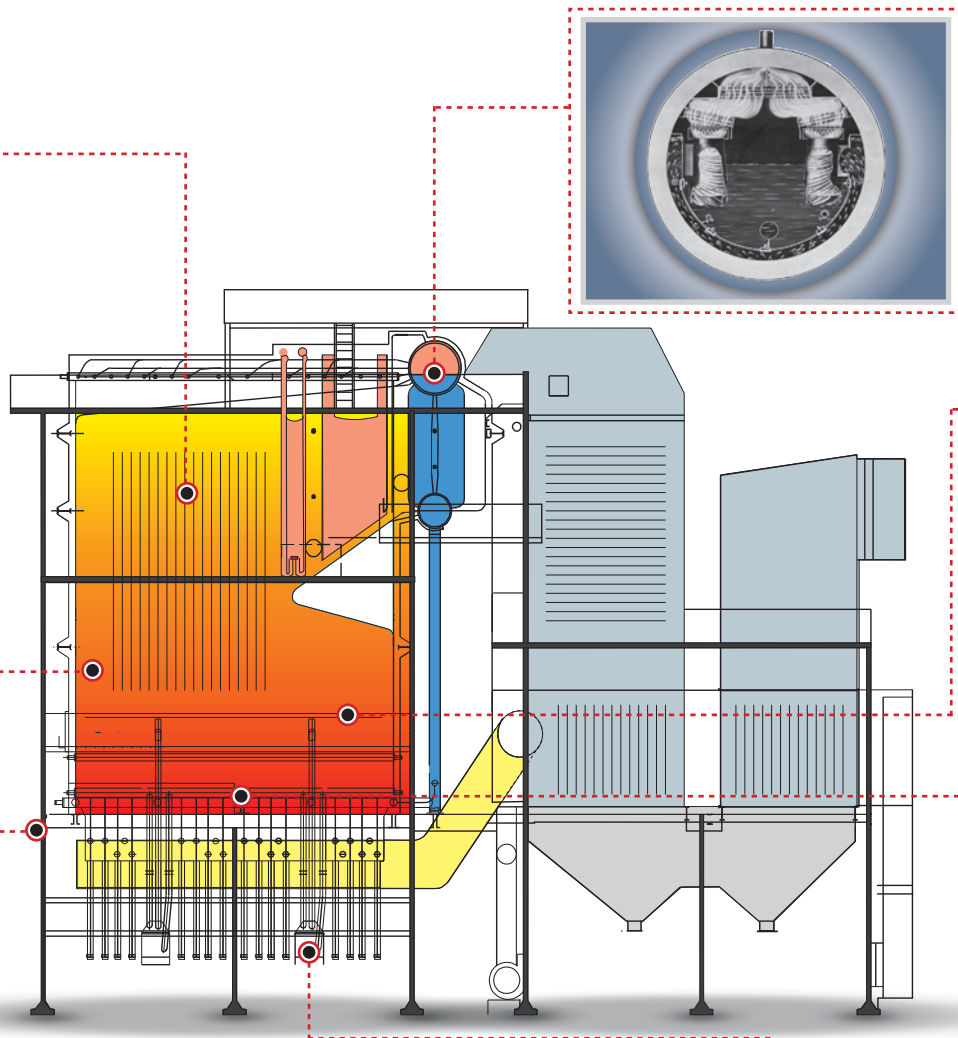


Secondary overfire air is provided from both sides of furnace to ensure complete combustion, resulting in minimum unburnt, reduced carbon monoxide and improved efficiency.



Boiler operating in Mauritius

Salient Features of Atmospheric Fluidized Bed Combustion (AFBC)



B&W design two stage steam separating equipment inside the drum ensures turbine quality steam. Guaranteed 99.99 % steam purity even under conditions of rapid load changes.

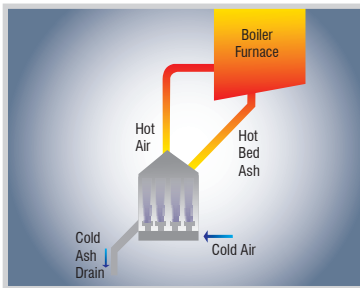
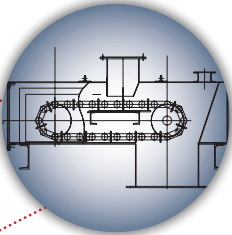
In line, spaced bed evaporator tubes for better access to bed plate. Pin studs welded on inbed surfaces and furnace walls eliminate tube erosion.



Inclined airholes prevent bed material re-entry hence eliminating back shifting.

Stainless steel air (Bubble Cap) nozzles for primary air are designed for higher pressure drop to achieve higher turndown ratios for better operational flexibility.

Underbed fuel feed system using drag chain/rotary feeders for smooth flow of high moisture fuel to furnace. Hot air for transport of fuel inside combustor for smooth flow of fuel in the feed lines. No bends on fuel transport lines improves the availability.



Fluid bed ash coolers for cooling bed ash. Air is used to cool ash. Flue gas sent back to the air heater to recover sensible heat resulting in further improvement in efficiency.



Flow Modelled Fuel Feed System



Fuel Feed Mixing Nozzles



Boiler Control Room

TBWES Technology : High Availability & Efficiency

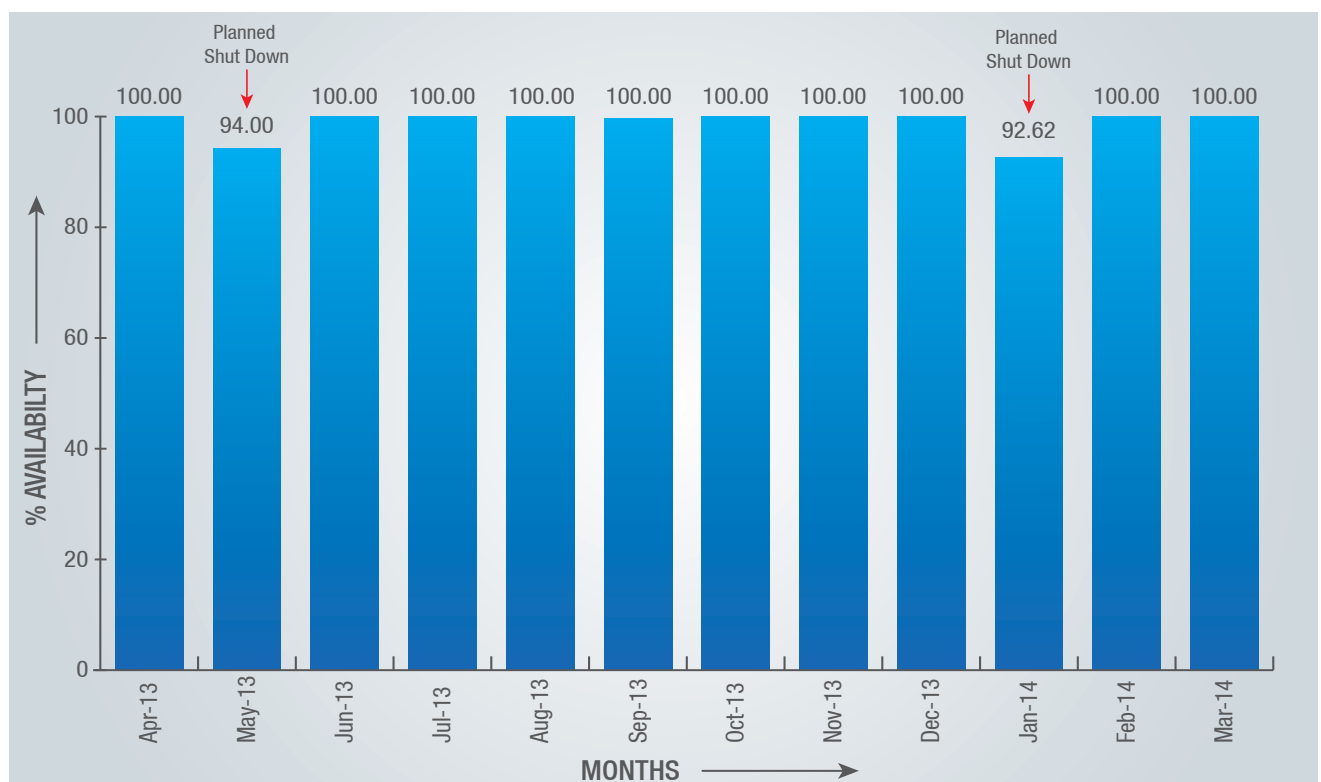
The challenge of the AFBC process is to burn fuel in an environmentally acceptable manner yet showing economic promise. The AFBC Boiler achieves this by carrying out combustion in a bed of crushed refractory / sand which is suspended by an upward stream of air, fluidising it and facilitating a significant higher degree of combustion completeness. In addition to this inherent advantage of the fluidised bed combustion process, design and operating characteristics of AFBC boilers offer a number of advantages for industrial steam and power generation.

Combustion temperatures of the AFBC process are maintained below the fuel ash softening temperature, so low-grade fuels can be burned without the risk of slagging and fouling in the boiler. The lower temperatures also limit the formation of nitrogen oxides. Fuels like coal, washery rejects, lignite (Kutch, Neyveli), petcoke, rice husk, DOB, bark, effluent sludge from paper mills, sludge from viscose plant, coffee waste etc. can be effectively burnt in AFBC Boilers.

Due to lower operating temperatures, the AFBC boiler design is less dependent on fuel and fuel ash characteristics than conventional boilers.

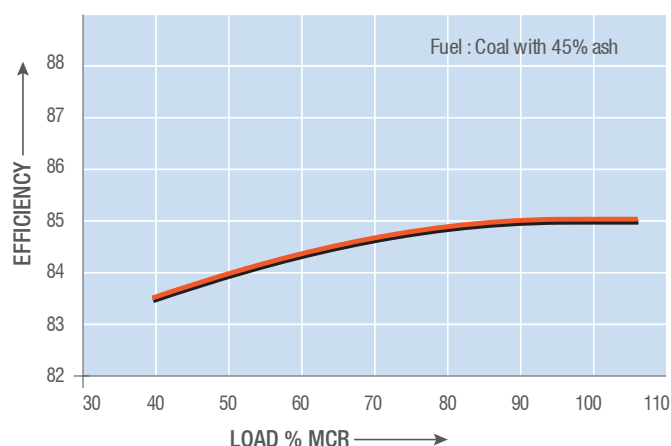
SOx control is achieved by limestone addition in the bed and FGD (Flue Gas Desulphurisation) is eliminated.

Boiler Availability*



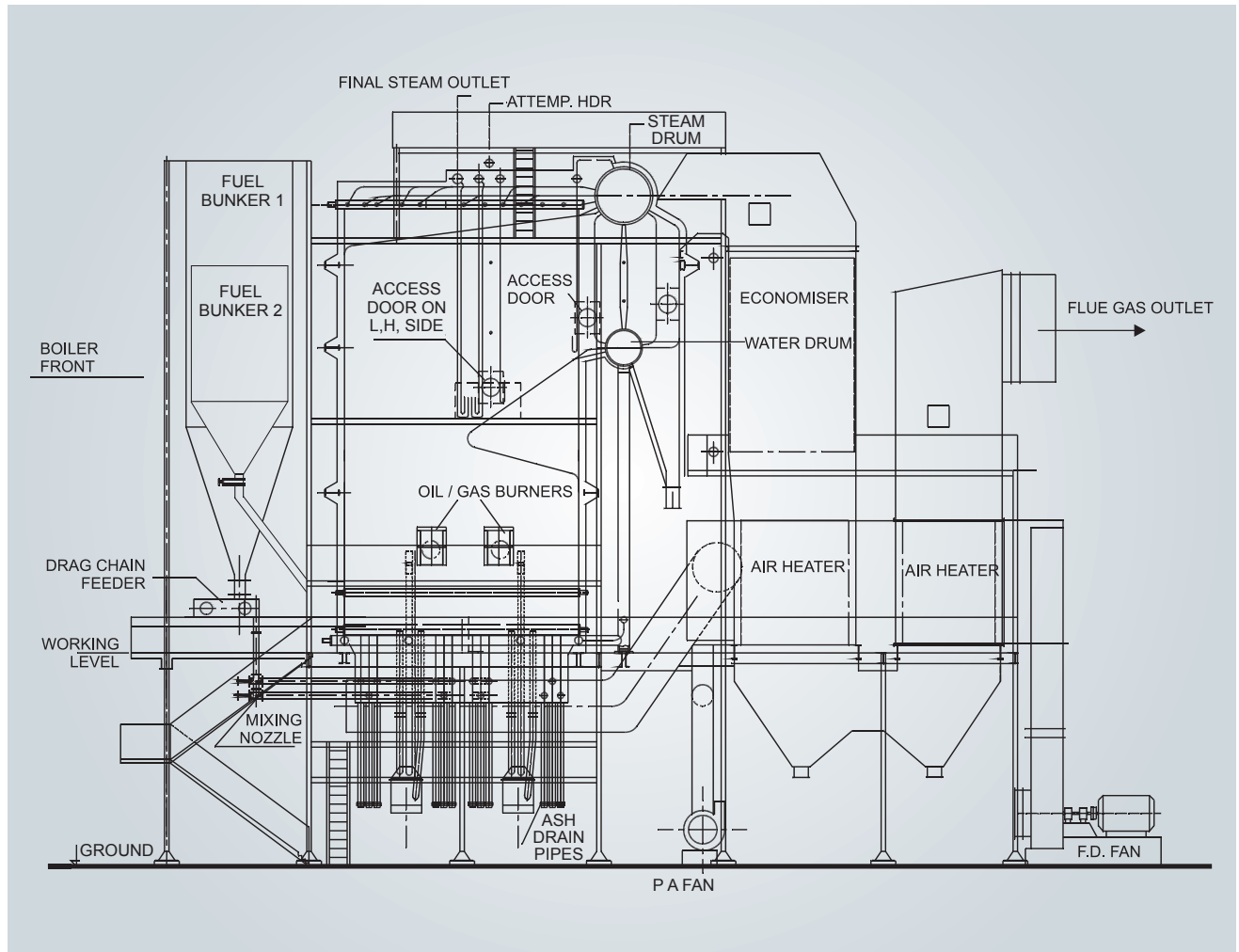
* Data from operating unit

Load Vs Efficiency



Atmospheric Fluidized Bed Combustion Boiler

(Underbed & Overbed feed system design)



Designed and manufactured to high quality, incorporating the latest advances in boiler and control technology, making it the most efficient and reliable boiler for combustion of diverse range of difficult fuels.

Capacity Range : Up to 300 TPH

Manufactured under License from Babcock & Wilcox, USA

Pressure : Up to 135 Kg/cm²g

Temperature : Up to 540°C

Fuel : Coal / Lignite / Petcoke / Rice Husk / Pith / Oil / Agricultural Waste / Washery Rejects / Char / Biomass / Spent Coffee Waste / Spent Tea Waste, Sawdust, DOB, etc.

Design Feature : Top or bottom supported, Single or Bi-drum design boilers suitable for firing low calorific value fuels. Suspension burning of fuel - higher combustion efficiency.

- Coal Size 6 mm
- Bubbling Bed Ash Coolers
- Inbed Superheater
- Stainless Steel Fluidizing Nozzles
- Boiler Bank without Baffles
- High Steam Purity
- Membrane Wall Furnace
- Start-up by Oil / Charcoal



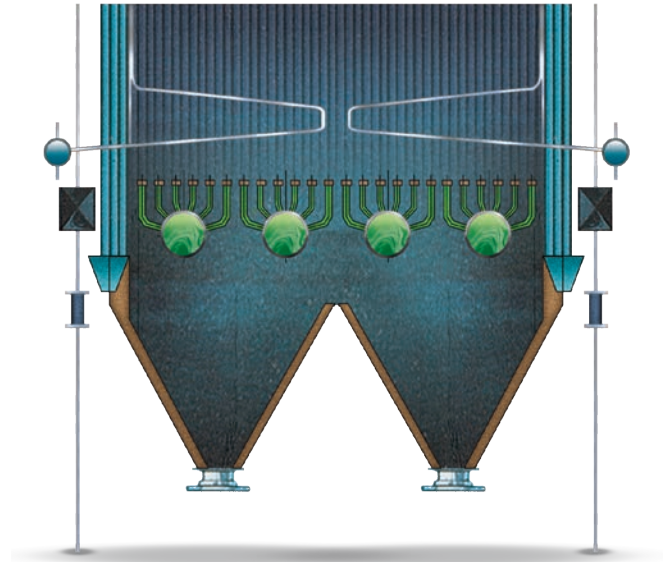
Hopper Bottom (Fluid Bed)

Salient Features

Manufactured under License from Babcock & Wilcox, USA



- Combustor does not have any moving parts thus reducing maintenance in the furnace.
- Uniform Temperature distribution in the bed and agitating characteristic of fluid bed ensures optimum combustion.
- Low excess air requirement resulting in higher efficiency.
- Lower NOx and CO emissions.
- Low SOx emission with limestone addition.
- Low temperature operation minimises the biomass fuel ash agglomeration and fouling tendency.
- Continuous slow draining of bed ash which aids:
 - Easy settling and disposal of large sized particles which hamper fluidisation.
 - Maintaining alkali concentration below acceptable levels.
 - Avoiding accumulation of denser particles in bed in maintaining uniform bed density across the entire bed.
- Under bed / over bed fuel feeding for proper distribution of fuel.

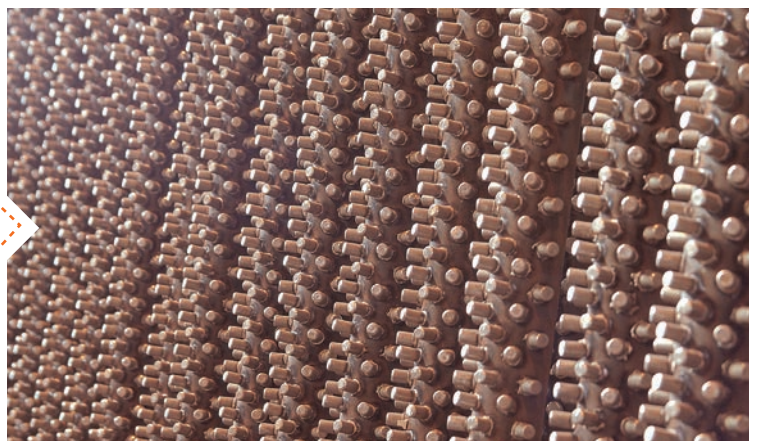


AFBC Features



Inbed Evaporator Assembly
at Shop

Stainless Steel Dense
Studs for Inbed Tubes



Shop Facilities



Drum Shop



Coil Shop



Panel Shop

Panel Bending Machine



AFBC Installations



Nestle Philippines Inc.

Philippines

Capacity : 25 TPH

Fuel used : Spent Coffee Ground,
Roasted Chaffs

Nava Bharat Ferro Alloys Ltd.

Orissa, India

Capacity : 125 TPH

Fuel used : Indian Coal



Usha Martin

Jamshedpur, India

Capacity : 110 TPH

Fuel used : Coal

Central Pulp Mills

Gujarat, India

Capacity : 50 TPH

Fuel used : Coal /lignite



Other products offered by TBWES

Solid Fuels, Agro-wastes, Biomass



Circulating Fluidized Bed Combustion Boiler (CFBC) (B&W Technology)

- Capacity: Up to 1000 TPH
- Pressure: Up to 200 bar (g)
- Temperature: Up to 560°C
- Fuels: High-ash/low ash coal, high-sulphur coal, mill rejects, washery rejects, lignite, pet-coke, sludge, oil pitches, agro-wastes, biomass etc.

Biomass Boiler (Travelling grate, Dumping grate, Pinhole grate, Pusher grate)

- Capacity: Up to 300 TPH
- Pressure: Up to 160 bar (g)
- Temperature: Up to 560°C
- Fuels: Bagasse, rice husk, straw, coffee grounds, coconut shells, lignite, coal, pith, jatropha oil, mustard husk, wood chips, paper sludge, biogas etc.



Waste to Energy



Spent Wash (Vinasse) Fired Boiler

- Capacity: Up to 75 TPH, Pressure: Up to 66 bar (g), Temp: Up to 480°C
Support Fuels: High ash, coal, imported coal, bagasse
- **Washery rejects fired** in AFBC & CFBC boilers
- **Petcoke fired** in AFBC & CFBC boilers

Waste to Energy (WTE)/ Refused Derived Fuels

The MSW/RDF fired boiler technology draws from Thermax's innovative tradition and experience with firing various non-conventional fuels including agro-wastes, spent-wash, sludge and other industrial wastes, and a variety of biomass.



Product Features

- Specially designed furnace to ensure complete combustion and automated soot removal system
- Hydraulic ram feeder provided considering fuel size variation
- Specially designed pusher grate to handle wide variation in fuel type, moisture and particle size; special grate and air plenum sections provided to ensure better distribution/control
- Positive movement of fuel over the grate minimises clinkering and blockages
- Ram feeding system ensures uniform distribution of fuel onto the grate
- No rotating parts, hence enhanced life and robust construction

Other Products offered by TBWES



Oil & Gas

- Ranging in capacities upto 500 TPH, 160 kg/cm²(g), 560°C
- Bi-Drum Boiler (FM/HCFM/PFM) (B&W Technology)
- Singe-Drum High-Capacity Boiler ("Radiant" Boiler)
- Heat Recovery Steam Generator (HRSG) (B&W Technology)
- Waste Heat Recovery Unit (WHRU)
- D-Type Boiler (Thermstar)

Lean Gas Fired Boiler

- Ranging in capacities upto 500 TPH, 160 kg/cm²(g), 560°C
- Blast Furnace Gas, Coke Oven Gas, Corex Gas Fired Boiler
- CO/H₂ Gas Fired Boiler



Fired Heater

- Vertical, Cylindrical or box type heaters upto 140 MM Kcal/hr capacity
- Chemical & Petrochemical
- Upstream Oil & Gas
- Refinery

Waste Heat Recovery Boiler (WHRB)

- | | |
|---|----------------------|
| ■ Ranging in capacities upto 500 TPH, 160 kg/cm ² (g), 560°C | ■ Chemical |
| ■ Sponge Iron | ■ Sulphur Recovery |
| ■ Coke Oven | ■ Exhaust Gas Boiler |
| ■ Non Ferrous (Copper Smelter/ Zinc Smelter etc) | ■ Hydrogen Plant |
| ■ Refinery and Petrochemical | ■ Glass Furnace |
| ■ Cement | ■ Coal Gasification |
| | ■ Coke Calcination |



Services

- Condition Assessment and Remaining Life Analysis and Engineering Studies
- Fuel Conversion and Firing System Upgrade
- Performance Enhancement Solutions
- Pressure Part Replacements and Upgrades
- Utility Boiler Revamps



Thermax Babcock & Wilcox Energy Solutions
Energy House, DII Block, Plot No
38 & 39, MIDC, Chinchwad,
Pune: 411 019

enquirytbwes@thermaxglobal.com








Customer Care: 1800-209-0115

www.thermaxglobal.com

 www.linkedin.com/company-beta/166428

 www.facebook.com/Thermaxglobal

Thermax Business Portfolio

-  Heating
-  Cooling
-  Power
-  Air Pollution Control
-  Chemicals
-  Water and Wastewater Solutions
-  Solar
-  Specialised Services



This brochure presents only some of our products and we reserve the right to amend any product details without notice. The photographs used in the brochure are indicative and may not match the actual plant.

© TBWES, January 2021