



Sustainable Solutions for Energy Transition in Chemical & Pharma Industries

Thermax Limited

Conserving Resources, Preserving the Future.



Our Vision

To be a globally respected high performance organisation offering sustainable solutions in energy and environment



Conserving Resources, Preserving the Future

Solutions



Power



Heating



Cooling Utilities



Water Treatment



Chemical

Raw Material



Waste



Desired Product

Hazardous Waste Treatment



Wastewater Treatment



Air Pollution Control



Waste to Energy Generation



Accelerating Decarbonisation

**Sustainable
Energy & Environment
Solutions**

(Capex / O&M)

**Green Utility
Solutions under
Build-Own-Operate**

From investment to
lifecycle responsibility

Green Hydrogen

Accelerating Decarbonisation

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**Green Utility
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Green Hydrogen

Sustainable Solutions by Thermax

Clean Air

Clean Water



Clean Energy

Sustainable Solutions by Thermax



Clean Energy



Process Heating



Steam Engineering



Cooling & Heating

Biomass as an alternative green fuel

Biomass is a carbon neutral fuel as the Carbon dioxide generation in the process of combustion is balanced by the carbon dioxide absorption in the plant growth period.

Challenges

Lower bulk density and lower calorific value

Higher moisture level

Fouling and slagging characteristics of biomass ash

Seasonal variation in biomass fuel

Biomass-Based Heating Technologies

55+ years of understanding heating needs of the process industries

30+ years of biomass-based solutions expertise

Wide range of technologies to combust 100+ biomass fuels

Persistent research and innovation to meet ever-changing market demands

Thermax Biomass Centre of Excellence's commitment towards technology leadership

Common biomasses and their classifications

Fibrous and low-density biomass



Rice Straw



Mustard Straw



Jaggery Bagasse

Shredded Biomass



Mustard Stalk



Cotton Stalk

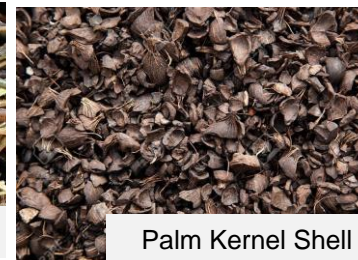


Rice Husk

Nut Shell Biomass



Cashew Shell



Palm Kernel Shell

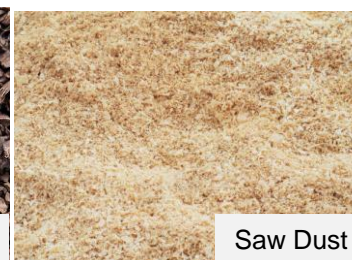


Groundnut Shell

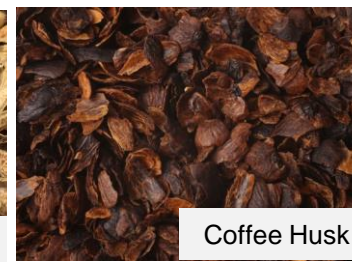
Fine or Dust Biomass



Mustard Husk



Saw Dust



Coffee Husk

Woody Biomass



Wood Chips



Bamboo

Bunch Biomass



Empty Fruit Bunch



Corn Cobs

Processed Biomass



Briquettes



Pellets

DOC / Process by-product

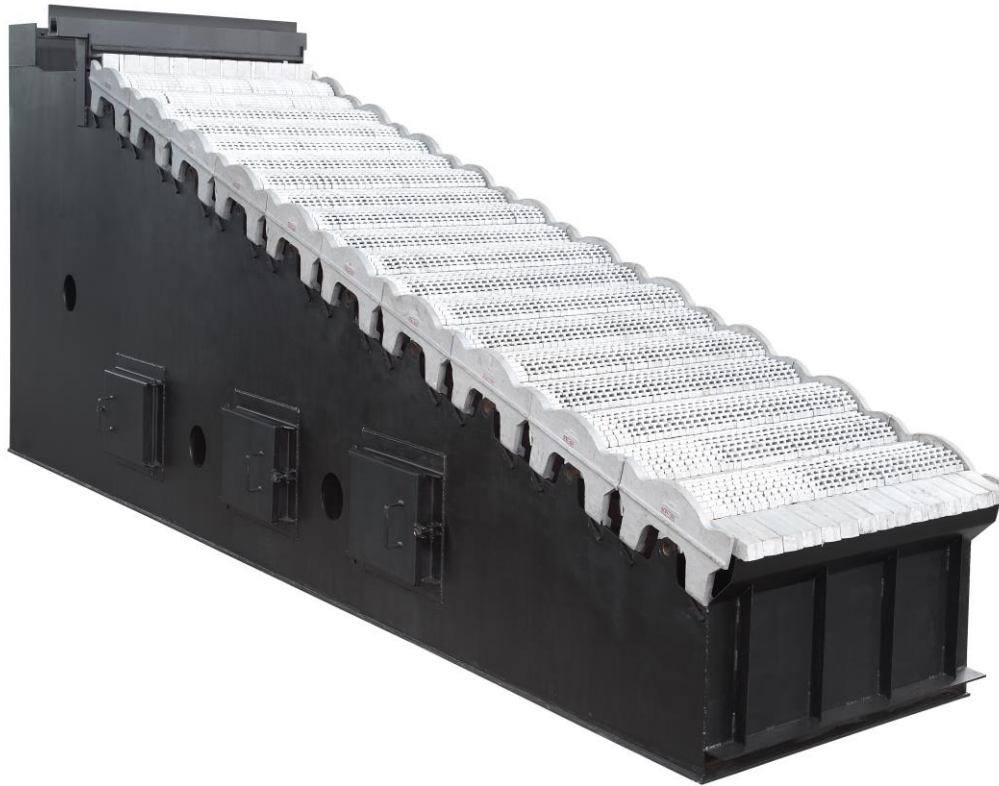


Groundnut DOC



Spent Coffee

Combustion technology for biomass fuels



Reciprocating Grate Technology from Lambion, Germany



Reciprocating Motion

- Reciprocating action of the alternate grate pushes fuel into different combustion zones causing toppling and intermixing of the fuel to achieve effective combustion, even for bulky and high moisture fuels

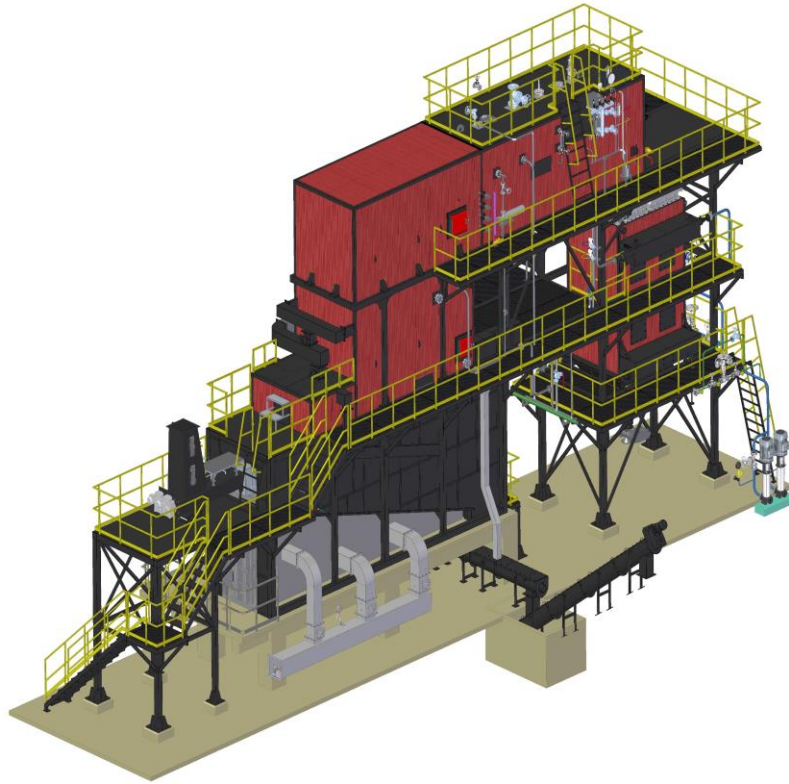
Multiple Trolley

- Multiple trolleys controlled by independent hydraulic cylinders operate at different speeds to meet the time requirement of different combustion stages
- Multiple trolleys provided with different air connections to ensure independent zone-wise air distribution

Multiple grate bar geometry

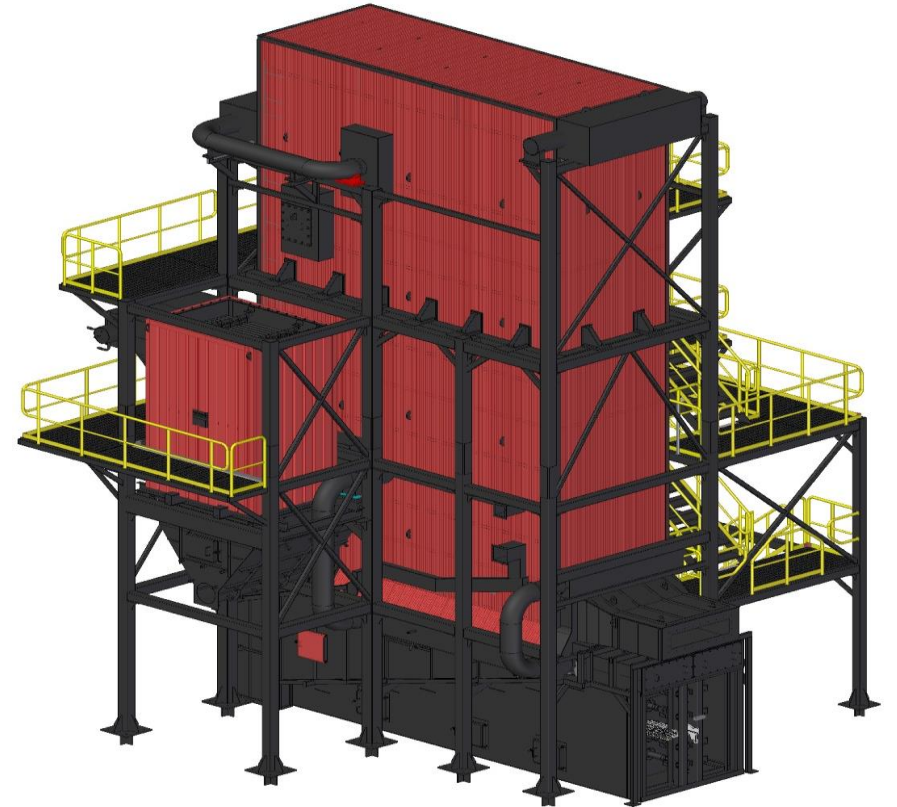
- Multiple grate bar geometries, namely block, full nozzle, half nozzle, and side plates for width and length-wise air control within the same trolley
- Avoids tongue effect

Products and solutions with reciprocating grate technology- wide range of offering



CPRG- Biomass fired hybrid boiler

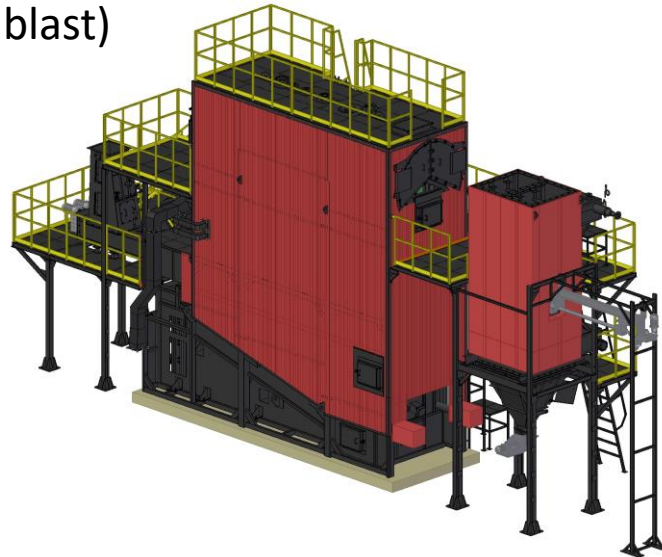
BDRG- Biomass
fired water
tube boiler



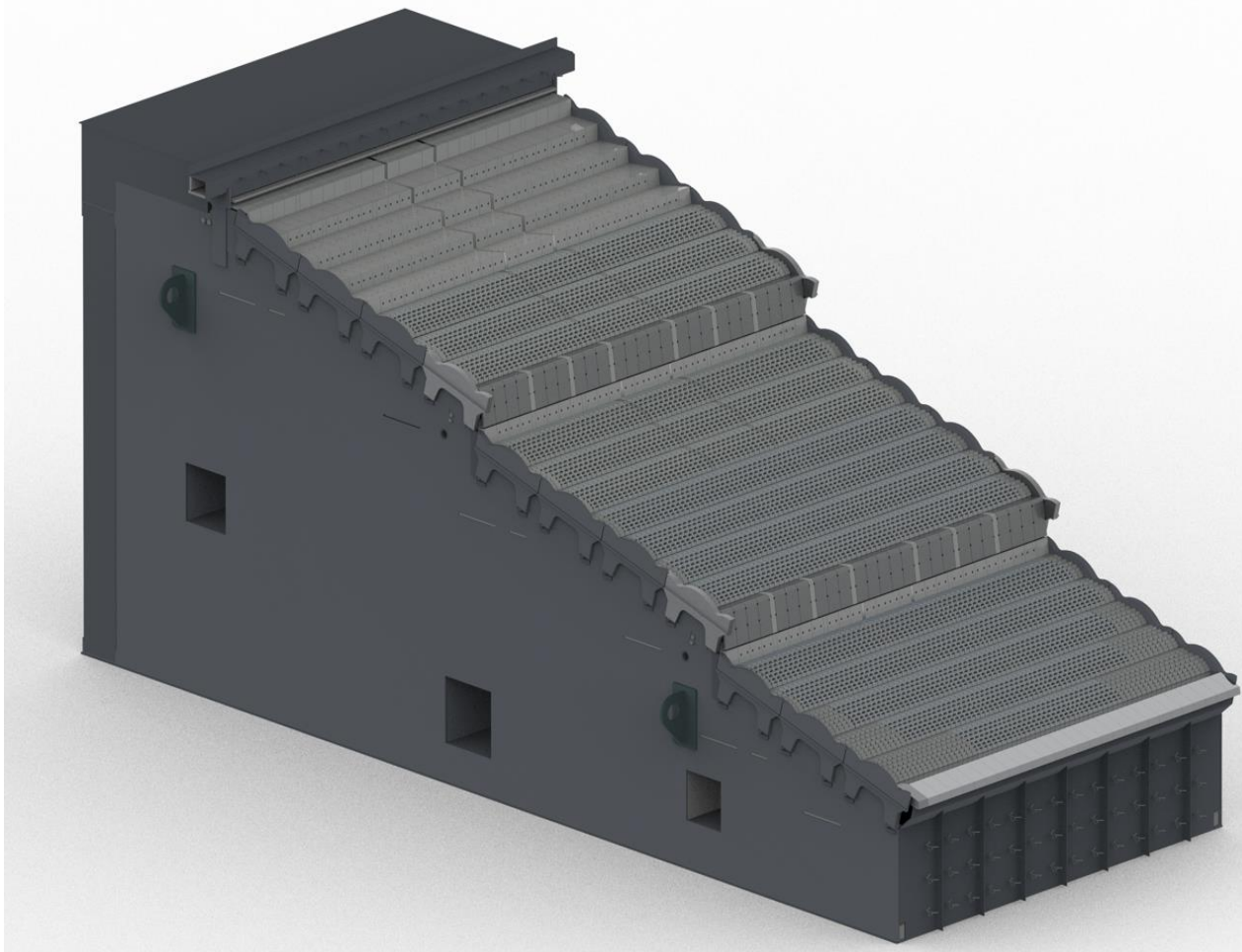
HTRG- Biomass fired Thermal oil heater

UPRG - Ultracompact, competitive and reliable biomass boiler for extremely fouling fuel

- Inclined membrane wall
- Multiple pass furnace
- Baffle wall arrangements for division of furnace in multiple passes
- Secondary and tertiary air
- Multiple convective passes with varied tube diameter Special arrangement for firetube cleaning (Danblast)
- Ultimate fuel flexibility (Rice husk, woodchips, groundnut husk, PKS, soya husk, mustard stalk, coffee husk, ply waste, briquette, pellet, palm fiber, cashew shell, cotton stalk, EFB etc)
- Highest uptime – Reduced slagging and fouling
- Refractory – 70 % reduction in refractory
- Compactness- 30 % less footprint area in comparison with conventional hybrid design
- Reliability- Elimination of refractory
- Ease in erection- Packaged solution, modular design, less refractory



Introducing Universal Bio Grate



- Open fire burning of Stubble leading to high emission in surrounding areas (Pollution in Delhi/NCR region due to stubble burning in Punjab)
- It requires special grate to deal with biomass wastes with extremely low bulk density.
- Multiple trolley design with independent air connection
 - ✓ Finer control on speed
 - ✓ First trolley designed to operate with higher speed to reduce accumulation
 - ✓ Second/ Other trolleys designed to operate with very low speed to provide desired residence time
 - ✓ Independent air control to meet the combustion requirements on each trolley
- Sharp step between trolley to promote intermixing of the fuel (Tumbling action)
- Optimal use of block grate bar- Initial section is made of sharp block grate bar for maximizing force for effective pushing of tall fuel layer to reduce accumulation. Other section of the grate is made of full nozzle grate to accelerate combustion
- Multiple perforation casting design for width wise air distribution
- Solution can be extended for other low bulk density, low calorific value , low grade fouling fuels like maize straw, wheat straw, sugarcane trash, jaggery bagasse, and jute caddy.

Green Steam Supply to Biocon, Bengaluru



PROJECT:

- **Location:** Bengaluru, Karnataka.
- **Solution:** Hybrid boiler with reciprocating grate installed by TOESL in a limited space of 966 m² with a 'G+1' layout (ground floor fuel storage, first floor boiler plant)
- **Boiler Capacity (F&A 100°C):** 30 TPH MCR / 17.5 kg/cm² (g)

BENEFITS:

- Reliable steam supply from 100% agro-waste biomass fired boiler in compromised space.
- Guaranteed supply of quality biomass for round the year operation.
- Est. CO₂e reduction: ~**30,000 tons/year** against gas. (Equivalent to ~72,000 barrels of oil consumed)
- 100% HSE compliance and uptime delivered as per commitments.

PARTNERSHIP WITH BIOCON

- Received constant customer **appreciation for execution** of large capacity biomass fired boiler plant on 'G+1' layout, enabling Biocon towards **energy transition and cost savings**.

Ultra Low Pressure & Hot Water Driven Chillers

L1 SERIES



HEAT ENERGY IN THE FORM OF

- Fryer
- Steamer Vapour
- Chemical Vapour
- Flash Steam

HEAT SOURCE: Vapour

PRESSURE: 0.0 – 0.3 bar

CAPACITY: 50 – 2000 TR

COP: 0.75



L5 SERIES



HEAT ENERGY IN THE FORM OF

- Engine jacket water
- Hot water from solar collectors
- Process condensate
- Flue gas recovery from incinerators
- Process heat recovery
- Fuel cells

HEAT SOURCE: Hot Water

INLET WATER TEMPERATURE: 80°C – 120°C

CAPACITY: 180 - 1650 TR

COP: 0.8

HEAT PUMP VARIANTS



Absorption Heat Pump

Energy savings Up to 40%

Water Savings: 60%

Heating Capacity: 0.25-40MW

Hot Water Output: Upto 110°C

CO2 Reduction: Upto 90%

Steam Pressure: 2-10 bar

COP: 1.7 -1.8

Electrical Heat Pump

Achieve Maximum Operational Savings

Heating Capacity: 50 kW to 2000 kW per single unit

Hot Water Output: Upto 120°C

Energy Savings up to 80%

Simultaneous Cooling generation capacity Upto 60%

COP: 1.8 – 6

Hybrid Heat Pump

Achieve 40% cost savings

Capacity: From 400 kW (Heating)

Heating Capacity: 0.25-40MW

Hot Water Output: Upto 120°C

Water Savings: Upto 30%

Direct Fuels Savings: Upto 40%

Simultaneous Cooling generation capacity Upto 30%

Feasibility Work out for AHP vs PHE



OPERATIONAL COST SAVING ANALYSIS FOR ABSORPTION HEAT PUMP				
Sl. No.	DESCRIPTION	UNIT	STEAM TO HOT WATER HEAT EXCHANGER	STEAM DRIVEN ABSORPTION HEAT PUMP
I	COOLING CAPACITY	TR	0	745
II	HEATING CAPACITY	kW	2000	2000
III	APPLICATION		Simultaneous Heating & Cooling	
IV	Energy/heat source		Steam from Coal	Steam from Coal & Power
V	ENERGY COST DETAILS			
i	Cost of Power (Unit Cost+Demand+Peak Charges+Other Costs)	Rs./kWh	8.00	
ii	Steam Cost -Coal Fired Boiler	Rs/kg	2.00	
VI	STEAM CONSUMPTION DETAILS			
i	Heat Duty	kW	2000	2000
ii	Steam Consumption for heating	KG/Hr	3353	2347
vi	Total Steam cost	Rs./hr	6706	4694
VIII	POWER CONSUMPTION DETAILS			
i	Total Power Consumption	kWh	0.00	28
ii	Power Cost	Rs./hr	0.00	224
IX	OPERATIONAL COST ANALYSIS			
i	Operational Cost/Hr	Rs./hr	6706	4918
X	Savings	Rs./hr		1788
i	Annual Energy Savings-8000 Hours Operation	Lacs/Annum		143.0
ii	Water Savings (Evaporation Loss+Blow Down Loss)	M3/Hr		1.2
iii	Water Saving Per Annum (80 Rs/KL Treated Water Cost)	Lacs/Annum		8
iv	Total Savings (Energy+Water)	Lacs/Annum		151
v	CO2 Emission	Tons/Annum	10828	7763
vi	CO2 Emission Reduction	Tons/Annum		3065
XI	ROI			
	Total Capex	Lacs	60	230
	Differential Investment	Lacs		170
	ROI	Months		14

SUCCESS STORY

Profitable way of Decarbonizing in a process Industry

Absorption Heat Pump



Problem Statement:

Customer was looking to reduce carbon emission & operation cost by optimizing steam consumption & water consumption

Solution:

Thermax offered end to end Absorption Heat Pump solution to Reduce Gas consumption, water consumption & carbon emission. The solution produces hot water at temperatures up to 95°C, ensuring cost savings of up to 30% compared to traditional methods, while also generating cooling capacity, solutions

Result:

1	Co2 Emission Reduced Per Year in Tons	2585
2	Water Savings / Year in M3	16830
3	Overall Operational Savings / Year in Lakhs	153

Electrical Heat Pumps



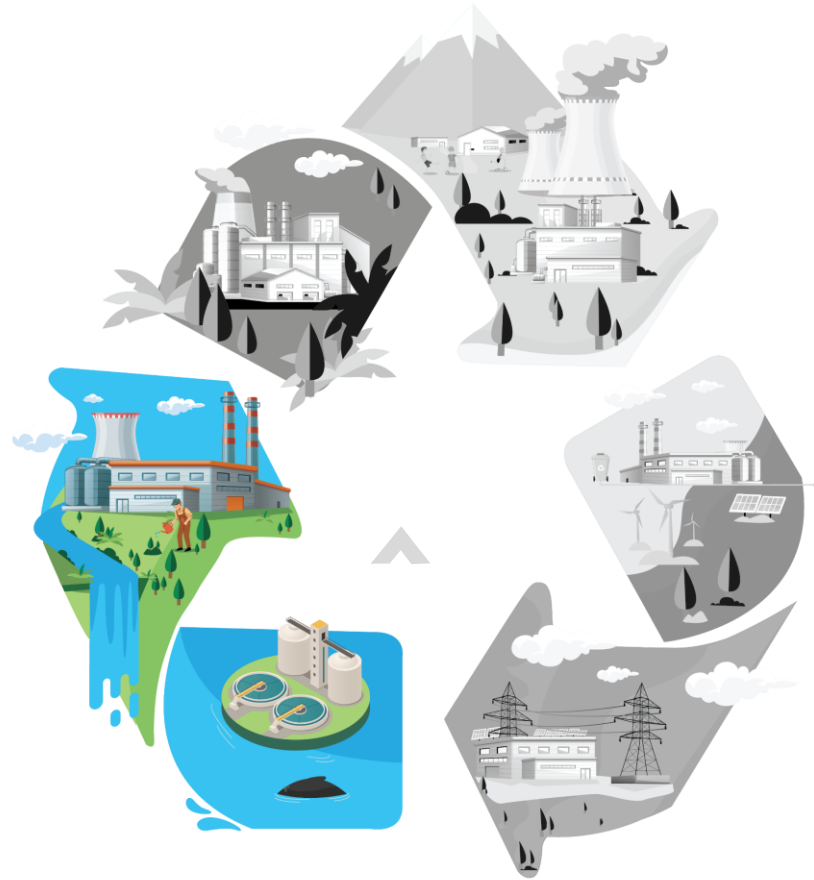
- **Water Source EHP (400 kW)**
- **Hot Water temperature – 92°C**
- **Application** : Sugar Dissolving & Pasteurization process – Potential to proliferate across beverages industries.
- **Overall Opex Savings** - About 100 Lacs with a payback period of Less than 2 years

Sustainable Solutions by Thermax

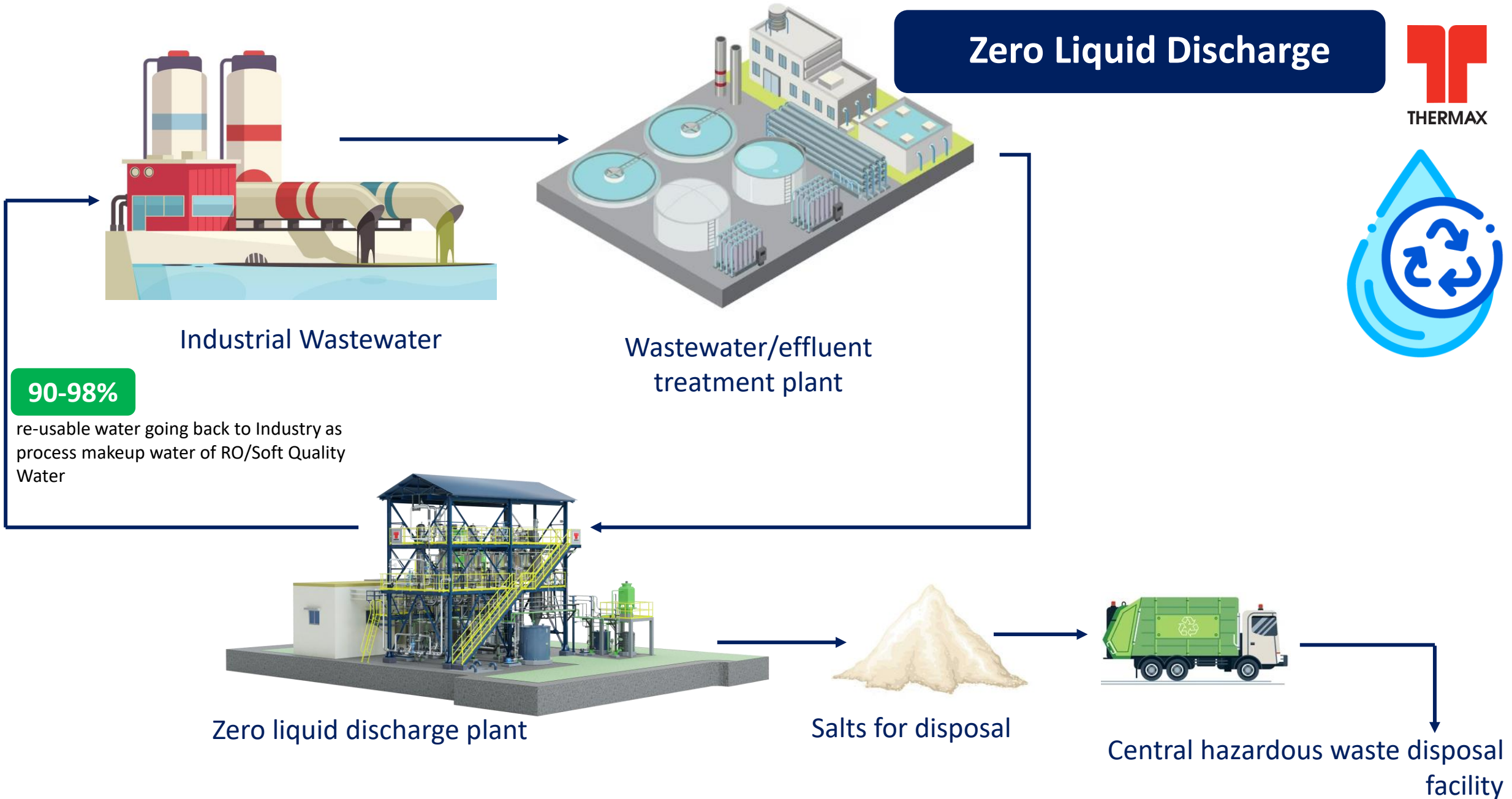
Clean Water



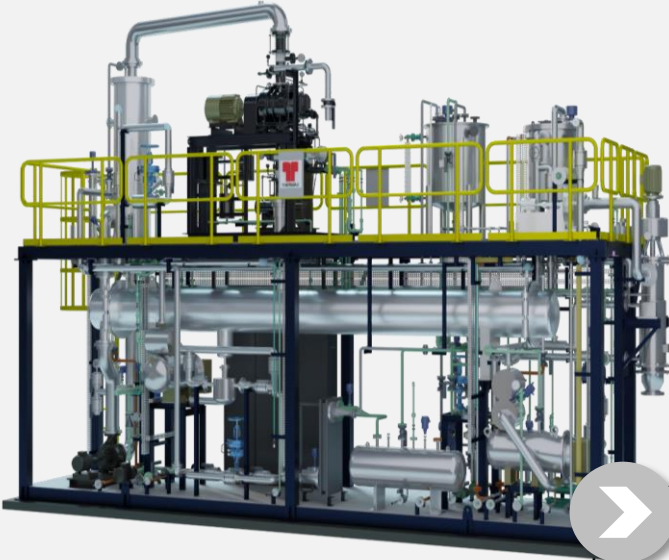
Water and Waste Solutions



Zero Liquid Discharge



Mechanical Vapour Recompression (MVR)



Features	MVR
Description	Mechanical Vapor Re-Compressor
Utilities required	Electricity
Operating Cost*	Rs. 0.7 to 0.9/ltr
Carbon Footprint	Low
Utility equipment required	No
Manpower requirement to operate the plant	Less
Space requirement	Less
Cooling water requirement for vapor condensation	No

Features	MEE
Description	Multiple Effect Evaporator
Utilities required	Steam & Electricity
Operating Cost*	Rs. 1.2 to 1.4/ltr
Carbon Footprint	High
Utility equipment required	WTP, Boiler & Air pollution equipment
Manpower requirement to operate the plant	More
Space requirement	30 to 40% More than MVR
Cooling water requirement for vapor condensation	Yes

Multi-effect Evaporator (MEE)



34



In-house designed, commissioned and installed

Evaporators

22



In-house designed, commissioned and installed

Advanced Multi-Effect Evaporators (MEE)

12



In-house designed, commissioned and installed

Advanced Mechanical Vapour Recompression (MVR)



Largest installed capacity of MEE

500 KLD



Largest MVR under execution

250 KLD

Zero Liquid Discharge



Operation and maintenance

More than 20 Plants experience for MVR MEE

Complete water reuse and zero liquid discharge to meet ESG goals

Sector : Chemical
Rishra, West Bengal

System : 113 KLD MEE followed by ATFD

Background :

- With increasing water scarcity, changing regulations, Jayashree was looking at water reuse and zero liquid discharge to meet their water-related environmental, sustainability and governance goal.

Requirement :

- Reuse of process condensate water and achieve ZLD.
- All heat exchanger tubes MOC shall be of Titanium Grade2.
- All liquid contact MOC shall be of SS 316L.

Scheme :

- Quadruple Effect Force Type Evaporator followed by Agitated Thin Film dryer.

Achievements :

- **99% water recovery** as a process condensate which is being used in process.
- Not a single drop of liquid discharge to soil, this **achieved complete zero liquid discharge**.
- Discharge is in form of dry powder having moisture less than 10%. w/w.
- **Complete operation of system is through HMI.**
- Single switch operations from HMI i.e. **fully automated.**

Safety at site :

- **No safety violations**
- **Zero accidents and no penalty**



Complete water reuse and zero liquid discharge to meet ESG goals

Sector : Chemical

Rishra, West Bengal

System : 113 KLD MEE followed by ATFD



Parameter	RO3 Reject (Design)	MEE Outlet
pH	11.15	8.55
TDS	45648	8852
TSS		52
Calcium as Ca	23.07	148.9
Magnesium as Mg	23.07	70.6
Chloride as Cl	25356	625.3
Colloidal silica as SiO ₂		4.8
Reactive silica as SiO ₂		79
Total silica as SiO ₂	306.35	83.8
Fluoride as F	24.54	1.2
Bicarbonate as HCO ₃	5.72	4362
Carbonate as CO ₃	1138.78	237.6
Boron as B	0	0.82
Barium as Ba	0	< 0.1
Carbon dioxide	0	< 0.1
COD		877
BOD		203
Nitrate as NO ₃	48.07	65.1
Potassium as K	18.13	542
Sodium as Na	17734.54	1428
Sulphate as SO ₄	945.73	1038
Total Nitrogen		104.1
Total ammonia as NH ₃	0	38.6



**One stop clean water solution for
Pharma/Biotech and FMCG Industries**

Water Treatment Systems

- Multi grade filters
- Activated carbon filters
- Iron removal filters
- Softener
- Ultrafiltration
- Reverse osmosis
- Electro-deionization
- DM plant

Distribution Systems

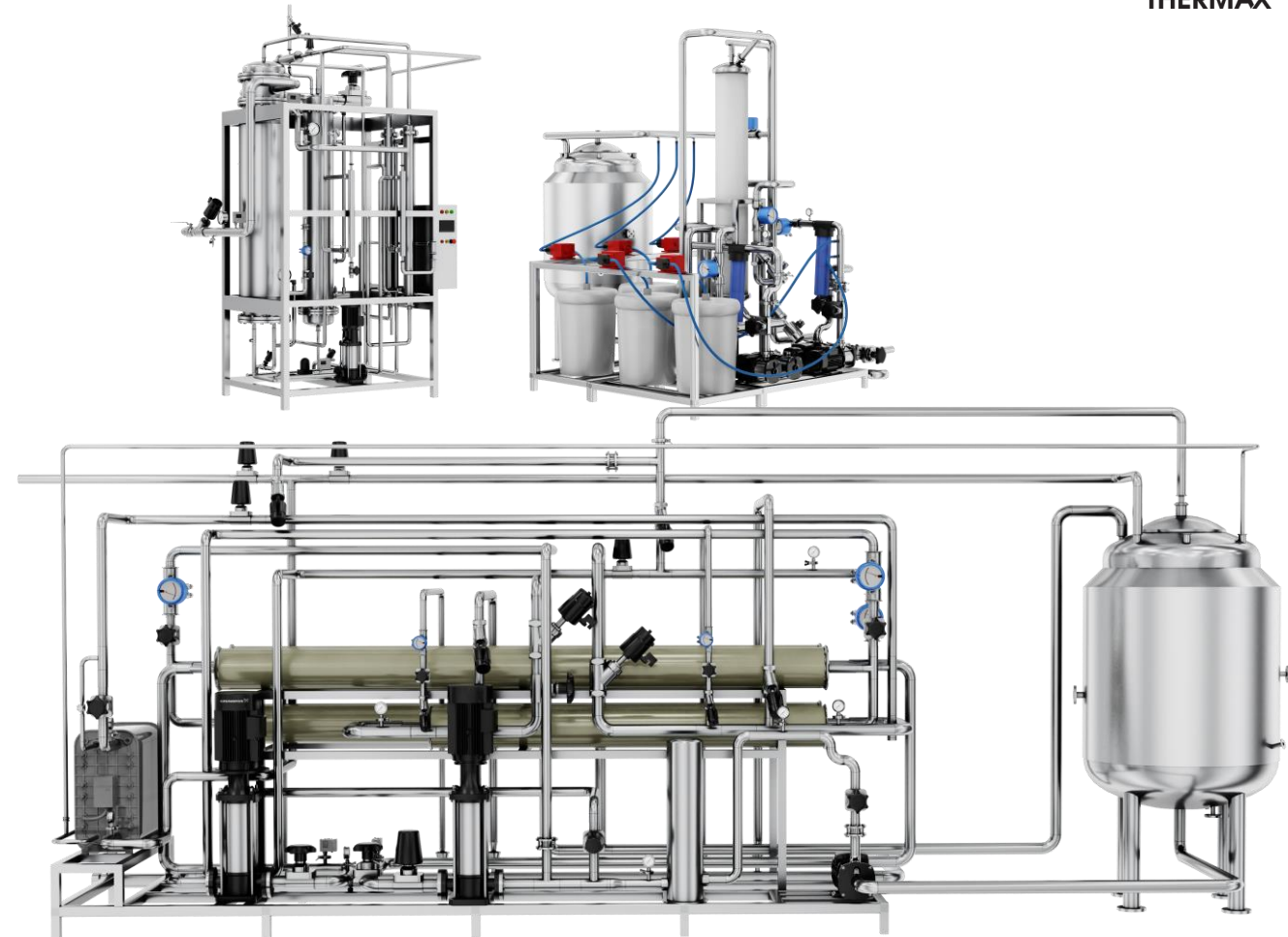
- Purified water with SCADA and automation
- WFI with SCADA and automation
- Pure steam distribution
- Process piping for product transfer

Tanks & Vessels

- PW tanks
- WFI tanks
- Process vessels
- Product storage tanks
- Sterile manufacturing vessels

CIP-SIP Systems

- CIP systems
- SIP systems



One stop clean water solution for Pharma/Biotech and FMCG Industries



Case Study



Wockhardt, Waluj, Aurangabad

Indian Pharmaceutical and Biotechnology Company

Application: Sterile Insulin | Capacity: 400,000 Litres per Day

Background:

- Our mandate for Wockhardt India's biotech facility in Waluj was to deliver a high purity water treatment plant with a capacity of 400,000 litres of purified water per day making it one of the largest plants in India.
- Their Effluent Treatment plant was being over utilised.

Solution:

- We have designed a water system that also minimised the load on the ETP resulting in a reduction of wastage from 35 percent to 5 percent.

Water System Specifications

- Pre-treatment
- Pre-ultra filtration
- Reverse osmosis
- Softening plant
- High purity RO system
- Electrodeionization unit
- High purity water distribution system





Case Study



Fidson Healthcare Plc.

Largest Pharmaceutical Company in Nigeria

Application: Injectables & Solid Dosage | Capacity: 6000 litres per hour

Background :

- Project seemed like a regular water optimisation project with a total TDS of under 330 ppm which could be resolved with a single pass RO.

Challenges:

- Our testing and analysis revealed that the pH of the water was too low (5.2 in this instance).
- To increase the pH value as per feed limiting conditions of RO, pH correction dosing to be done, and due to the same TDS increased to 500 ppm.

Solution:

- Offered a double pass RO which none of our competitors had realised.
- While our cost of the project was higher than the competition all of whom quoted for a single pass RO, we saved the client a lot of money by correctly diagnosing the requirement and preventing future plant failure and loss of business.
- We also installed RO to minimise reject water.

Water System Specificatons:

- Pre-treatment
- Softening plant
- Double pass reverse osmosis
- RO System
- Electrodeionization unit
- Post ultra filtration
- High purity water distribution system



Sustainable Solutions by Thermax

Clean Air

Air pollution control



Clean Air Solutions



Gaseous Segment

Particulate Segment

FGD

- Dry Type
- Semi-dry Type
- Wet Type

Scrubbers

- Packed Bed
- Spray Towers
- Plate

ESP

- Dry Type
- Wet Type

Bag House

- Pulse Jet
- Reverse Air

Hybrid System

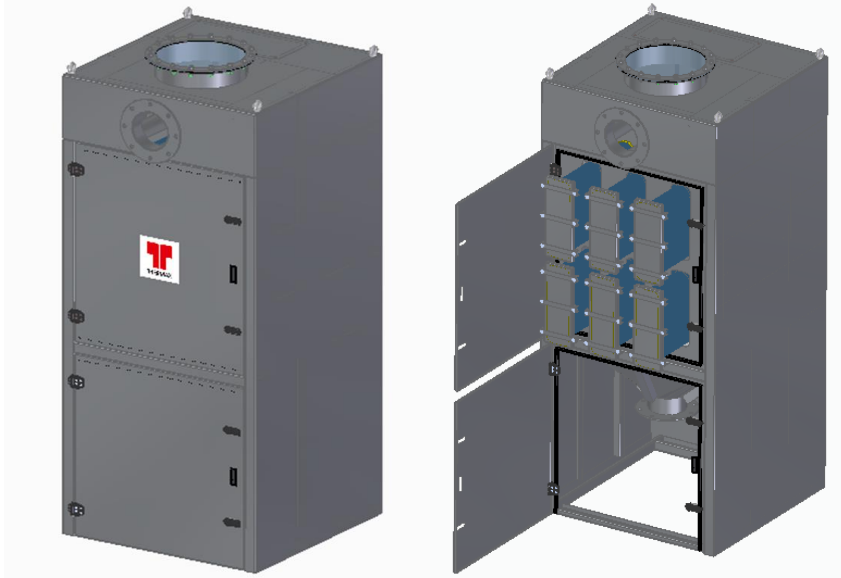
- ComboFilter®
- Cyclomax Plus
- Electrostatic Fabric Filter

Scrubbers

- Venturi
- Cyclonic

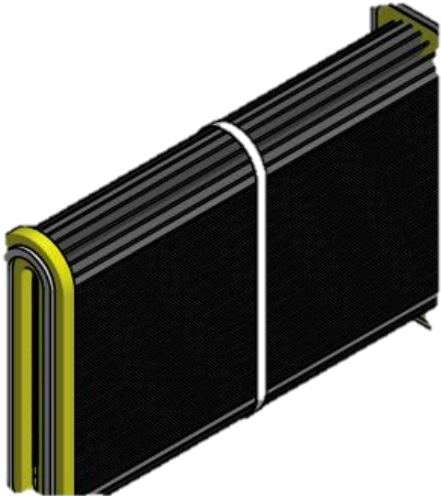


Thermax Pocket Cartridge Filter for Dust Collection



Key Features

- Compact Design : 33% less footprint area than competition
- Best in Class Filtration Media
- 99.9% Filtration efficiency
- Maintenance friendly - Easy Filter Replacement & Dust Disposal Arrangement
- Compliance with NFPA & ATEX safety standards



Pharma Industry Applications

- Tablet Coating
- Fluidized Bed Dryer
- Tablet Compression
- Mixing & Sieving



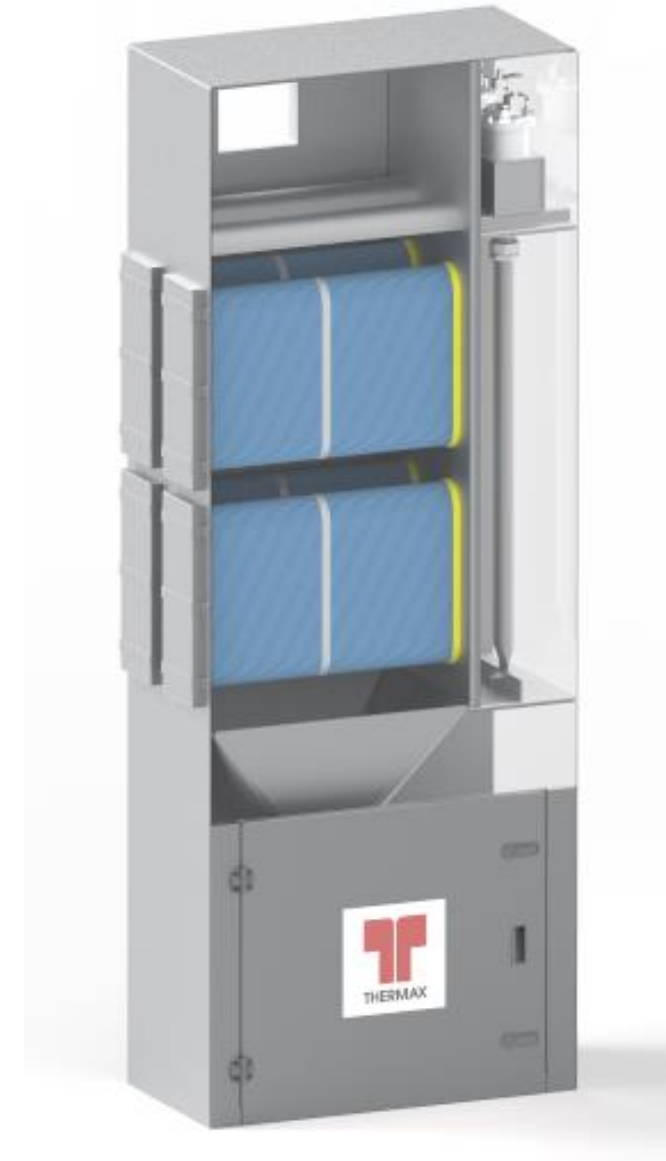
Chemical Industry Applications

- Material Handling: Bag Dumping, Grinding, Material Conveying, Extruder Lines etc.
- TSD Mixer
- Automatic Bagging Machine

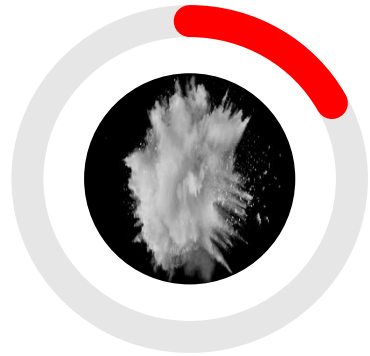
Success Story

- **Customer:** Pharma Equipment OEM
- **Application:** Dust collection from Fluidized Bed Dryer (FBD)
- **Thermax Product:** Thermax Pocket Cartridge with HEPA Filter
- **Challenges & Solutions**

Customer Requirement	Solution
Limited space availability	Thermax Cartridge filter equipped with HEPA filter requires 33% less space than the alternatives in the market.
High temperature working condition of 120°C	Constructed with specialized temperature resistant mold material suitable for high temperature applications
Safety Feature for ensuring workplace safety	Concurrent flow dust collector facilitates installation of explosion vent on the dust collector top, which enhance safety



Important Consideration in Dust Handling



Explosive Dust



Flammable
Dust



OE Level
(Potent Dust)



Outlet Emission



Hygroscopic &
Sticky Dust

Accelerating Decarbonisation

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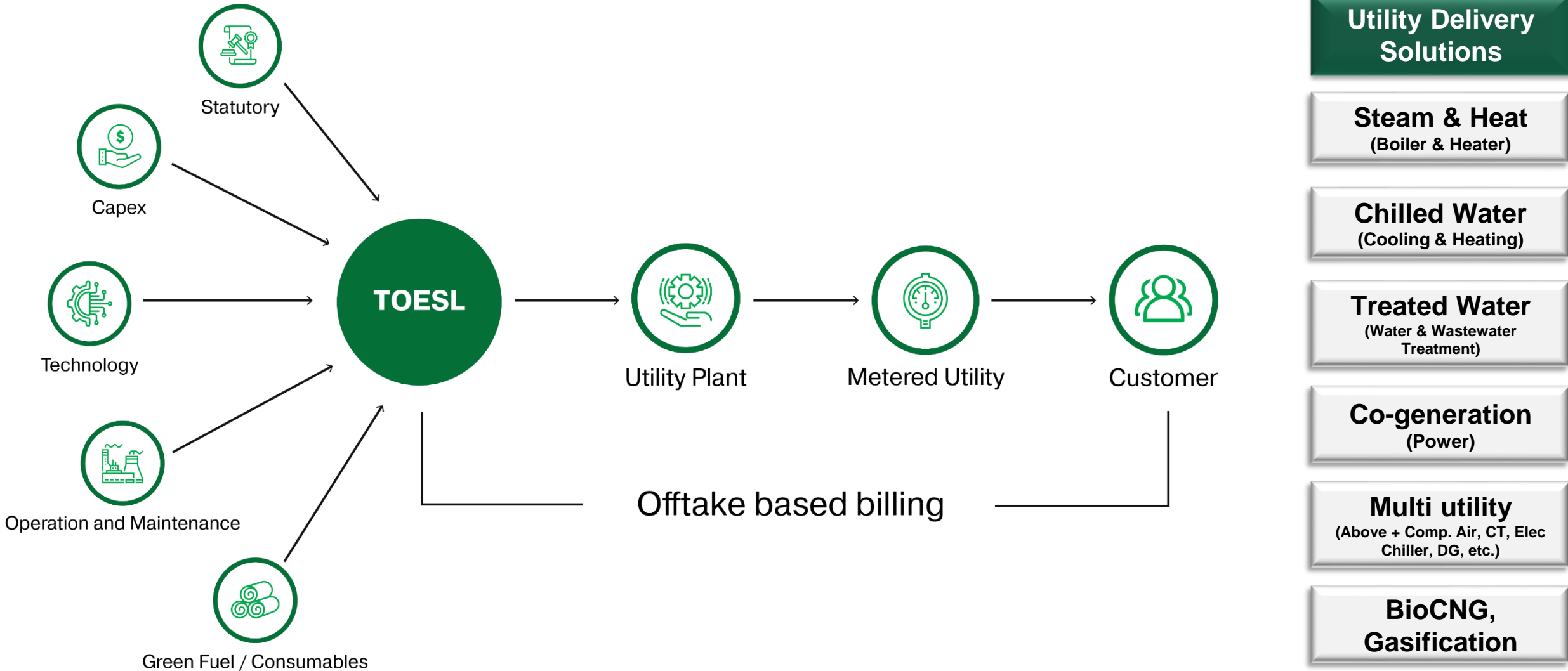
From investment to
lifecycle responsibility

Green Hydrogen

Green Utility Solutions under Build-Own-Operate



Thermax Onsite Energy Solutions Limited (TOESL) – championing sustainable solutions in industries



Green Steam Supply to Biocon, Bengaluru



PROJECT:

- **Location:** Bengaluru, Karnataka.
- **Solution:** Hybrid boiler with reciprocating grate installed by TOESL in a limited space of 966 m² with a 'G+1' layout (ground floor fuel storage, first floor boiler plant)
- **Boiler Capacity (F&A 100°C):** 30 TPH MCR / 17.5 kg/cm² (g)

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PARTNERSHIP WITH BIOCON

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***“Profit is not only
a set of figures,
but of values.”***

Rohinton D. Aga

Chairman, Thermax
(1935 - 1996)





Boundlessly bridging the gap
between energy availability
and sustainability

Thank You

Conserving Resources, Preserving the Future.

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