

Enviro Division



Renovation & Modernization for Capacity Enhancement & Lower Emission Norms *Cleaning the air for better returns*

Improving your business is our business

Thermax offers products, systems and solutions in energy and environment engineering to industrial and commercial establishments around the world. It's business expertise covers heating, cooling, waste heat recovery, captive power, water treatment & recycling, air pollution control & waste management and performance chemicals.

Thermax brings to customers extensive experience in industrial applications, and expertise through technology partnerships and strategic alliances.

Operating from it's Headquarters in Pune (Western India), Thermax has built an international sales & service network spread over South East Asia, Middle East, Africa, Russia, UK and the US. It has a full-fledged manufacturing setup that is certified for ISO 9001 : 2000,ISO 14001 and saftey management according to OSHAS (ISO 18000).

Enviro Division

Enviro Division was conceived with a belief that *pollutants are inevitable but pollution is not.* An acknowledged leader in Air Pollution Control and Purification business, it offers a wide range of flange-toflange products, customised systems and valueadded services. Thermax Enviro is present in most industries and application segments therein, viz. cement, steel, nonferrous metallurgical, power plants, fertilisers, tyres, paper, chemicals, petrochemicals and textiles.



Services & Solutions (S & S) from Thermax



Three decades of pioneering research & installation of thousands of industrial & utility Air Pollution Control (APC) Equipments and Systems has given Thermax Enviro an invaluable insight into commissioning and up keeping of these equipments. It provided Enviro with the engineering and service expertise through regular on-site inspections, study and assessments of the existing Air Pollution Control systems. Thermax has been also associated in helping customers in enhancing the performance of APC equipments supplied by them/others. These culminated in recommendations on corrective measures to be taken and thereby development of complete solutions to achieve customer satisfaction.

"Put new life into your existing air pollution control equipment"

The equipment faces challanges associated with:

- Higher outlet emissions
- Production capacity enhancements and related deficiencies
- Non compliance with new and more stringent emission norms
- Breakdowns & failures
- Shorter life of components like bags, electrodes, insulators etc.
- Dust/gas leakages
- High differential pressure
- Obsolescence

.....amongst others.

Emergence of S & S

Sometimes new equipment is not the only solution to a problem; it can be addressed through an upgrade or mere changing of the type of components used.

Possible solutions that Enviro crafted:

- Retrofit and upgradation packages for the Electrostatic Precipitators (ESPs) for the entire range of Industrial applications for reducing the outlet emissions.
- Retrofit and upgradation packages for Fabric Filters i.e. Pulse Jet & Reverse Air type bag houses for both process and dedusting applications. These include extensions, module additions / retrofits (as per requirement) to reduce outlet emission and enhance bag life.
- ESP to fabric filter conversions for various industrial applications. Typical cement industry application would be Kiln Raw mill circuit, Cement mills and Coal mills.
- Comprehensive services including gas flow distribution studies, gas distribution tests, and solution development therein.
- Performance studies and design audits/validation, field studies for performance enhancement.

Thermax-Enviro gathered expertise on designing retrofits for various applications of particulate collection equipment, including all leading designs besides Thermax's own.



New Thermax ESP (replacing leading European make) on lime kiln application

S & S Offerings

Thermax Enviro can provide the following services - timed to suit the customers down time schedules as may be required.

Bag filters & Bag houses

Various measures that can be undertaken while retrofitting the Bag filter to enhance the capacity & lower the oulet emissions :

- Increase in filtration area by modifying casing, bag height, pulse valves and air manifolds ;
- Addition of multiple modules for capacity upgradation;
- Installation of parallel stream bag filter unit(s) for additional capacity ;
- Conversion of shaker type bag filters to pulse jet types including casing rebuild & ducting modification if called for;
- Upgradation of the bag filters to improve performance, avoid filter bag failures, and reduce outlet emission to below 30 mg/Nm3;
- Conversion of modular on-line BF to off line operation;
- Designing and modifying the air / gas handling arrangement within the fabric filter, as well as in up-stream and down-stream circuits, towards better performance and / or pressure drop reduction.



Reverse Air Bag House for carbon black application at Thailand

Electrostatic Precipitators



ESP retrofits featuring a compact & efficient designs, Rigid Discharge Electrode systems, Rapping systems with conventional rotating hammer designs or the state of the art Electromagnetic Impulse Gravity Impact (EMIGI), external top rapped designs. Offerings to best suit the customer's requirements.

Various measures that can be undertaken while retrofitting the ESP to enhance capacity & lower the outlet emissions:

- Capacity upgradation Turnkey Project solutions covering replacement of existing ESP (any make, any design), series or parallel ESP constructions etc.
- Addition of fields for capacity upgradation / emission reduction.
- Assessment and refurbishment of the ESP system, refurbishment of damaged field internals &modifications and improvements therein.
- Rebuild configuration with higher collecting area and fields' arrangement utilizing the existing space-to achieve higher collection efficiency.
- Replacement of bottom rapped design with top rapped configurations or improved in-kind type design.
- Splitting of the ESP fields, sectionalisation and addition of new T/R set(s).
- Supply of Thermax Rigitrode® discharge electrodes to replace existing electrodes of the ESP (any make, any design).
- Relocation and rebuild of the existing ESP.
- New PLC based rapper control panel to replace older micro processor based panel.

Annual Maintenance Contracts

Our experienced service team is trained to carry out maintenance tasks quickly and efficiently. This helps the customer to budget the maintenance cost over the period of the contract and adhere to the same.

S & S Industry Application Matrix



Satisfied customers are benefiting from our solutions for the following applications.....

Industry	Application	Product*	
Thermal Power Stations	Boiler	ESP	
Captive Power Plants in various Industries like Textiles, Food etc	Boiler	ESP, BF	
Cement	Cement Kiln Transfer Point DE Systems Cement Mill Coal Mill Clinker Cooler	PJBF, RABH, ESP BF ESP, PJBF ESP, BF ESP, BF	
Paper & Pulp	Recovery boiler Lime Kiln	ESP ESP	
Chemicals	Dust Extraction Systems for Ash handling	BF	
Non Ferrous	Kiln	ESP, BF	
Carbon Black	Process Dedusting	RABH, PJBF	*ESP - Electrostatic Precipitators BF - Bag Filters PJBF - Pulse Jet Bag Filters RABH - Reverse Air Bag House
Iron & Steel	Submerged Arc Furnace	ESP, BF / Heat Exchanger	
Sponge Iron	Sponge Iron Kiln	PJBF , RABH, ESP	

......have the capability to develop others too!!

Paper & Pulp

* A typical case study - Electrostatic Precipitator on Soda Recovery Boiler

Objective – To rebuild the existing precipitator to achieve an outlet emission of less than 100 mg/Nm3. Scope included design engineering and supply of ESP internals, rapping system and drag scrapper conveyor system.

- The new ESP internals were designed and installed in the RCC casing of the ESP build by customer.
- The inlet and outlet transitions were suitably modified. New gas flow distribution devices were designed and supplied in order to maintain satisfactory gas flow distribution in the ESPs.
- The arrangement of the ESP field internals consists of roll-formed panel type collecting electrode system and RIGITRODE® rigid discharge electrode system. The collecting plates support arrangement and other internal arrangement was specially designed to suit the casing arrangement to minimize the RCC casing modification.
- New Electromagnetic Impulse (EMIGI) rapping system was provided to clean the collecting and discharge electrodes of
 the new field. Unlike the conventional tumbling hammer type mechanical rapping system, in the EMIGI rapping system,
 there are no moving parts like shafts and sprocket chains or the cams and hammers. Also the rappers are external,
 located on precipitator roof out side the gas stream, do not need routine maintenance or lubrication. The rappers were
 individually controllable by the microprocessor based rapper controller which will be located inside the local control room.
- The RIGITRODE® discharge electrode system comprises of the patented design of electrodes with unique corona generating studs on a rigid pipe mast. The design uniform corona generation over the collecting surface and maintains excellent alignment during operation for effective precipitator performance.
- Drag scrapper system at the bottom of ESP casing was supplied for the transfer of collected dust.

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'Customers Speaks for themselves'

Thermal Power Stations

Complete services and solutions for the ESPs in Coal based Thermal Power Plants including,

• Comprehensive services for ESP gas flow distribution studies including development of Computational or Physical Flow Models, Field Gas distribution tests, solution development to address gas flow distribution and pressure drop problems as shown below.

Offer of improved gas flow media/distribution devices based on engineering evaluations/field studies.

- Entire range of replacement parts and systems for ESPs, within kind and improved designs, including mechanical & electrical parts, collecting and discharge electrode systems, rapping systems, state of the art controllers / control systems and accessory equipment.
- State-of-the-art Ammonia Flue Gas Conditioning (AFGC) System from Thermax helps to reduce ash resistivity, avoid back corona and significantly increases the particulate collection in the ESPs minimizing the stack emission. With the AFGC system installed at coal based Thermal power station and captive power station; it is possible to achieve outlet dust particulate emission well within PCB limits without undertaking major ESP modifications / upgradations and shut down requirement.





Outlet Flange

Inlet Flange



Development and Analysis of Computational Flow Dynamics (CFD) model of ESP

A Typical Case study - ESP for 2 x 70 MW Thermal Power units in Western india

Retrofit and upgrade was done for the existing **BHEL** make ESPs to upgrade & improve the deteriorated performance of the ESPs. The up-gradation was aimed to meet the revised plant requirement i.e. firing higher ash content fuel than original, and to maintain ESP outlet emissions within the specified PCB limit, while operating at the full rated capacity of 70 MW. Complete turnkey project for Renovation, Modification and Upgradation of ESPs was undertaken as a part of the overall Power plant R&M project.



Thermax responsibilities included,

- Complete turnkey execution of the ESP upgradation;
- Design engineering, manufacturing and supply of equipment, components and systems;
- Erection & commissioning; and
- Performance guarantee testing for the ESP units.

The retrofit development included construction of an additional field using the dummy field casing available, with the stateof-the-art design to maximize collecting area, modification to the existing roof and hoppers, retrofit of rigid discharge electrodes and inlet / outlet funnel modification to improve gas flow distribution (as shown below).

Both units are successfully commissioned and are performing with a level of outlet emissions well within the guarantee limit.





Electrostatic Precipitator (ESP) retrofit arrangement details

Captive Power Plants / Industrial Boiler Serving all major industries

Rich experience in offering solutions for boilers, firing range of fuels: Different types of Coals as well as variety of renewable fuels like Baggase, Rice Husk & other agro-waste materials or combinations of the above.

Typical case studies

ESP for 35 TPH FBC Boiler in pulp and paper plant

The retrofit package was designed and supplied to reduce the outlet emission to less than 80 mg/Nm3 for the original **Andrew Yule** design ESP to increase the collecting area within the existing casing with marginal increase in the height, within the same foot print of the ESP, reusing the casing and hoppers. State-of-the-art design included mechanically interlocked roll-formed collecting surfaces, Rigid discharge electrode system along with Electro-magnetic (EMIGI) external top-rapped rapping system along with better sectionalized internal arrangement. Erection and commissioning was done during a short annual shut down.





ESP for 60 TPH FBC boiler in a textile plant

The existing **European** design ESP was upgraded to serve a fluidsed bed combustion (FBC) boiler, to cater to increased inlet dust load and reduce outlet emission to less then 75mg/Nm3. The upgradation was accomplished by adding a series field integral to the existing ESP, which was installed during the annual shutdown of the boiler.

ESP for 30 TPH FBC boiler in sponge iron plant

The existing **European** design ESP was analyzed and following shortcomings were found, which were needed to be improved to bring in the required performance of the ESP :

- Insufficient rapping impact for both collecting & discharge electrode systems.
- Snapping and loosening of existing spiral electrodes that reduce electrical clearances and hence the performance of field.
- Sluggish/ delayed controlling action by the T/R controllers.



The following modification was proposed and implemented in order to improve the ESP performance as per the customer's requirement:

- Replace the existing spiral type discharge electrodes with Rigitrodes®, rigid type discharge electrodes using the existing frames with least modifications.
- 2) Incorporation of additional rappers to the existing fields to improve the cleaning efficiency.
- 3) Replace the gas distribution screens at inlet nozzle with new design.
- 4) Modification of existing retaining wall at outlet nozzle to restrict the carry over of precipitated dust.
- 5) Retrofitting of the existing T/R set control panels with new generation controllers to improve the field performance as well as to control the additional rapping devices.

Thermax ESP's have been rebuilt on many locations like Roshini Power, Matrix Power, Ridhisidhi Glycol amongst others.





Cement

Typical case studies

Kiln / Raw Mill Upgrade Package

Thermax has always believed that for Raw Mill – Kiln application, too many variations in input parameters, dictate that Gas Conditioning Tower & Electrostatic Precipitator combination would be a doubtful starter.

Presently lower emission norms coupled with the reliability for process variations have forced the industry to convert these precipitators to either Pulse Jet Bag filters or Reverse Air Bag houses with or without membrane bags. The bag houses have also been installed in series or in parallel to improve the performance. Fiber glass has been the chosen fabric though alternate fabric choices are also available.

Thermax has already commissioned a RABH after GCT for one of the leading cement manufacturer in South and currently is under execution for one of the largest RABH that will replace the ESP. This bag house has 53,000 m2 filtration area with 22 modules.

Clinker Cooler Retrofit

Thermax ESP's for clinker cooler application have been retrofitted at several sites for improving the outlet emission. Cement Industry sometimes faces surge conditions in their Cooler ESP when significantly high temperature gases pass through the ESP in an accidental situation. Opportunity is then taken to improve the performance by not only replacing the "heat affected components" in kind, but also upgrading distribution & alignments to better the performance.



To replace existing ESP on a Cement Kiln (project under execution)



Conversion of existing ESP to Pulse Jet Bag Filter for cement mill application

The ESPs installed during the 1980s were unable to maintain outlet emission within the present norms of less than 50mg/nm3. Also due increased the capacity of cement mill, the inlet gas flow and dust load to the ESP (existing **European** Design) was increased. The cement being the finished product was being emitted to the atmosphere was causing a considerable loss.

- To achieve the outlet emission of < 50 mg/Nm3 on consistent basis, Thermax recommended retrofitting and converting the existing ESP to online Pulse-Jet bag filter.
- The bag filter retrofitted & installed in the existing ESP casing after removing the ESP internals. The existing casing, hoppers, dust discharge & handling equipment, access facilities etc. was retained during the modification.
- Thermax engineered and supplied customized equipment; parts and retrofit assemblies like filter bags, cages, clean-air plenum with top covers, inlet/outlet gas transitions, pulse & solenoid valves and instrumentation.
- The erection & commissioning activity was completed in less than 25 days. The actual outlet emission & pressure drop across the Bag filter is well below the guaranteed.

Retrofit the bag filter for coal grinding circuits

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Customer was facing problems in their **Andrew Yule** make bag filter system installed for the coal grinding circuit. Subsequent modification and addition of filter bags in extended module (by the supplier) also did not achieve the desired result and frequent failure of filter bags, high pressure drop and outlet emission remained persistent problems. Thermax offered solution to retrofit and modify the bag filter casing & associated ducting to streamline the high dust load & gas flow and augment the filtration area well within the overall of the existing bag filter.

In this modification, Conventional in-expensive filter bags were used, improved performance and reduced emission (< 30 mg/Nm3) was achieved to the satisfaction of the customers.

Sponge Iron



Sponge Iron industry is facing the continuous challenge of meeting lower emission norms (50 mg/Nm3 presently as against 100 mg/Nm3 for which the ESP's were originally designed for the plants that became operational in last 2/3 years). Regular maintenance issues like Gas Conditioning Tower / Heat Exchanger upkeep, along with the some critical components like insulators, electrodes & rappers etc for ESP also needs to be taken care of.

Thermax is currently providing engineering services and components for one of the leading sponge iron producer, wherein additional field in series is retrofitted to the existing **Thermax** precipitator in order to reduce the outlet emissions.

During the upgradation exercise, usually alignment checks are performed to find the areas for improvement. Gas distribution tests also can be conducted to improve the utilization of the entire cross section of the precipitator.



Retrofit and Up-gradation of Sponge Iron Kiln ESP

Non Ferrous

A typical case - Retrofit of alumina kiln ESP

Retrofit and field addition to the existing Alumina kiln ESP was done including engineering, supply and erection and commissioning. Upgradation of the original **Voltas** make ESP was planned due to substantial increase in the inlet dust load as a result of capacity increase and process changes in the upstream circuit.

The ESP retrofit was designed to cater the increased dust load & gas flow and to maintain outlet emissions below 50 mg/Nm3 i.e. to increase the ESP efficiency. Thermax services included design assessment and development of scheme to improve the efficiency of the old fields with minimal modifications and addition of new fields in series with the existing fields, retrofitting Rigid emitting electrodes to replace the existing electrodes, transformer rectifier sets, rapping system modification in the existing fields etc. to meet the stringent performance requirement.



Addition of one field to the existing two field ESP



Addition of two field to the existing two field ESP



Spares Support

Thermax Enviro has the infrastructure in place to support its customers on their Spares requirements with the Thermax Channel Associates (TCAs) located all over the country. The Regional Service Hubs are also at hand to support for installations if required.



Thermax Enviro Portfolio

• Air pollution control

- High Efficiency & Spray Cyclones
- Bagfilters & Baghouses
- Electrostatic Precipitators Dry & Wet
- Particulate & Gaseous Scrubbers
- Flue Gas Desulphurization (FGD)
 Systems
- Ammonia Flue Gas Conditioning Systems
- Dedusting & Fume Extraction Systems
- Coal Preparation Plants & Coal Injection Systems
- Pushing Emission Control Systems for Coke Ovens
- Services and Solutions

Air purification systems with chemical air filters

The Purafil Range (for removal of corrosive, toxic and odorous gases)

- Equipment
- Media

The division undertakes turnkey projects to offer complete technology on air pollution control and its management.

THERMAX

Sustainable Solutions in Energy & Environment

Enviro Division

PMT Complex, Behind PCMC Building, Mumbai - Pune Road, Pimpri, Pune - 411018. India Tel. : 020-6615 5574, 6612 2999 Fax : 020-2742 6532/33 E-mail : enviroservices@thermaxindia.com

AHMEDABAD

Tel. : (079) 2657 5408 / 5341 / 7073 Fax : (079) 2657 7270 E-mail : ahmedabad@thermaxindia.com

BANGALORE

Tel. : (080) 2346 7761 - 64 Fax : (080) 2346 7760 E-mail : bangalore@thermaxindia.com

CHENNAI Tel. : (044) 2435 3831 - 34 Fax : (044) 2435 3841 E-mail : chennai@thermaxindia.com

HYDERABAD Tel. : (040) 2339 6820, 2331 0254 Fax : (040) 2331 2335 E-mail : hyderabad@thermaxindia.com

KOLKATA Tel. : (033) 2282 6711/2/3 Fax : (033) 2282 6796 E-mail : kolkata@thermaxindia.com

MUMBAI Tel. : (022) 2204 5391/324 Fax : (022) 2204 0859 E-mail : mumbai@thermaxindia.com

NEW DELHI Tel. : (011) 2614 5319/5701 Fax : (011) 2614 8679 E-mail : psupport@thermaxindia.com

VADODARA Tel. : (0265) 231 4802, 234 5442 Fax : (0265) 231 0051 E-mail : pbaroda@thermaxindia.com

www.thermaxindia.com

Overseas Offices

Bangladesh, Belgium, Brazil, China, Hong Kong, Indonesia, Kenya, Kingdom of Saudi Arabia, Malaysia, Nigeria, Phillippines, Russia, Sri Lanka, Thailand, UAE, United Kingdom, USA

Thermax Business Portfolio

Air Pollution Control

Absorption Cooling

Boilers & Heaters

Captive Power

Chemicals

Water & Waste Solutions

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