



█ Burners

█ Thermal Oxidisers & Incineration

█ Aftermarket - Parts Supply, Engineering & Site Services

█ Burner Testing

█ Flares

# About Greens Combustion

In a crowded market with a number of established suppliers, Greens Combustion has made a virtue of flexibility and heritage, combining competitive costs and smart solutions with first class environmental and technical credentials.

Based in the United Kingdom, we have a team of leading experts from across the industry, with specialist knowledge gained from over 250 years of combustion experience. Our expertise varies from concept research right through to on-site trouble-shooting, meaning Greens can offer a complete service to all our clients.

In 2015, Greens Combustion joined the HS Group of Companies which expanded our in-house engineering resources to over 100 engineers. The move allowed us to complement the Group's established international supply chain, with the option of low cost in-house manufacturing at a modern 12,000 square metre facility in Gujarat, India.

As both our company and product names suggest, our technology and many of our projects are centred on energy efficiency and minimising harmful atmospheric pollutants. To support this environmental commitment, we have invested significant funds in establishing a wholly-owned and dedicated combustion Research and Test Centre, allowing us to bring new designs to market and perform customer demonstrations to the highest industry standards and demands. The site also houses a number of other furnaces that can accommodate testing up to 40 MW.

With the mission to provide contractors, licensors and end users access to a level of engineering knowledge only typically associated with large conglomerates, Greens Combustion offers highly personalised, one-to-one client relationships often missing in today's market. This rare combination of factors has seen Greens Combustion rapidly become a recognised name in the global combustion market, supplying major users and contractors in over 60 countries.



## **Our products and services are designed in accordance to relevant API and industry standards, and include:**

- › Burners for fired heaters, reformers, crackers, incinerators and boilers
- › Gaseous and liquid incinerators, tail gas incinerators, fume and vent plants, liquid waste and SRU plant
- › Computational Fluid Dynamics of the ducting, burner and combustion chamber
- › Installation services
- › Burner spare parts for many makes and models of equipment
- › Burner and incinerator trouble shooting
- › Burner testing – existing equipment and contract testing
- › Flare gas recovery systems

## **Greens Combustion also acts as the international sales office for our sister companies' product ranges:**

- › Centrifugal heavy duty forced draught and induced draught fans – TLT Engineering India Pvt Limited
- › Full range of onshore and offshore flares – Airoil Flaregas Private Limited.

# BURNERS

Refineries, petrochemical and fertiliser plants use a vast array of burner configurations that are very specific to individual licensors and processes. The trade marked **GreenBurn®** range of burners has been designed with extensive application knowledge covering the full range of technology providers and installations.



## GreenBurn® SA & ULN

### Applications - Refinery process heaters.

The SA version uses advanced staged air NOx reduction processes allowing the burner to meet the majority of the world's emissions legislations whilst still providing operational characteristics not normally associated with low NOx burners.

A key benefit of the burner is that due to its large gas ports it is resilient to dirty fuels reducing maintenance and extending tip life.

When tougher more stringent NOx numbers are demanded the ULN version will be selected. This burner uses a synergy of staged air / fuel technology and incorporates internal fuel gas entrainment.



## GreenBurn® RWFD & RWND

### Applications - Radiant wall furnaces such as SMRs and EDC Crackers.

The RWFD is a low NOx forced draught, nozzle mix design burner and uses a 3 stage NOx reduction process of fuel staging, gas dilution and flue gas recirculation for optimum NOx reduction.

The RWND is a low NOx natural draught, self inspirating premix burner and benefits from staged fuel technology with aerodynamically designed internals allowing a very wide range of gases to be fired and a high resilience to flashback.



## GreenBurn® DFFD

### Applications - Top fired reformers.

The burner has been specifically designed to offer a long tight flame to suit the process demands of a top fired reformer. The staged air principle of NOx reduction is perfectly suited to this application, producing a harder flame to overcome the natural buoyancy of the flame, thus avoiding flame impingement on the process tubes.



## GreenBurn® HI

### Applications - SRU Claus furnaces and tail gas incinerators.

The burner is a High Intensity burner with an internal combustion chamber. It is designed to provide a short, intense flame and is readily adaptable for a wide range of off-gases, liquid fuels, acid gases and other waste streams.

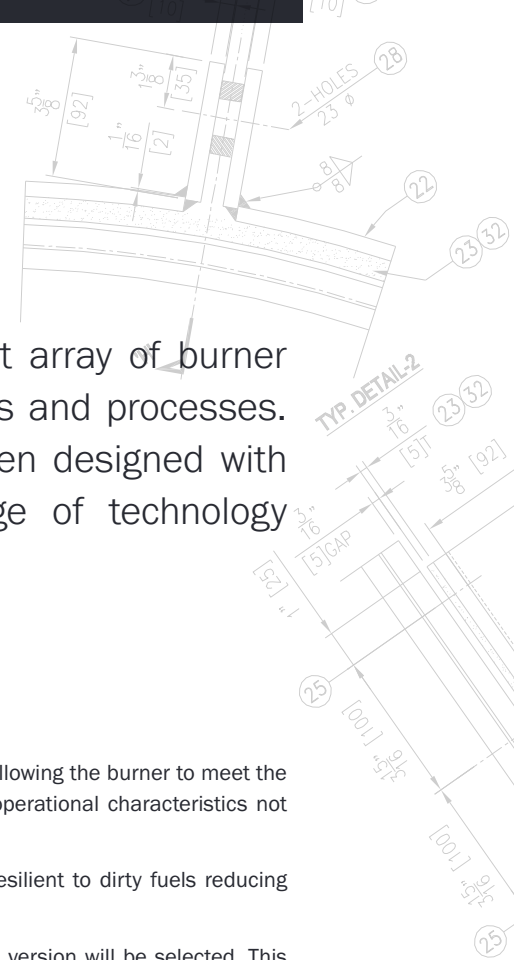


## GreenBurn® MB

### Applications - Boilers (CO), kilns and incinerators.

A register burner designed to fire gas and / or liquid fuels whilst retaining a shorter flame than the SA or ULN burners. The burner can be supplied in its own windbox or for installation in a common air plenum.

The burner can also be configured to handle blast furnace gases.

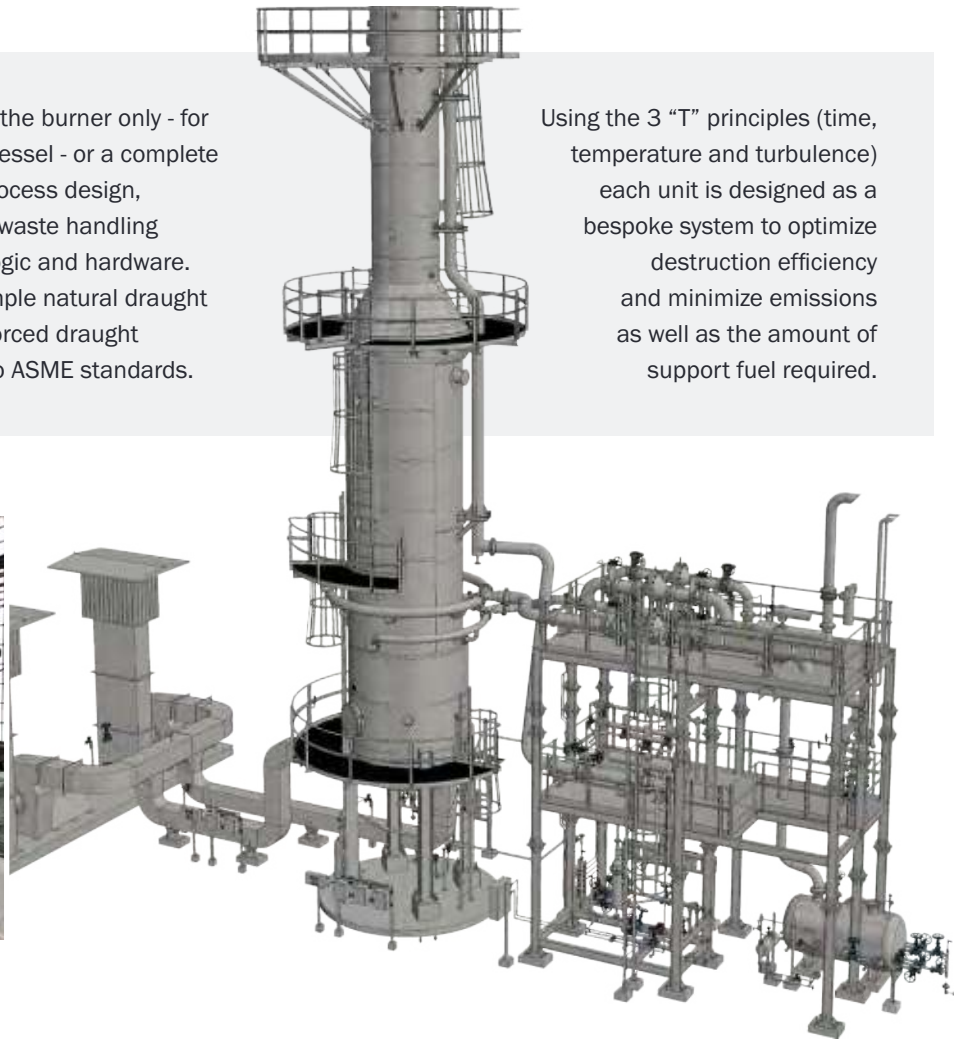


# Thermal Oxidisers & Incinerators

Greens Combustion specialises in all types of gaseous and liquid waste incinerators.

The scope can comprise the burner only - for installation in a client's vessel - or a complete package including the process design, vessel, support fuel and waste handling valve units and control logic and hardware. Packages range from simple natural draught designs to pressurised forced draught systems in accordance to ASME standards.

Using the 3 "T" principles (time, temperature and turbulence) each unit is designed as a bespoke system to optimize destruction efficiency and minimize emissions as well as the amount of support fuel required.



## Types of Units

- Acid Gas, Vent Gas and Tail Gas Incinerators
- Wet Sulphuric Acid Combustors
- Catalytic
- SRU Reaction Furnace and In-line Heaters
- Reduction / Oxidation for Nitrogenous Wastes

## Thermal Oxidisers

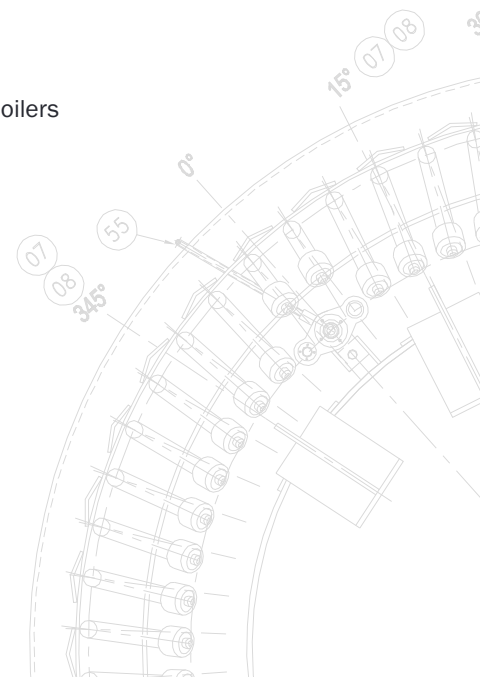
- SRU Plant Tail Gas
- Process Off Gases
- Fumes
- Tank Vents
- Aqueous & low CV Wastes
- Hydrocarbons & high CV Liquids

## Heat Recovery Options

- Waste Gas Preheating
- Combustion Air Preheating
- Steam Raising Waste Heat Boilers
- Fire Tube
- Water Tube
- Hot Oil Systems

## Configuration

- Horizontal End Fired
- Vertical Up Fired
- Down Fired
- Single or Multiple Burners





# Burner Research & Test Centre

2017 saw the opening of our full scale dedicated burner firing facility allowing us to undertake research projects as well as optimise existing product lines.

In between ongoing research projects and contractual burner testing our rig is often used by clients for upgrading or troubleshooting existing equipment across of wide range of burners and applications.

Our transparent, partnership approach has allowed many clients to retain existing equipment instead of replacing it, saving time and money.

## Furnaces

Configuration	Rating and size	Preheat
Up-fired	5 MW (Ø 3.0m x 8.2m)	Air - 450 °C / Gas - 350 °C
Down-fired	3 MW (Ø 2.5m x 6.7m)	Air - 450 °C / Gas - 350 °C
Side / Up-fired	1 MW (2m x 2m x 2m)	Air - 550 °C / Gas - 350 °C

- All measurements and readings connected to data logging system
- Flue gas monitoring system for NO<sub>x</sub>, CO, O<sub>2</sub>
- CO probing
- Access to 40 MW & 3 MW horizontal furnaces

## Fuels

- ✓ Natural Gas
- ✓ LPG
- ✓ Hydrogen
- ✓ Nitrogen
- ✓ Carbon dioxide
- ✓ Other bottled fuels
- ✓ Heavy fuel oil
- ✓ Client's fuel oil

# Parts Supply

With our collective know-how, the Greens Combustion burner team can supply a range of aftermarket parts for virtually any make and model of burner or flare.

Our expertise in combustion is matched by our experience in supply chain and logistics management, allowing us to meet the clients' requirements and deliver customer satisfaction in every element of our service.

Our parts supply service covers burners for Fired Heaters, Steam Methane Reformers (SMRs), Crackers, Thermal Oxidisers (TO's), Sulphur Recovery Units (SRUs) and Flares including:

- Burner Windbox & Damper Assemblies
- Air Intake Filters & Silencers
- Flare Tips, Liquid Seals & Knock Out Drums
- Burner Refractory Tiles & Modules
- Gas Nozzles, Tips & Jets + Oil Atomisers
- Burner & Flare Pilot / Ignition Systems & Ancillaries
- Complete Gas Gun, Oil Gun & Poker Assemblies
- Flame Detection Systems & Ancillaries
- Oil & Water Sprayer Assemblies & Parts
- Actuated Assemblies & Components
- Combustion Air Swirlers & Stabilisers
- Fixings, Fittings, Gaskets, Seals & Hoses

**Greens Combustion part supply is facilitated through the following methods:**



## Replacement Parts

Our extensive catalogue includes replacement parts for our own and other manufacturers' burner and flare systems. We guarantee interchangeability between our own and other products, removing the need for timely on-site modification when replacing non-proprietary components. Each order can be supplied with material and test certifications where specified.



## Reverse-Engineered Parts

We can reverse-engineer existing parts and assemblies to ensure long-term supply and support when they are no longer available from the manufacturer. We can take detailed measurements of parts and assemblies during on-site visits or from returned component samples. Once we have measured them we can fully model the parts and assemblies using 3D software and generate production drawings from the model.



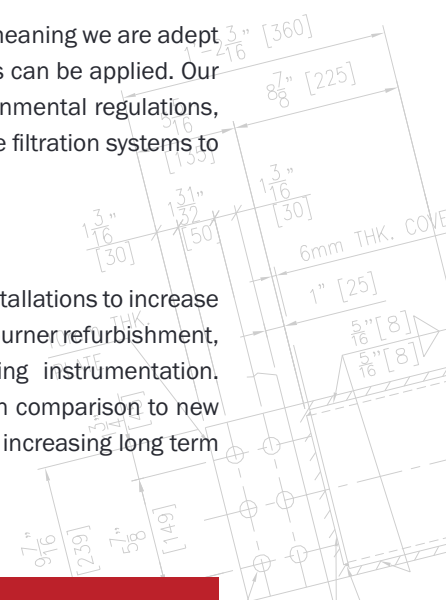
## Engineered Solutions

Greens Combustion engineers have a wealth of practical knowledge, meaning we are adept at analysing on-site issues and identifying where engineered solutions can be applied. Our solutions can range from Low NOx burner conversions to meet environmental regulations, atomiser reconfigurations to reduce steam consumptions and bespoke filtration systems to limit particulate ingress.



## Revamps

We are skilled at identifying revamp opportunities of existing burner installations to increase life, efficiency and capacity. Typical burner revamp activities consist of burner refurbishment, tile replacement, re-sizing tips for actual conditions and upgrading instrumentation. A successful burner revamp can result in considerable cost savings in comparison to new burner supply whilst reducing maintenance, noise and emissions and increasing long term support for spare parts.



# Site Services

Greens Combustion specialise in a full range of site services in support of their own and others' burners, incinerators and flares, from onsite supervision and surveying to the delivery of bespoke training packages. Our engineers have an in-depth knowledge of burner applications, maintenance and operation and each has a wealth of onsite experience.

## Installation Supervision

Our site engineers can supervise and manage single or multi-heater burner installations from concept to completion. Each install team is equipped to cover process, mechanical, electrical and project activities with the support of our office team which provides detailed installation plans comprising drawings, method statements and risk assessments. Our day reports and daily timesheets ensure accurate monitoring of the installation project milestones, providing our clients with top level oversight of our activity.

## Commissioning Supervision

Our skilled site team can take a project from installation to commissioning, ably supporting dry-out, start-up, test runs and operation.

We provide full documentary support in the form of operating manuals and performance curves, ensuring on-spec operation and effective transfer of knowledge to onsite staff. We strive always to maintain our staff's certifications so they are fully qualified to deliver support (e.g. the oil & gas safety passport, H2S awareness qualifications, confined space and offshore Bosiet & Mist certification).

## Our site expertise covers:

- ✓ Process Burners
- ✓ SRU Train Burners
- ✓ Boiler Burners
- ✓ Incinerator Burners
- ✓ Air Pre-Heater Burners

## Pre-Turnaround & Combustion Surveys

We can offer a range of surveys covering existing and new installations for our own and other burner models. Our full combustion survey can identify opportunities to optimise burner set-up and often leads to simple changes that result in cost savings through improved fuel efficiencies, longer run times and reduced downtime.

Our pre-turnaround surveys can identify problems and recommend solutions for replacing components. These surveys help to ensure requirements are known well in advance of a plant shutdown so provisions can be made for a seamless turnaround.

## Training

We offer basic to advanced level classroom and site-based training courses tailored to our clients' specific requirements. Our courses are typically delivered to site operators and maintainers and/or heater contractors and vendors. They cover burner design, operation, troubleshooting and maintenance. We have also led and participated in multi-day symposiums delivered in partnership with relevant organisations including fired heater designers, tube and catalyst suppliers and catalyst loaders. These events typically provide a one-stop technical overview of heater-related technology for plant operators.



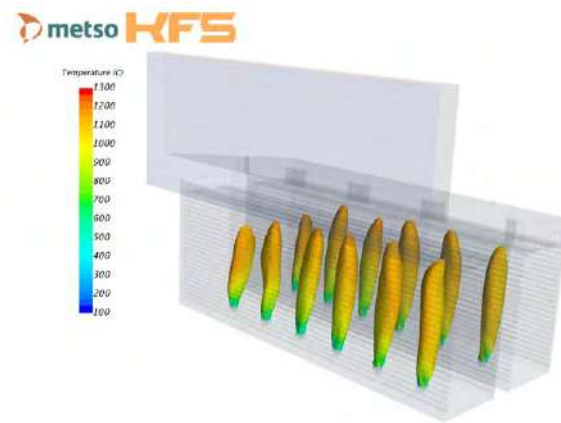
# Computational Fluid Dynamics

Access to computing capability along with knowledge of burner and furnace systems means we can execute CFD studies that accurately predict the performance of burners and furnace environments with regards to flow, turbulence, thermodynamics and combustion.



Our 3DCAD system provides real-time control over burner design changes identified through CFD simulation. It allows us to generate detailed modification drawings and implementation plans if modifications are required in order to overcome constraints in existing systems.

We simulate multi-burner applications through use of a multi-million polyhedral cell system aptly supported by the latest technology computer power. We employ CFD to support burner design and validation, and to identify potential inefficiencies in existing burner, furnace and combustion air duct systems.



## Lump Sum Turnkey Availability

Dependent upon the product supply and location we are able to offer a full turnkey solution to include duct work, minor furnace modifications, installation, commissioning, start-up and training.



This provides our clients with a truly one-stop solution for projects that are too small for the normal furnace contractors or EPCs. Greens' select team of on-site supervisors and trainers are complemented by contract labour which can be provided on a 24 hour shift basis to accommodate site shut down requirements.







# Manufacturing

Our manufacturing process allows us to combine state of the art quality and the highest safety standards with competitive pricing.

We sub-contract manufacture to our established international supply chain for maximum flexibility, meaning we benefit from leading edge manufacturing facilities whilst keeping internal overheads low. All suppliers must comply with the rigorous Greens Combustion supplier assessment and are periodically audited to ensure compliance and continuous improvement.

## Worldwide Supply Chain

**5 global fabrication suppliers, providing production capacity in excess of 500 burners per month with capabilities comprising:**

- › Turning & milling
- › Cutting
- › Flanging
- › Rolling
- › Bending
- › Punching
- › Laser Cutting
- › Mechanical & hydraulic pressing
- › Robotic and manual welding (TIG, MIG, MAG)
- › Assembly
- › Cleaning & Finishing

**Products comprising:**

- › Pre-cast shapes
- › Refractory bricks
- › Firebricks
- › Calcium fibre boards
- › Ceramic fibre products
- › Refractory anchors

**Accreditations** - ISO9001:2015, ASME IX BS4870, EN287, EN15614, EN288, BS5500, OHSAS 18001:2007, ISO 14001:2004 etc.



**4 global refractory suppliers with a production capacity in excess of 1200 tiles per month & facilities comprising:**

- › Advanced mixing facilities
- › Raw material storage
- › Mould making facilities
- › Drying furnaces
- › Test & inspection laboratories

Greens Combustion also has access to the HS Group workshop facilities on its 36,000 m2 design office and manufacturing site in India. The principal manufacturing facility located in India complies with ISO 9001/14001, BS OHSAS 18001 and ASME 'U' & PP stamp certification. All team members have extensive experience in the manufacture and supply of quality products to meet various project-specific requirements and timelines.

## India Workshops

- › 3 workshops, crane covered totalling 12,075 m2.
- › Accreditations - ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007, ASME 'U', 'PP' Stamps & Indian Boiler Reg.

# Flares and Flare Gas Recovery (FGR)

**Airoil Flaregas Private Limited trading as AFG Combustion** specialises in the design, manufacture, supply, installation, commissioning and aftermarket support of high performance flare equipment, including Flare Gas Recovery that is deployed in oil refining, petrochemical, marine & utility industries throughout the world.

For full details see our separate brochure dedicated to flares, but in summary we are able to offer the following:



## Flare types

- › Pipe Flares
- › Steam Assisted Flares
- › Air Assisted Flares
- › Gas Assisted Flares
- › Low BTU Flares
- › Portable Flares
- › Pit Flares
- › Totally Enclosed Ground Flares
- › Multipoint Ground Flares

## Ancillaries

- › High Stability Pilots & ignition systems (FFG, HE, Ballistic)
- › Seals - Velocity or Molecular
- › Knock-out & liquid deal drums
- › Aircraft Warning Lights
- › Retractable Davit for flare tip handling
- › Flame / Smoke Monitor
- › Flame Arrestor

## Support mechanisms

- › Tripod Supported
- › Self-Supported
- › Guy Wire Supported
- › Derrick Supported
- › Demountable Derrick Supported
- › Portable Skid or Trailer Mounted

# Fans



**TLT Engineering India** supply heavy duty FD and ID centrifugal fans for power plant, refineries, petrochemical & fertiliser plants with comprehensive references to major global engineering and manufacturing companies.

Designs and testing are in accordance to API 673, manufacturing facilities incorporate an area under crane of approximately 10,000m<sup>2</sup> and testing facilities allow for full duty tests to be conducted using actual project motors up to 6.6kV.

Fans are supplied to the following applications:

## Petroleum Refinery & Petrochemicals - ID & FD

- › Hydrogen Generation Unit (HGU)
- › Crude Distillation Unit (CDU)
- › Vacuum Distillation Unit (VDU)
- › Delayed Coker Unit (DCU)
- › Diesel Hydrotreater Unit (DHDT)
- › VGO-HDT Unit
- › Sulphur Recovery Unit (SRU)

## Steam Generation & Power Plant

- › Primary & Secondary Air Fans

## Steel & Metallurgical Industry

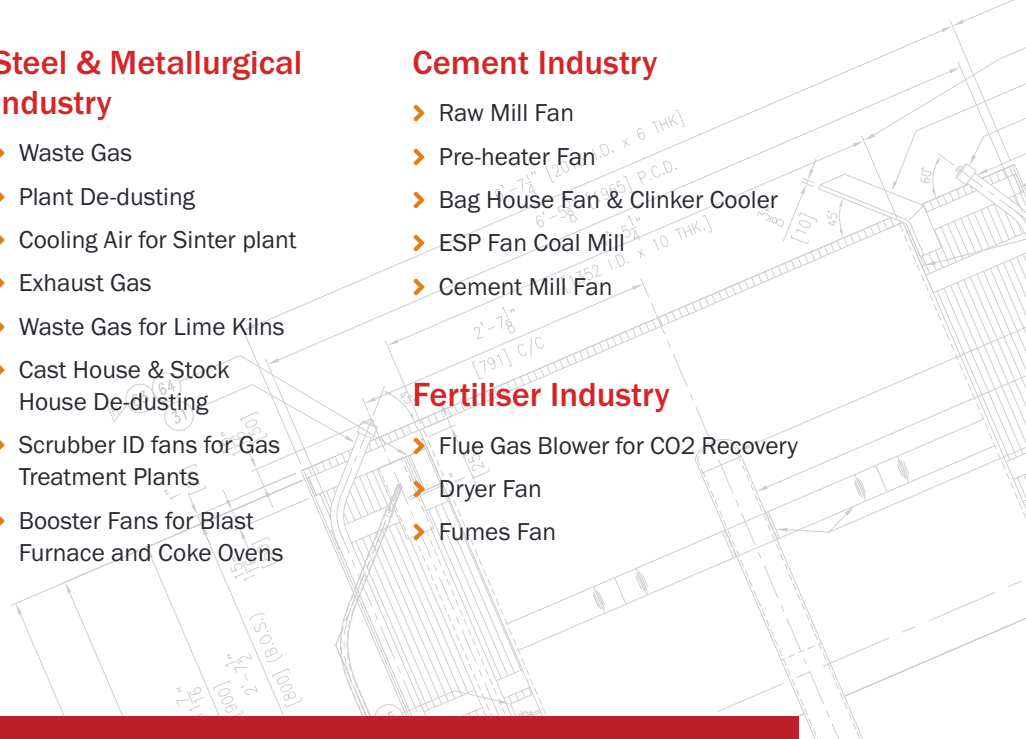
- › Waste Gas
- › Plant De-dusting
- › Cooling Air for Sinter plant
- › Exhaust Gas
- › Waste Gas for Lime Kilns
- › Cast House & Stock House De-dusting
- › Scrubber ID fans for Gas Treatment Plants
- › Booster Fans for Blast Furnace and Coke Ovens

## Cement Industry

- › Raw Mill Fan
- › Pre-heater Fan
- › Bag House Fan & Clinker Cooler
- › ESP Fan Coal Mill
- › Cement Mill Fan

## Fertiliser Industry

- › Flue Gas Blower for CO<sub>2</sub> Recovery
- › Dryer Fan
- › Fumes Fan





CORPORATE OFFICES

**Greens Combustion Limited**

A31 Arena Business Centre,  
Holyrood Close, Poole, Dorset,  
BH17 7FJ, United Kingdom

**Airoil Flaregas Private Limited**

204, Sumer Kendra, Pandurang  
Budhkar Marg, Worli,  
Mumbai, 400 018, India

**TLT Engineering India Pvt. Ltd**

204, Sumer Kendra, Pandurang  
Budhkar Marg, Worli,  
Mumbai, 400 018, India

REGIONAL OFFICES

New Delhi	B-2/73C, Safdarjung Enclave, New Delhi - 100 029, India
Kolkata	31 B, Lake Place, Kolkata - 700 019 India.
Chennai	Unit No.29, Block II, Sidco Electronic Complex, Thiru-Vi-Ka Industrial Estate, Guindy, Chennai - 600 032. India
Hyderabad	3-6-14/3/1, Ratan Mahal, Viccajee's Estate, Himayat Nagar, Hyderabad - 500 029, India.
Vadodara	5, Shree Hari Apartment, 13, Anand Society, Behind Express Hotel, Vadodara - 390 005, India.
Singapore	101 Cecil Street #20-11, Tong Eng Building, Singapore 069533
Hong Kong	Suite 1201, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon Hong Kong
Italy	Via Antonio G Ignazio Bertola 34, Torino (TO), CAP 10122, ITALY

PRINCIPLE MANUFACTURING LOCATIONS

India	Indrad, Mehsana, Gujarat, India
Vietnam	Thanh Xuan, Hanoi, Vietnam Hoa Mac Park, Hanoi Vietnam
UK	Southampton, United Kingdom Dorset, United Kingdom
Italy	Legnago, Verona, Italy

RESEARCH, DEVELOPMENT AND TESTING CENTRE

70023 Gioia del Colle, Via Milano,  
km 1,600, Bari, Italy