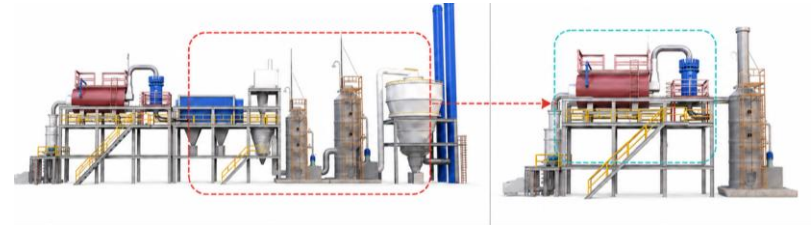


Ecoplantech Patented Technology

Introduction to HTO Vortex Combustion Technology

ECOPLANTECH HTO is a high-efficiency thermal oxidation system designed to destroy VOCs, Hydrocarbons, CO, Aldehydes, PAHs and Odorous organic compounds. Acid gases, Fluorides and particulate matter are controlled through appropriately integrated downstream APC systems.



MONOTECH and ECOPLANTECH are combining HTO Technology with MONOTECH's industrial waste recycling and international project-development capabilities to deliver practical environmental solutions across the GCC, MENA and Africa.

Our next objective is to establish a commercial HTO test bed in a strategically selected regional country, verify performance under actual industrial conditions and create a reference platform for market expansion.

We invite qualified local partners, industrial operators and host facilities to join us in developing the region's first HTO demonstration project and building new environmental business opportunities together.

MAJOR INDUSTRIAL PLANTS BY COUNTRY

Representative facilities in industrial sectors with potential HTO / air-pollution-control applications

COUNTRY	OIL REFINING & PETROCHEMICALS	STEEL / PELLET / DRI	ALUMINIUM	FERTILIZER / AMMONIA / METHANOL
SAUDI ARABIA	Saudi Aramco: Ras Tanura, Riyadh and Jazan Refineries JV Refineries: SATORP (Jubail), YASREF (Yanbu), Petro Rabigh	Hadeed - Jubail Rajhi Steel - Jeddah / Riyadh	Ma'aden Aluminium Ras Al Khair Smelter & Refinery	Ma'aden Phosphate - Ras Al Khair / Wa'ad Al Shamal SABIC Agri-Nutrients - Jubail
BAHRAIN	Bapco Refining Sitra Refinery	Bahrain Steel - Pelletizing SULB - DRI / Melt Shop / Rolling Mill	Aluminium Bahrain (Alba) Askar Smelter & Carbon Plant	GPIC - Sitra Ammonia, Urea and Methanol Complex
KUWAIT	KNPC: Mina Al-Ahmadi and Mina Abdullah Refineries Al-Zour Refinery	Kuwait Steel Shuaiba Steelmaking & Rolling Complex	No major primary aluminium smelter identified	PIC / EQUATE - Shuaiba Petrochemical Complex No major operating ammonia/urea complex identified
QATAR	QatarEnergy: Mesaieed Refinery Laffan Refineries 1 & 2 - Ras Laffan	Qatar Steel Mesaieed DRI / EAF / Rolling Complex	Qatalum Mesaieed Aluminium Smelter	QAFCO - Mesaieed Ammonia and Urea Trains; Blue Ammonia Project
UAE	ADNOC Refining - Ruwais Refinery ENOC - Jebel Ali Refinery Borouge - Ruwais Petrochemicals	Emirates Steel Arkan Abu Dhabi DRI / EAF Complex	Emirates Global Aluminium: Al Taweelah and Jebel Ali Smelters	Fertiglobe Fertil - Ruwais Ammonia and Urea Plants TA'ZIZ - Low-Carbon Ammonia Project
NIGERIA	Dangote Petroleum Refinery - Lekki Indorama Eleme - Petrochemicals NNPC: Port Harcourt, Warri and Kaduna Refineries*	African Foundries - Ogun KAM Industries - Kwara Ajaokuta Steel Complex*	ALSCON - Ikot Abasi Smelter* Tower Aluminium - Rolling / Downstream	Dangote Fertilizer - Lekki Indorama Eleme Fertilizer - Port Harcourt Notore - Onne

Facilities marked with an asterisk may be under rehabilitation, restart, partial operation or operational transition. This is a representative market screening list, not an exhaustive plant registry. Facility status should be reconfirmed before commercial contact. Information reviewed: August 2026

Potential Toxic Air Pollutants and HTO Applicability in Middle East & Africa Major Industries

Industry / Process	Potential Toxic Gases and Air Pollutants	HTO Applicability
Petroleum Refinery	VOCs, THC, BTEX (benzene, toluene, ethylbenzene and xylene), H ₂ S, SO ₂ , CO, NOx, NH ₃ , mercaptans, PAHs and aldehydes	High: VOCs, CO, odorous compounds, mercaptans and aldehydes
Steel / Pelletizing / DRI / EAF	CO, NOx, SO ₂ , VOCs, PAHs, benzene, oil mist, metal fumes, iron-ore dust and carbon dust	Medium: Exhaust from coating, degreasing, oil-mist and VOC sources
Aluminium Smelting	HF, SiF ₄ , fluoride dust, SO ₂ , CO, PAHs, pitch/tar VOCs, CH ₄ , and HCl or Cl ₂ during melting and fluxing	High: Pitch, tar, PAHs and VOCs from anode-baking operations
Ammonia Plant	NH ₃ , H ₂ , CO, CO ₂ , CH ₄ , NOx and trace methanol	Limited: Combustible process gases and VOC vents
Urea / Fertilizer Plant	NH ₃ , urea dust, NOx, fluorides from phosphate-fertilizer processes, methanol/VOCs and aldehydes	Low to Medium: Applicable to VOCs; unsuitable as a stand-alone control for NH ₃ and particulate matter
Methanol Plant	Methanol vapour, formaldehyde, VOCs, CO, H ₂ and CH ₄	High: Low-concentration methanol, formaldehyde and VOC vents

Pollutants Effectively Treated by HTO

HTO is particularly effective in treating the following pollutants:

THC and general VOCs

Hydrocarbons such as benzene, toluene, and xylene

Methanol, acetaldehyde, and formaldehyde

Pitch, tar, and certain PAH-containing organic vapours

Mercaptans and organic odorous compounds

Carbon monoxide and products of incomplete combustion

Oil vapours and certain non-condensable process gases

A thermal oxidizer combusts VOCs, carbon monoxide, and volatile hazardous air pollutants, converting them primarily into carbon dioxide (CO₂) and water (H₂O). Typical thermal oxidizers are designed to achieve destruction efficiencies of approximately **98% to over 99.99%**, depending on operating conditions. Actual performance is determined by combustion temperature, residence time, mixing, oxygen concentration, inlet pollutant composition, and pollutant loading.

HTO LIMITATIONS AND REQUIRED APC EQUIPMENT

Pollutants requiring pre-treatment, downstream control or an alternative treatment strategy

POLLUTANT / GAS	ISSUE DURING HTO APPLICATION	REQUIRED ADDITIONAL EQUIPMENT
H₂S and Organic Sulfur	Oxidation produces SO ₂ and SO ₃ .	Quench + caustic scrubber, or flue-gas desulfurization (FGD)
HF, SiF₄ and Fluorine Compounds	Thermal oxidation does not remove fluorine.	Alumina dry scrubber or wet scrubber
HCl, Cl₂ and Chlorinated VOCs	Oxidation may generate HCl and other corrosive acid gases.	High-temperature HTO + rapid quench + alkaline scrubber
NH₃	May be converted into NOx under certain operating conditions.	Acid scrubber; evaluate selective catalytic reduction (SCR)
NOx	High-temperature HTO operation may increase thermal NOx formation.	Low-NOx burner + SCR or selective non-catalytic reduction (SNCR)
Metal Fumes, PM and Dust	Not destroyed by combustion and may accumulate inside the HTO.	Cyclone, bag filter or electrostatic precipitator (ESP)
High-Volume CO₂ and CH₄	Energy recovery or process optimization may be more economical than direct treatment.	Evaluate gas recovery, boiler utilization or flare integration

- HTO Vortex (Tornado Flame) Combustion Technology

- Implementing a 3T environment for complete combustion

Temperature

Decomposition
temperature
abnormality

850 °C ~1700°C
Maintaining high
temperatures

Time

Decomposition
retention time
exceeds

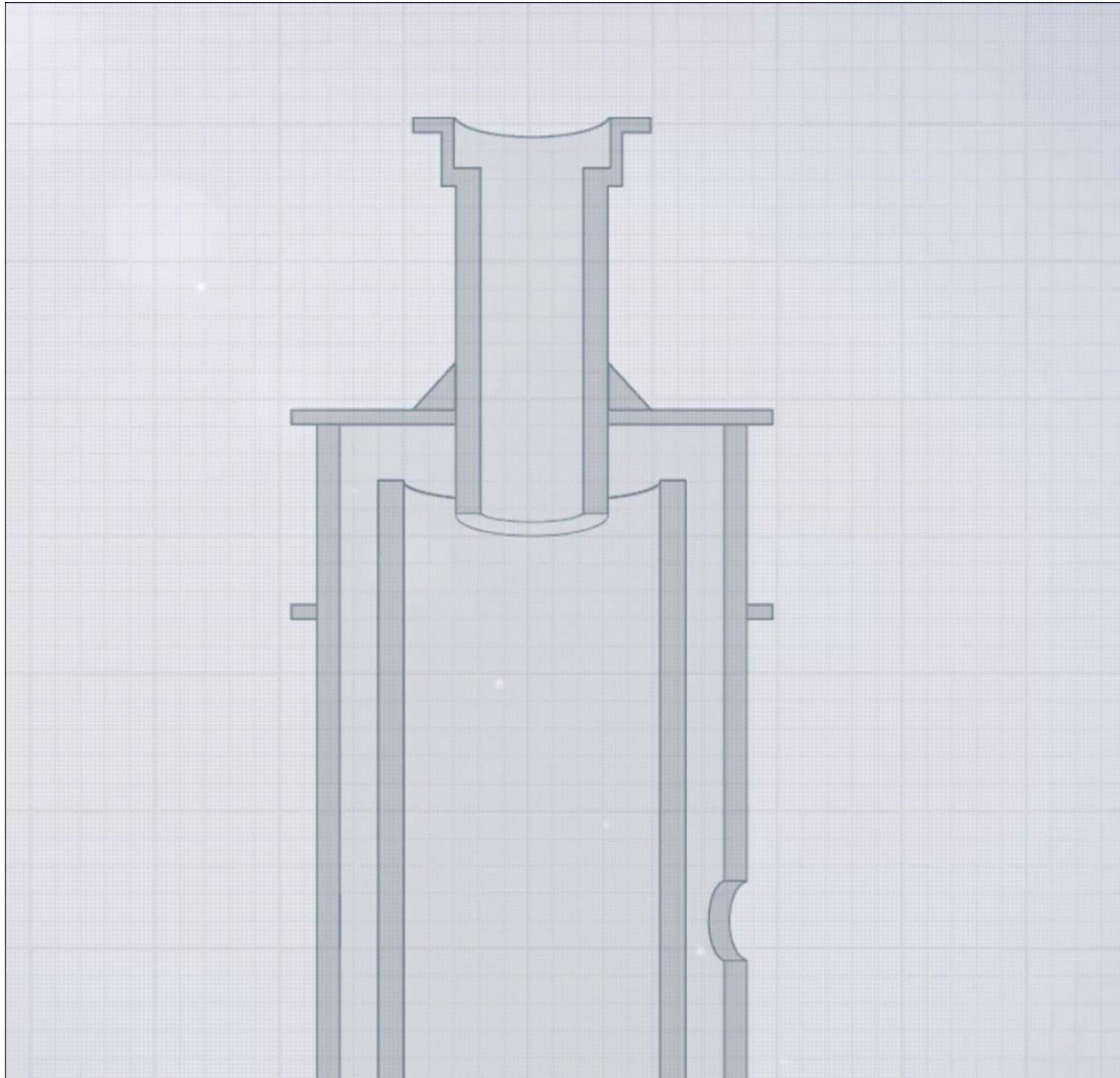
2 seconds ~ 5 seconds or more

Turbulence

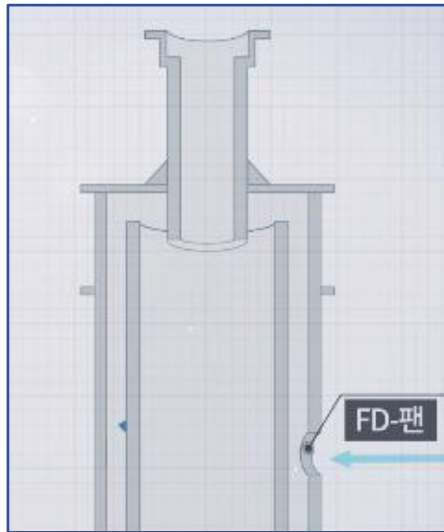
Proper Mixing

Uniform mixing of target
substances (combustibles) and
air (oxygen) and Flame
Stabilization

● Ecoplantec's HTO Vortex Combustion Technology

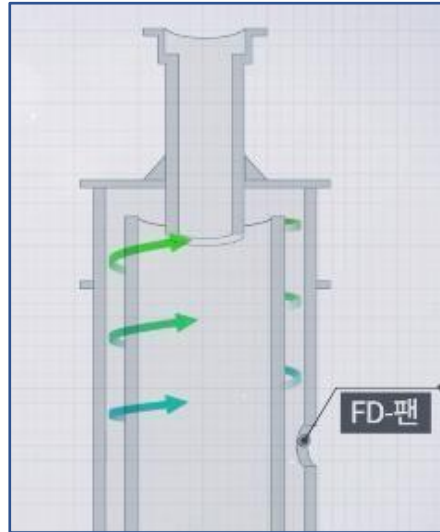


● Ecoplantec's HTO Vortex Combustion Technology



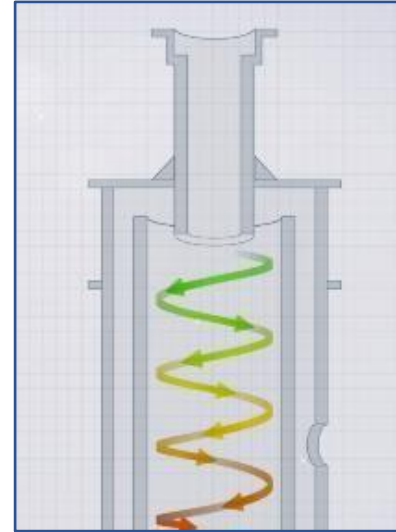
Combustion air input

Strongly applied tangentially between the outer and inner tubes of the dual cylindrical combustor



Combustion air rotation rise

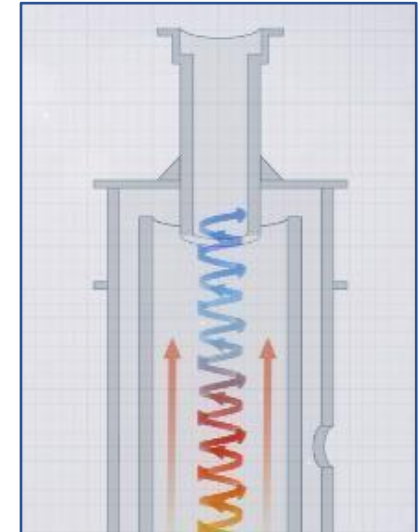
Rapidly turns in the space between outer and inner passages, generating rotational force and blocking external heat transfer from inside.



Turning descent

After reaching the top of the combustor and rotating inertia, it adheres closely to the inner wall of the inner tube, turning down and preheating

Forms an air curtain on the internal wall of the combustor to block the transfer of radiant heat to the wall

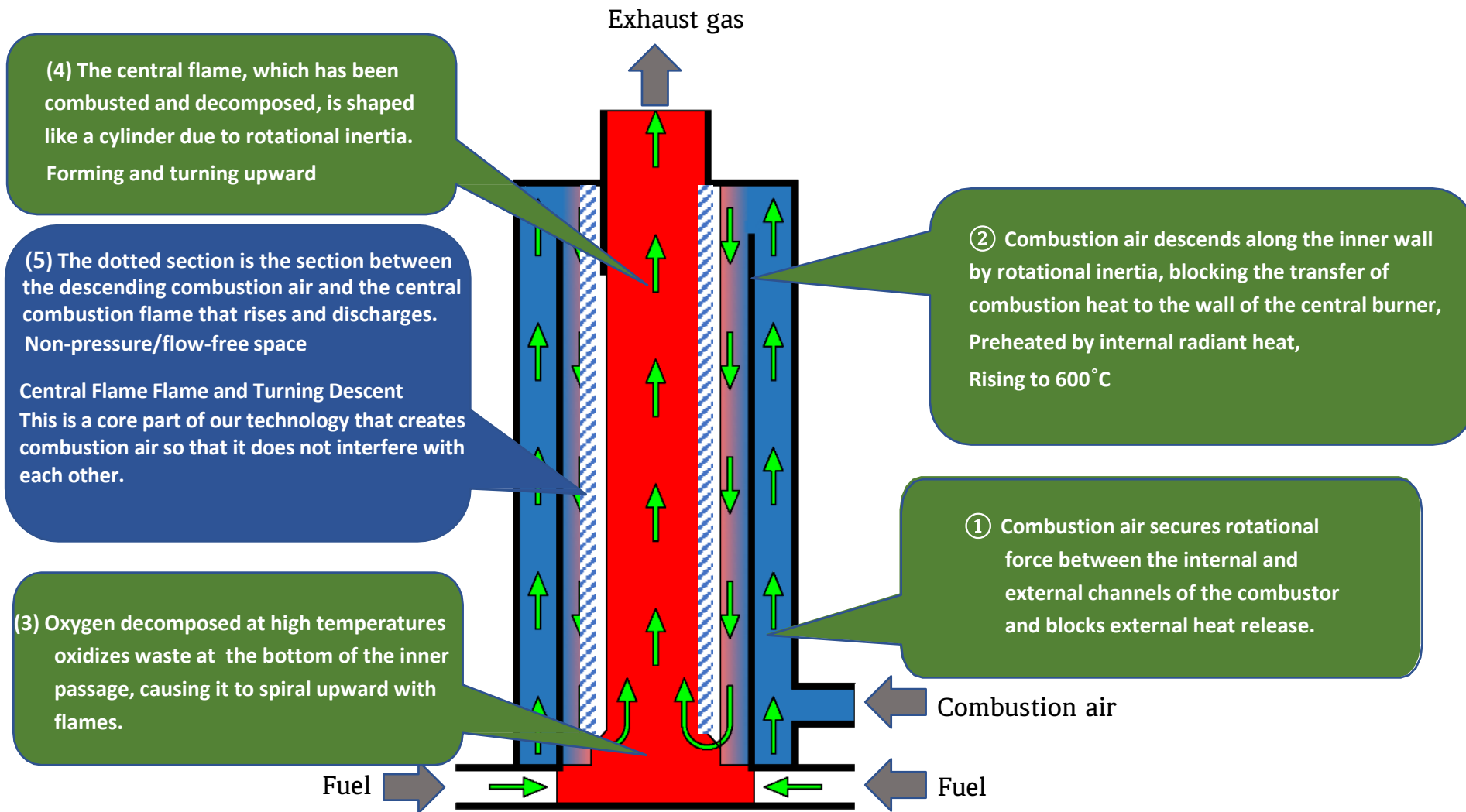


high-temperature combustion

Combustion air with centrifugal force forms turbulence and mixes uniformly, then decomposes at high temperatures with flames.

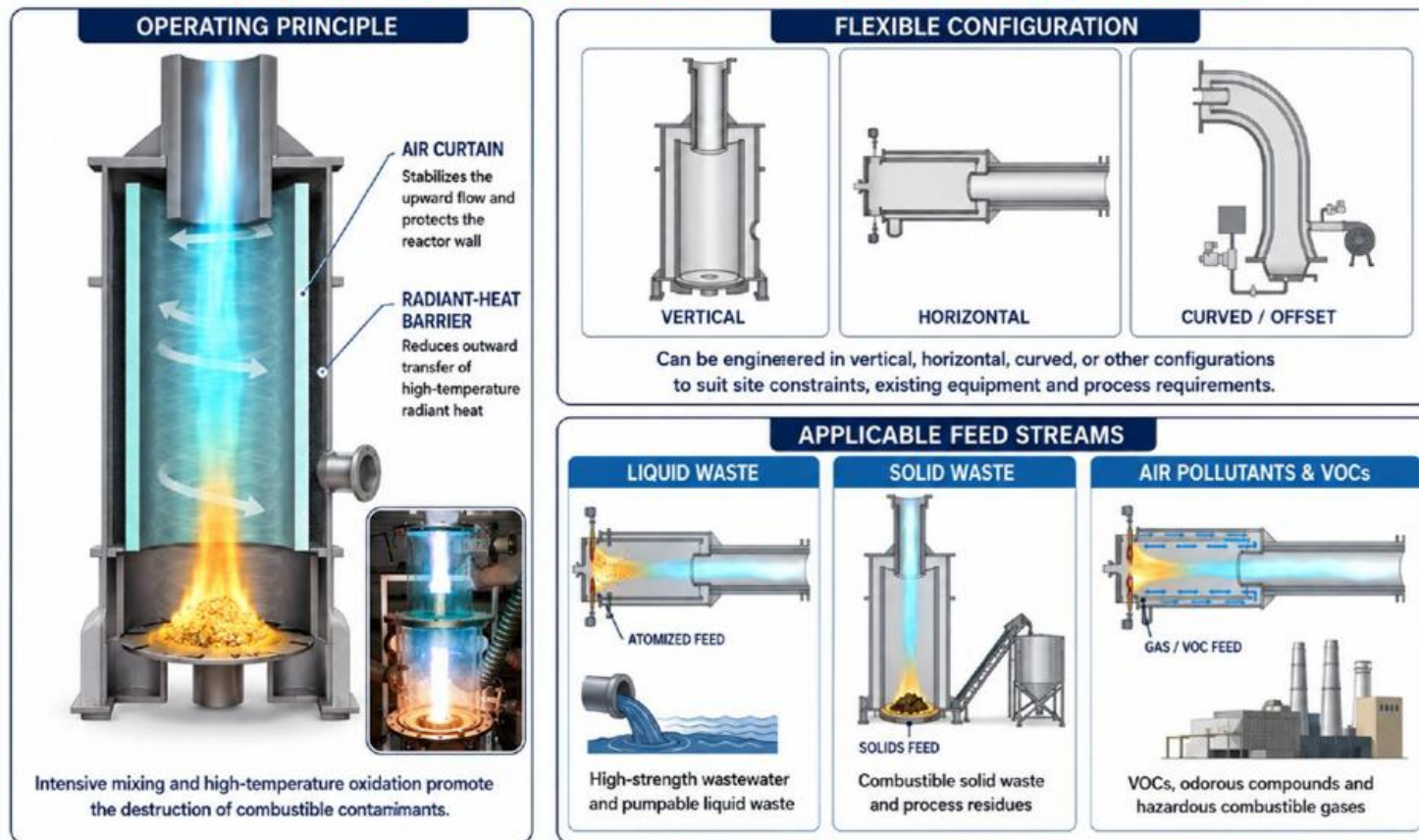
Ensuring flame residence time and preventing incomplete combustion

● Core Technology of Ecoplantech's HTO Vortex Combustion Technology



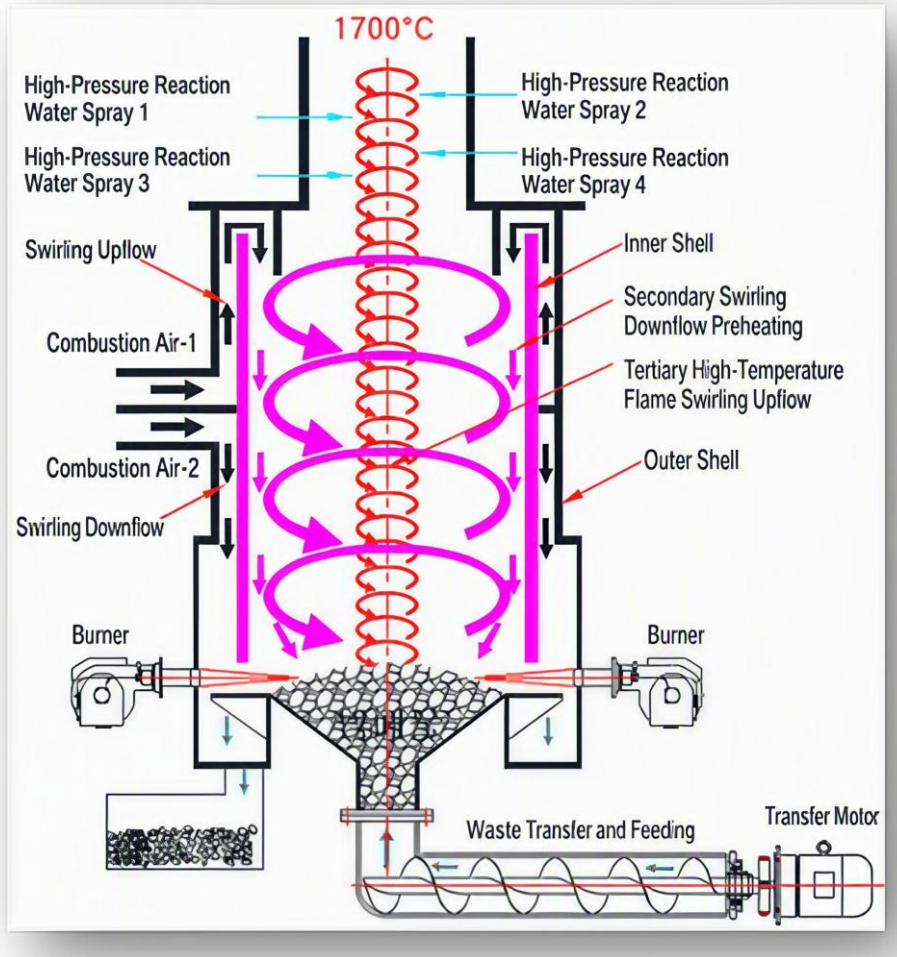
HTO — HIGH-TEMPERATURE OXIDATION SYSTEM

Compact, Flexible Treatment for Diverse Waste Streams and Air Pollutants



Final system configuration and auxiliary controls are determined by feed composition, particulate and acid-gas loading, required destruction efficiency and applicable emission limits.

● Core Technology of Ecoplantec's HTO Vortex Combustion Cracking Technology

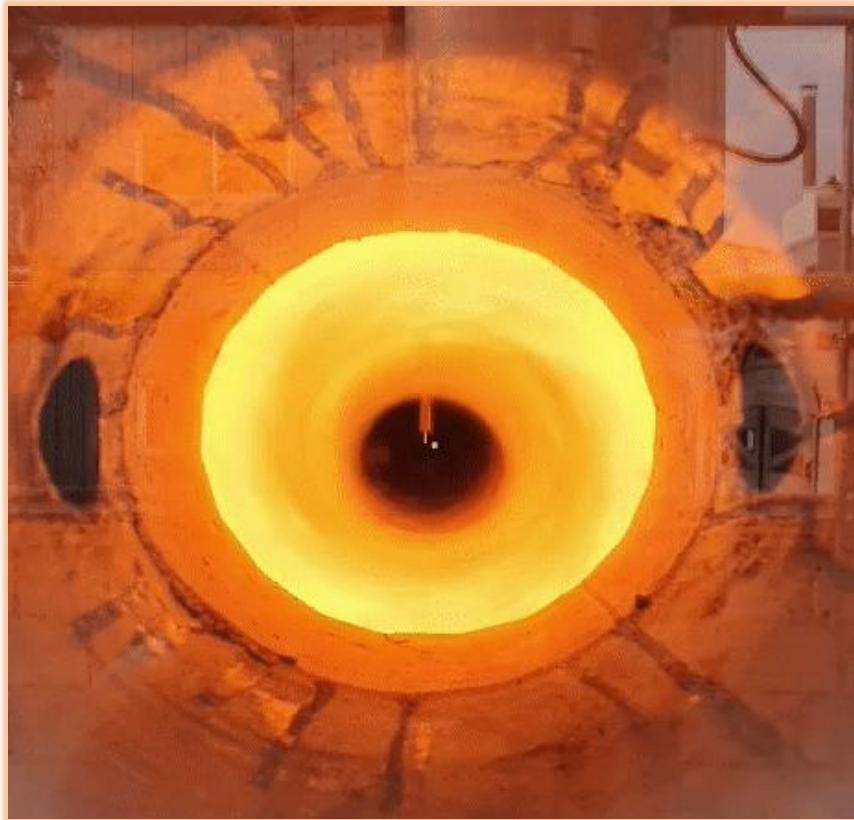


< HTO(Hybrid Thermal Oxidation) Combustion Principle >

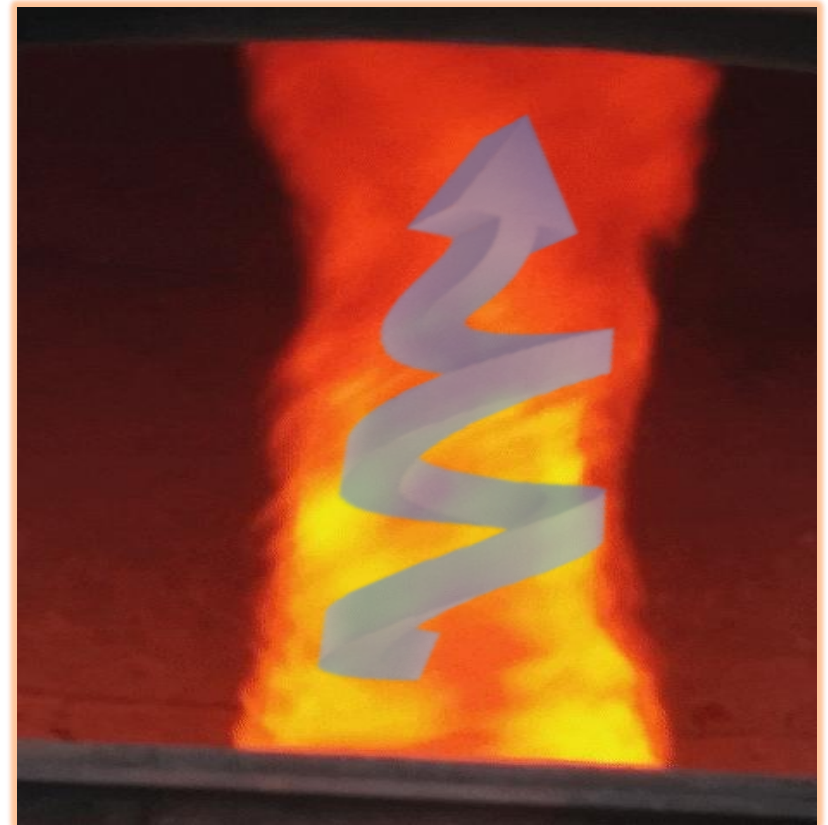
The hybrid system lowers the combustion air inflow into the combustion chamber with a double cylindrical structure, so the combustion air entering between the outer and inner passages

As it rises after cooling and preheating, centrifugal force is formed, and the combustion air formed by centrifugal force forms an air curtain along the inner wall, descending at high temperatures and mixing with the supplied fuel, decomposing and rising, thus blocking the high-temperature radiant heat emitted from the center from contacting the wall. After ultra-high temperature combustion and rising to the center by preheated descending air at high temperature (600°C), energy density is maximized, enabling ultra-high-temperature combustion decomposition inside the chamber with a combustion temperature above 1,700°C. A complex pulsating water spray control device periodically sprays trace amounts of water into the rising ultra-high temperature combustion airflow, inducing steam explosion and plasmaization. The gas molecules are excited to a theoretical equilibrium state (vibrational state), and then oxygen radical (.O) generated from oxygen and moisture is produced. By reacting with hydroxyl radicals (.OH) and oxidizing them before release, it reduces the emission of air pollutants through complete decomposition of waste gas, enabling eco-friendly combustion and decomposition of all fluids. This perfectly solves the problem of incomplete combustion in conventional combustion cracking while maximizing energy efficiency.

- The flame's HTO Vortex shape (ensuring combustion residence time)

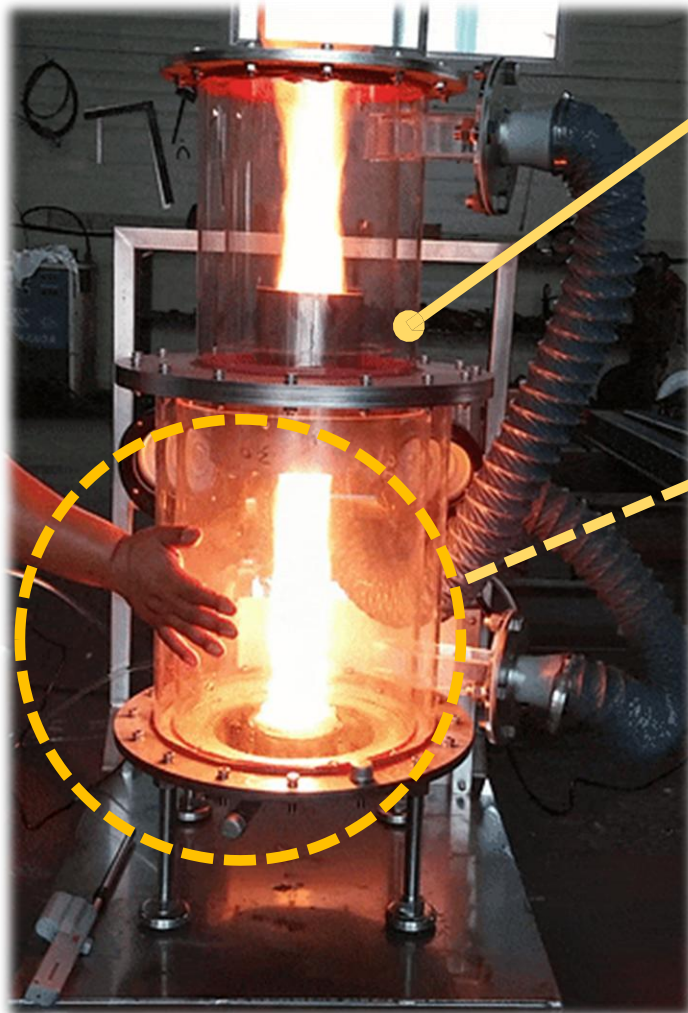


Flame rotation caused by the rotational force of combustion air



The flame rises as the flame spirals like a rising dragon due to the rotational force of the combustion air.

● HTO Vortex combustion Pilot Test



- **Combustor material: Acrylic resin (Acrylic)**
- **flame temperature: Approx. 1,100 °C**
- **Fuel used : kerosene**

- Formation of an air curtain completely blocks external heat transfer from internal radiant heat (outer wall temperature: about 20°C)
- The flame ascends from the center in a swirling, tornado-like motion.

● HTO Technical characteristics of the combustor

1

No need for fireproof walls

By injecting combustion air into the combustion chamber wall, the combustion wall is protected by only cooling air from the heat generated in the combustion chamber (air curtain).

2

Complete combustion of various fuels and minimal harmful gas emissions for environmental friendliness

Complete combustion possible thanks to a structure that can preheat the incoming air to a high temperature above 600°C

3

ultra-high temperature combustion

High preheating enables ultra-high temperature combustion above 1,400°C (heat load ratio, high efficiency)

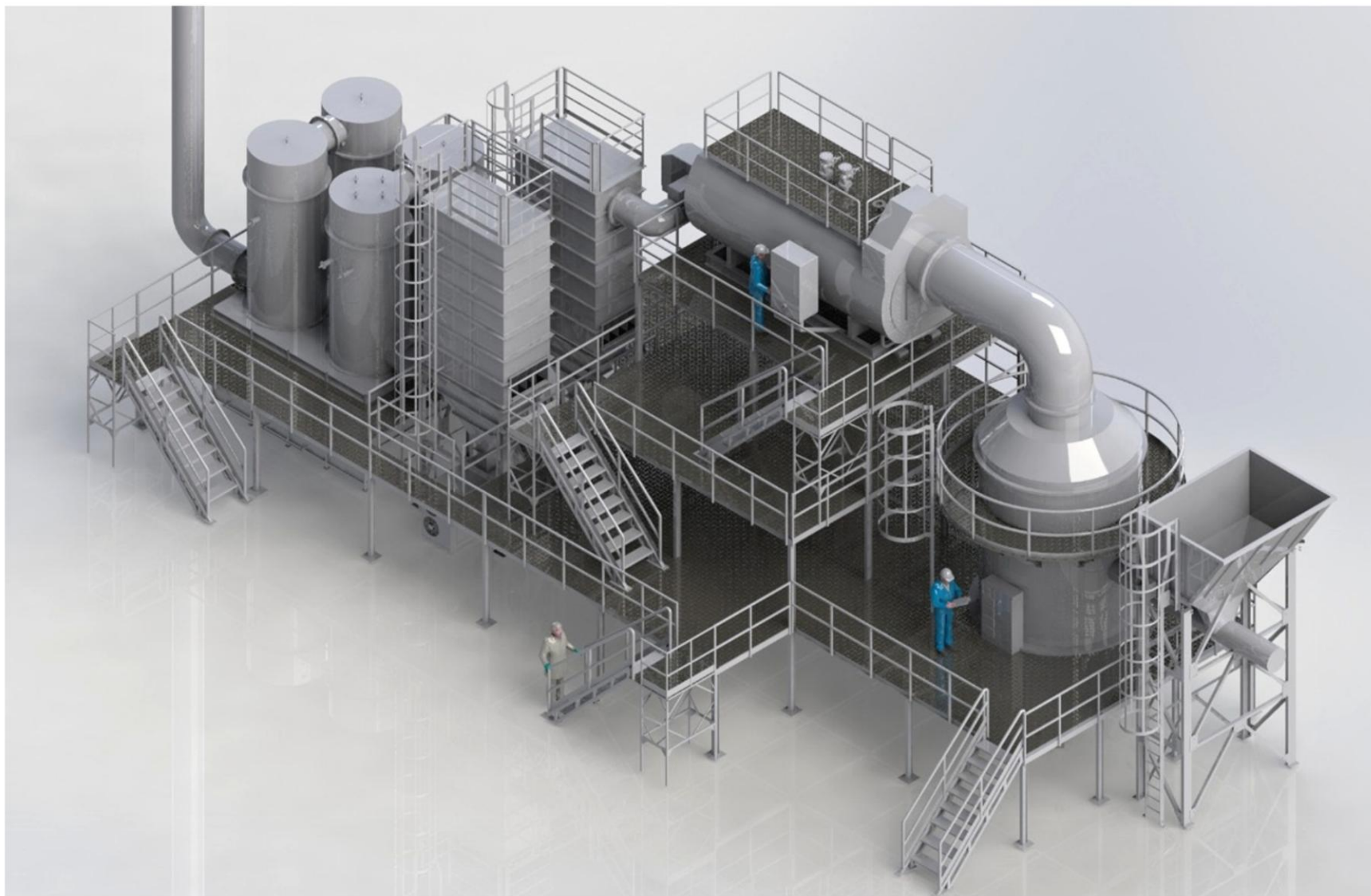
Higher combustion efficiency compared to other technologies, making it suitable for power generation and advanced materials industries

4

Miniaturization

High efficiency achieved without axles, resulting in a significantly smaller combustion furnace volume compared to conventional products

- System configuration image



● Ecoplantech Introduction Video

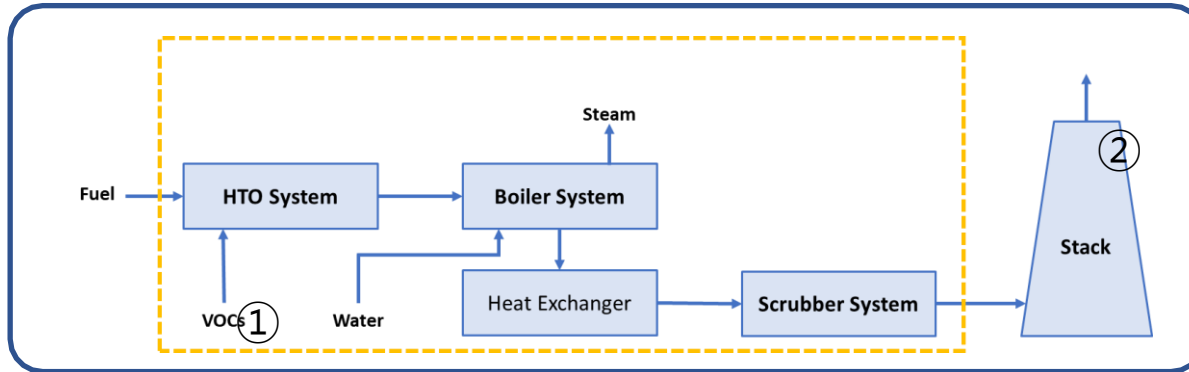


● Case Study of HTO Technology

● JMC VOCs (Chloroform) Treatment System (Onsan) - Video



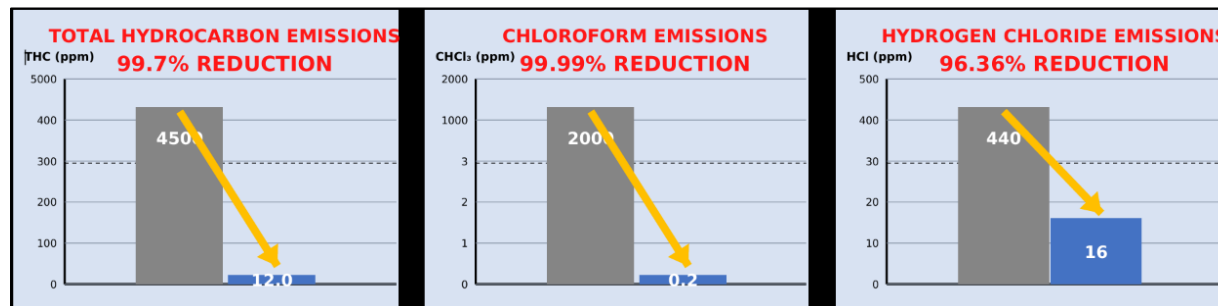
● HTO Technology Application Cases JMC (Ulsan)



Item	Operation conditions
VOCs inflow volume	180 CMM @ 30°C
LNG usage	429 m³/hr
Steam Production volume	6.0 ton/hr
operating temperature	>1,250 °C (HTO nside)

ITEM	GENERATION CONCENTRATION (ppm)	AUXILIARY TREATMENT CONDITION (ppm)	HTO INLET ① (ppm)	FINAL EMISSION ② (ppm)	MEASUREMENT METHOD
THC		100 ↓	4,500	12	GC (FID, Flame Ionization Detector)
HCl	340	4 ↓	440	16	Ion Chromatography Method
CHCl₃	1,000	2.5 ↓	2,000	0.2	Gas Chromatography Method
HCHO	480	4 ↓	580	0	Gas Chromatography Method
NOx		60 ↓		20	Electrochemical Method

• Measurement Date: March 21, 2022
• Analysis: Conducted in-house by JMC Co., Ltd.

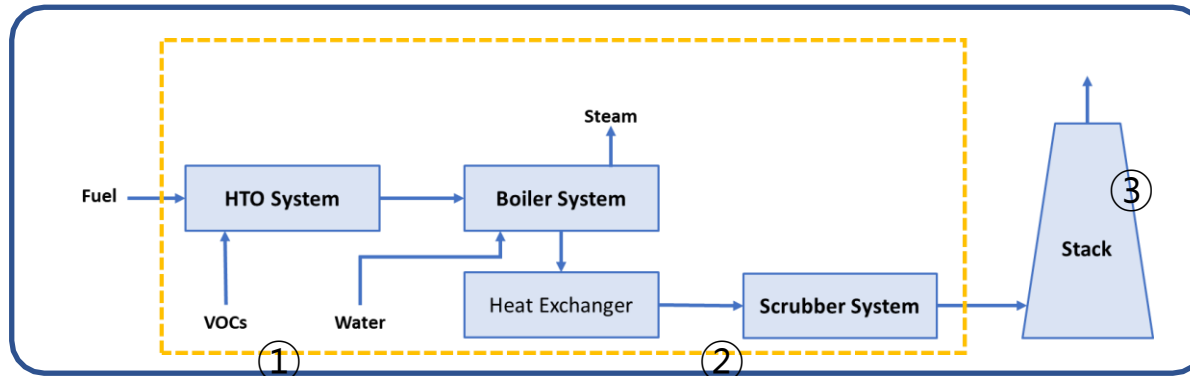


- HTO Technology Application Cases
VOC Processing System (Incheon)

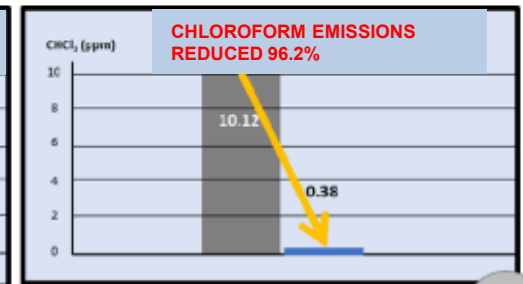
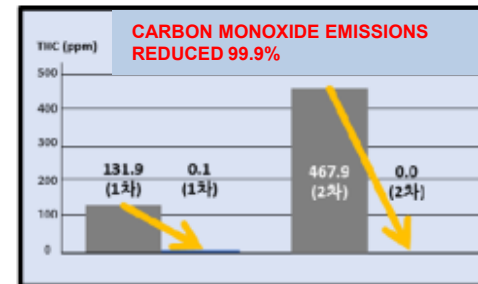


● HTO Technology Application Cases

Kyungin Corporation (Incheon) VOCs Treatment



Item	Operating conditions
VOCs inflow volume	30 CMM @ 20°C
LNG usage	72 m³/hr
Steam Production volume	0.99 ton/hr
operating temperature	>1,250 °C (HTO Inside)



ITEM	GENERATION CONCENTRATION (ppm)	AUXILIARY TREATMENT CONDITION (ppm)	HTO INLET ① (ppm)	FINAL EMISSION ② (ppm)	MEASUREMENT METHOD
THC		100 ↓	4,500	12	GC (FID, Flame Ionization Detector)
HCl	340	4 ↓	440	16	Ion Chromatography Method
CHCl ₃	1,000	2.5 ↓	2,000	0.2	Gas Chromatography Method
HCHO	480	4 ↓	580	0	Gas Chromatography Method
NOx		60 ↓		20	Electrochemical Method

- Measurement Date: March 21, 2022
- Analysis: Conducted in-house by JMC Co., Ltd.

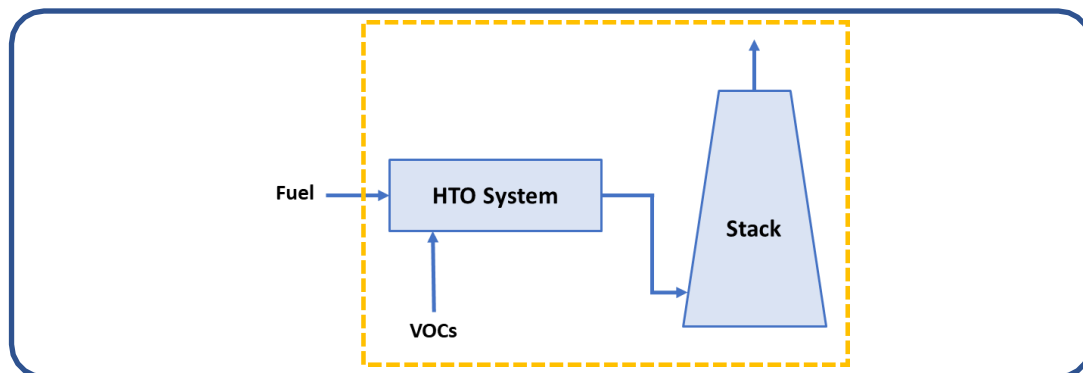
Chloroform (CHCl₃) is a hazardous chlorinated VOC associated with potential liver and kidney damage and an increased cancer risk from long-term exposure. Reducing its emissions is essential for protecting workers and local communities and demonstrating the HTO system's chlorinated-VOC treatment performance.

Carbon monoxide (CO) is a highly toxic, colorless and odorless gas that reduces the blood's ability to carry oxygen and can cause serious health effects. Reducing CO emissions is essential for protecting workers and local communities and demonstrating efficient, complete combustion in the HTO system.

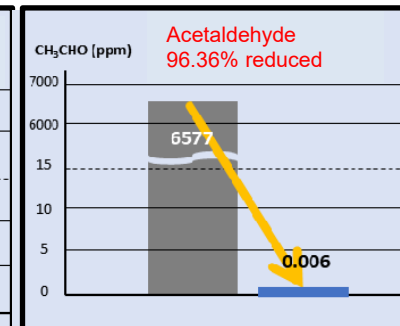
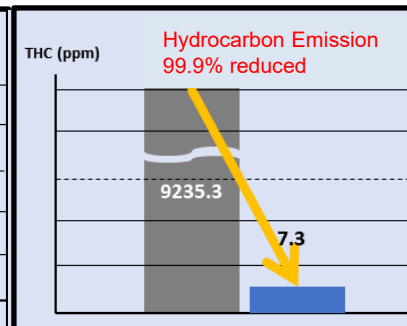
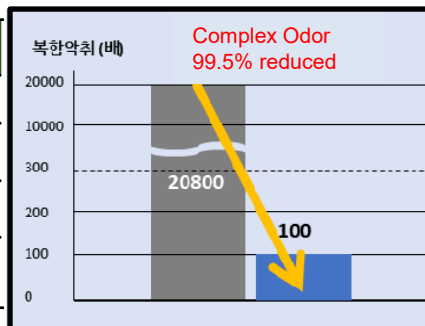
- HTO Technology Application Cases
Lotte Chemical VOCs Treatment System (Ulsan)



HTO Technology Application Case: Lotte Chemical (Ulsan)



Item	Driving conditions
VOCs inflow volume	30 CMM @ 20 °C
LNG usage	56 m³/hr
Steam Production volume	N/A
operating temperature	>850 °C (HTO Inside)



Acetaldehyde is a toxic and highly volatile compound that can irritate the eyes, skin, and respiratory system. Long-term exposure may increase cancer risk, so its emissions require strict monitoring and control.

Acetaldehyde emissions are commonly generated from combustion, petroleum refining, petrochemical production, and ethanol manufacturing.

They may also occur during waste incineration, biomass burning, paint and resin production, and incomplete oxidation of organic compounds.

Item	Guaranteed Treatment Condition (ppm)	HTO Inlet (ppm)	Final Emission (ppm)	Measurement Method
Odor Compounds	448 x ↓	20,800 x	100 x	Air Dilution Olfactory Method
THC	180 ppm ↓	9235.3	7.3	GC (FID, Flame Ionization Detector)
NH ₃	20 ppm ↓	5.3	1.4	Indophenol Method
CHCl ₃	5 ppm ↓	N/D	N/D	High Performance Liquid Chromatography Method
CH ₃ CHO	10 ppm ↓	6577	0.006	High Performance Liquid Chromatography Method
NOx	49 ppm ↓	17.7	11.7	Electrochemical Method

• Measurement Date: September 22, 2023 / October 19, 2023 (Odor)
• Analysis Company: KI Environment Co., Ltd. / HM Solution (Odor)

- HTO Technology Application Cases
Sunhwa Industry Asphalt Concrete VOCs Treatment System (Geomdan)



● HTO Technology Application Cases

● Salegun Up Asphalt Concrete VOCs Treatment System (Seongju) - Video



- HTO Technology Application Case:
CJ , VOCs Combustion Treatment System (Incheon)



- **HTO Technology Application Cases**
Odor from Buan-gun Sewage Sludge Treatment Plant/Toxic Gas Treatment System



- **HTO Technology Application Cases**
Sunjin Energy Pyrolysis Waste Gas Treatment System (Hwaseong)



● Company Introduction: History

2024	JAN	Signed a Patent Licensing Agreement for the Buan County Odor Improvement Project
2023	DEC	Obtained ISO 9001 Certification
	OCT	Installed an Odor Control System at Lotte Chemical
	FEB	Registered as an Air Environment Specialist Contractor
	JAN	Obtained a Patent for an Asphalt Plant VOC Combustion System
2022	NOV	Obtained a Patent for a Hybrid Burner
	OCT	Installed a Pilot Waste-Heat Recovery System Downstream of the Kiln at GS EcoMetal
	APR	Registered as a Mechanical and Gas Facility Contractor
2021	DEC	Certified as a Venture Company
	NOV	Certified Corporate Research Institute
	MAY	Installed a VOC Removal System at Kyung-In Synthetic Corporation
	APR	ECOPLANTECH Co., Ltd. Established

● Company Introduction: Certification and Patent Status



Certification and compliance, delivered as one integrated solution.

MONOTECH provides customized consulting for KS, JIS and ISO quality and technical-standard certifications, together with practical support for global ESG requirements including the EU CBAM, CSDDD and EcoVadis.

KS

JIS

ISO

EU CBAM

CSDDD

EcoVadis

Global Quality & ESG Certification Total Solution



We provide customized, integrated consulting for global quality and technical-standard certifications, including KS, JIS and ISO, and for global ESG environmental regulations such as the EU CBAM, CSDDD and EcoVadis.



CORE BUSINESS

One network, Multiple Recovery Pathways

01



Spent Catalyst Metal Recovery



In spent catalysts Alumina constitutes 55% of the carrier include Mo, Ni, Cu, Zn, Si, Iron with Vanadium adsorbed from crude oil comprising more than 15%

02



Second Aluminum Recycling

(Nano Al(OH)₃, Nano Alumina)



Composition of Second A/L dross by chemical analysis - 80-90% Al₂O₃.

03



EV Battery Black Mass Recycling



The recycling process of spent catalysts and aluminum dross is very similar to the process of recovering metals from the black mass of battery & e-waste.

04



Non-Ferrous Metal Recycling

Copper • Aluminium Ingots • Titanium • Tungsten • Nickel Alloys



We recycle and trade non-ferrous metals, including copper, aluminium ingots, titanium, tungsten and nickel alloys, through a reliable global sourcing and distribution network.

05



Plant EPC, Trading & Consulting



From engineering, procurement and construction to equipment and material trading, we provide integrated technical and business consulting throughout the entire project lifecycle.

06



Global Quality & ESG Certification Total Solutions



We provide customized, integrated consulting for global quality and technical-standard certifications, including KS, JIS and ISO, and for global ESG environmental regulations such as the EU CBAM, CSDDD and EcoVadis.

OUR CORE VALUES

The principles behind every partnership and every solution.



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